Trinity College

Trinity College Digital Repository

Spring 2018

2018 Annual Research Symposium Abstract Book

Trinity College, Hartford Connecticut

Recommended Citation

Trinity College
HARTFORD CONNECTICUT

THIRTY-FIRST ANNUAL SYMPOSIUM OF TRINITY COLLEGE UNDERGRADUATE RESEARCH

TABLE OF CONTENTS

Poster #	Title

9. **ANALYSIS OF THE STRUCTURE AND SYNTHESIS OF (±)-PENTACYCLOANAMMOXIC ACID**
Joshua Corbo '19, Vanessa Jones '19

10. **SYNTHESIS AND CONFORMATIONAL ANALYSIS OF PEPTIDES LINKED TO A RIGID, BIMETALLIC RING SYSTEM USING AROMATIC SPACERS**
Lauren M. Davidson '16, Niranjana Pokharel '15, Josephine Frempong '18, Michael L. Phillip '19, Cosmic B. Gober '18

11. **A CUSTOM-BUILT SOFTWARE METHOD OF DATA ANALYSIS FOR SINGLE CELL ANALYSIS**
Jason S. Deck '21

12. **ANALYSIS OF R. B. WOODWARD'S TOTAL SYNTHESIS OF QUININE**
Maxwell H. Furigay '19, Michael L. Phillip '19

13. **SYNTHESIS AND CONFORMATIONAL ANALYSIS OF ALANINE PEPTIDE DERIVATIVES OF THE ALLISON LAWRENCE COMPLEX USING PHENYL SPACERS**
Cosmic Gober '18

14. **THE PSEUDOELASTICITY OF SPHERICAL GOLD NANOPARTICLES**
Anika Harkins '21

15. **KETOGENIC DIET INDUCED METABOLIC CHANGES INFLUENCING NEUROPROTECTION IN SH-SY5Y CELLS**
Lucy Honeycutt '18

16. **TRITYL CATION-CATALYZED COMPLEX MOLECULE SYNTHESIS**
Vanessa Jones '19

17. **COMPARING PEPTIDE SUBSTRATE REPORTER LOADING METHODS: HOW EXOGENOUS MOLECULES ENTER CELLS AFFECTS THEIR FATE**
Grigorii Kalminskii '20, Rahuljeet Chadha '20, Allison J. Tierney '17

18. **CANDIDATE BASED BIOMARKER DETECTION IN PARKINSON'S DISEASE**
Eugene Miller '21

COMPUTER SCIENCE

19. **AN APPLICATION OF NEURAL NETWORKS TO CONTINUOUS AUTHENTICATION**
Karishma Asthana '18

20. **K.E.A TRAINER**
Isabella Dahilig '18

Poster #	**Title**

21. **ACCELERATING BLOCK-TRIDIAGONAL MATRIX INVERSION ON GPUS**
Bemnet Demere '19

22. **RAETHER MAP**
Ngoc (Norah) Do '18

23. **TRAUMA REGISTRY DATA ANALYSIS**
Ebenezer Hormenou '18

24. **DIMENSIONALITY REDUCTION TECHNIQUES FOR DATA VISUALIZATION**
Ilya Ilyankou '18

25. **TRINEVENTS - A HTML BASED SOLUTION TO TACKLE THE EFFECTIVENESS OF EVENT MANAGEMENT AT TRINITY COLLEGE**
Alodie Iradukunda '18

26. **RATEMYRESIDENT: A SECURE AND EFFORTLESS MEDICAL RESIDENT EVALUATION SYSTEM**
Alex Johnson '18

27. **ECONOMICS THE INTERACTIVE EXPERIENCE**
Francis Maugeri '18

28. **USING MACHINE LEARNING TO STUDY YOUTUBE COMEDY SLAM**
Anastasija Mensikova '18

29. **SENTENCE ANALYZER – A TOOL FOR STUDENTS LEARNING JAPANESE**
Anh Nguyen '18

30. **COLLEGETHRIFT**
Kalyan Parajuli '18

31. **A DEEP LEARNING POWERED CHATBOT**
Shufan Wang '18

32. **POLICY NETWORK ON ATARI GAME**
Yinghuan Wang, '18

33. **PERSONALIZED FITNESS PROGRAM BUILDER**
Weixi Zhang '18

Poster #	Title

ENGINEERING

34. **VIRTUAL REALITY MEDIATED ROBOT TELEOPERATION AND GRASPING**
Kun Chen '18, Prawesh Dahal '18, Mariam Avagyan '18

35. **KINETIC ENERGY CONVERTER AND CHARGER**
Nicholas P. Constantine '18, Jack H. Stallman '18, Abigail L. McInerney '18,
Eric C. Gendron '18

36. **BIOMIMETIC AUTONOMOUS UNDERWATER VEHICLE**
Sean Coughlan '18, Alex Laferriere '18

37. **AUTOMATIC 3-AXIS CAMERA STABILIZING GIMBAL**
Daniel Hughes '18, Daming Xing '18

38. **ROBOT FIREFIGHTING USING CARBON DIOXIDE**
Aedhan Healy '21, Hannah Zukowski '21, Rahul Mitra '21

39. **INVESTIGATION OF CONTINUOUS FLASH SUPPRESSION THROUGH VIRTUAL REALITY**
Evelyn Luciani '21, Logan Drescher '21, Patty Gaitan '19

40. **UNDERWATER ROV**
Aaron Porter '18, Brayan Duarte '18, Eduardo Murillo '18, Gregory McKinnon '18

41. **BEAT PARKINSON'S (PD) TODAY**
Hannah Shaievitz '18, Katharine Haghdan '18, Tasha Adams '18, Delaney Harrop '18

42. **MORPHING AIRPLANE WING WITH VARIABLE LIFT FORCE**
Raneem Sharaf '19, Yuriy Syromyatnyk '18

43. **DESIGN AND IMPLEMENTATION OF A SMART DIGITAL STETHOSCOPE**
Skyler Szot '21, Alisa Levin '21, Anthony Ragazzi '21

44. **LIQUID NITROGEN PROPULSION SYSTEM**
Dana Wensberg '18, Anthony Egeln '18, Louis Cappucci '18

ENVIRONMENTAL SCIENCE

45. **A FIELD INVESTIGATION OF MERCURY IN SOILS ACROSS THE WHITE MOUNTAIN NATIONAL FOREST, NEW HAMPSHIRE: IMPLICATIONS FOR BOREAL FOREST ECOSYSTEMS**
Kevin Oleskewicz '19, Joseph Ruggiero '19

| | |

HEALTH FELLOWS

NEUROSCIENCE

Poster #	Title

56. **INFLUENCE OF ALCOHOL ON TIME-BASED PROSPECTIVE MEMORY AND ELECTROPHYSIOLOGICAL MEASURES IN COLLEGE-AGED INDIVIDUALS**
Christy Chan '18

57. **KEEPING YOUR ATTENTION: LONG AFTER THEY'RE GONE, ABRUPT ONSETS REFLEXIVELY MODULATE VISUAL PROCESSING**
Gabriela Christensen '21, John Albanese '21

58. **THE PREVALENCE OF TRAUMATIC BRAIN INJURY IN ADULT FEMALE VICTIMS OF DOMESTIC VIOLENCE**
Olivia DeJoie BS/MA '18, Anna Lee '20, Chloe Ouchida '21

59. **HARMONIC SIGNALS WITHIN RESTING STATE fMRI**
Rachel L. Fox '21

60. **THE KETOGENIC DIET SHIFTS THE CEREBROSPINAL FLUID METABOLOME AND HAS DIFFERENTIAL EFFECTS IN RESPONSIVE VS. NON-RESPONSIVE PEDIATRIC EPILEPSY PATIENTS**
Natalie Freedgood '18

61. **THE EFFICACY OF COGNITIVE REHABILITATION IN IMPROVING PROSPECTIVE MEMORY OF INDIVIDUALS WITH ACQUIRED BRAIN INJURY**
Lilla Kis '18

62. **NEUROMUSCULAR PHYSIOLOGY OF THE ESCAPE WITHDRAWAL BEHAVIOR OF THE CHINESE MUD SNAIL, *CIPANGOPALUDINA CHINENSIS***
Ashley Kupferschmid '20

63. **EFFECTS OF THE KETOGENIC DIET ON BEHAVIORAL RESPONSES TO COCAINE IN MALE AND FEMALE RATS**
Meghan Lees '18

64. **ASSESSING POST-CONCUSSION BALANCE USING THE ELITE BALANCE PROTOCOL (EBP) AND VALIDATING THE USE OF THE WII BALANCE BOARD TO TRACKING THE RECOVERY OF A CONCUSSION**
Kathryn Marsden '21, Anna Hackett '20, Zachary C. Bitan M.A. '18

65. **THE IMPACT OF THE KETOGENIC DIET ON REPETITIVE GROOMING IN MICE**
Jean Lewis Nikuze '21

66. **THE USE OF FMRI TO INVESTIGATE PHYSIOLOGICAL FUNCTIONING ASSOICATED WITH PROSPECTIVE MEMORY PREFORMANCE BEFORE AND AFTER COGNTIVE REHABILITATION IN INDIVIDUALS WITH ACQUIRED BRAIN INJURY**
Meaghan Race '18, Lilla Kis '18, Sarah Vimini '19, Allie Bieling '19, Gianna Barbadillo '21

67. **THE EFFECTS OF KETOGENIC DIET ON APOMORPHINE-INDUCED REPETITIVE MOTOR BEHAVIOR IN MICE**
Lillian Russo-Savage '18

68. **DISCRIMINATING COVARIATION BETWEEN IMPULSIVITY AND ALCOHOL USE AND ITS IMPACT ON REGIONAL HOMOGENEITY USING A MULTIMODAL FUSION APPROACH**
Molly Ryan '18

69. **DIFFERENTIAL DIAGNOSIS OF HIGH-GRADE OSTEOSARCOMAS USING BMPR2 AND CTSK ANTIBODIES**
Molly Schineller '18

70. **INCREASED CONTAGIOUS ITCH IN CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD)**
Molly Schineller '18

71. **SYNTHESIS AND EVALUATION OF ACETYLCHOLINE MOLECULARLY IMPRINTED POLYMERS**
Nathaniel Thiemann BS/MA '18

72. **MEMORY FOR INTENTIONS TEST (MIST) AND DIAGNOSIS THREAT IN TRINITY COLLEGE STUDENTS WITH A HISTORY OF CONCUSSION**
Clotilde White '18

PSYCHOLOGY

73. **ALTERNATIVE WAYS TO MEASURE METACOGNITION: OFFLINE VERSUS ONLINE ASSESSMENT**
Michelle Treglia '18

74. **DEVELOPMENTAL DIFFERENCES IN METACOGNITION AND MOTIVATION**
Jillian Ramsay '18

75. **GENDER DIFFERENCES IN METACOGNITION AND MOTIVATION**
Adelaide Jenkins '18

Poster #	Title

76. **WHAT DO YOU MEAN I GOT A D+? EFFECTS OF FEEDBACK TYPE AND QUALITY ON METACOGNITION, MOTIVATION, AND ACADEMIC PERFORMANCE IN HIGH SCHOOL STUDENTS**
Daisuke Katsumata IDP

77. **IMMIGRANT STATUS AND PSYCHOLOGICAL WELL BEING**
Joanne Chambers '19, Isabella Chen '19, Stefania Ruibal '19

78. **WHY SELFIES?**
Olivia Consoli '19, Jamie Dingus '19, Ally Slowe '19

79. **INFANT MORTALITY AND MATERNAL HEALTH IN HARTFORD, CT**
Chelsea Armistead '18

80. **PERFORMANCE ON THE AFFECTIVE ODDBALL SILHOUETTE TASK IN PRESCHOOL-AGED CHILDREN EXPOSED TO INTIMATE PARTNER VIOLENCE**
Caroline Howell '18

81. **EXPLORING GENDER IDENTITY IN CISGENDER INDIVIDUALS**
Jacob Vargas '18

82. **AN EXPLORATION OF THE LINK BETWEEN FOOD TASTE PREFERENCES AND PERSONALITY**
Ania Aliev '18

83. **ASSOCIATIVE LEARNING ACCELERATES THE TEMPORAL DYNAMICS OF COVERT EXOGENOUS SPATIAL ATTENTION**
Devin Butler '19

84. **LINGUISTIC BEHAVIORS IN TELEVISION INTERVIEWS**
Esmé Douglas '18

85. **AMERICANS' ATTRIBUTIONS ABOUT A MASS SHOOTING AND ITS PERPETRATOR: THE ROLE OF THE PERPETRATOR'S CULTURAL BACKGROUND**
Zoe Ferguson '18

86. **MIRROR MIRROR ON THE WALL: INFLUENCES ON SHORT-TERM VERBAL MEMORY**
Brii Kuzmickaite '18

Poster #	Title

87. **WHY CAN'T YOU GUYS BE LIKE THEM? MODEL MINORITY MYTH SALIENCE HEIGHTENS WHITE AMERICANS' NEGATIVE PERCEPTIONS OF BLACK AMERICANS AND REDUCES SUPPORT FOR AFFIRMATIVE ACTION**
Timothy Lee '18

88. **EFFICACY OF DIFFERENT REFUSAL STRATEGIES FOR NON-MEDICAL PRESCRIPTION STIMULANT REQUESTS**
Eliza Marsh '18

89. **ATTIDUES ABOUT THE SELF, SOCIETY, AND CAMPUS LIFE AT TRINITY COLLEGE**
Sam Muse '18

90. **THE INFLUENCE OF PROTECTIVE BEHAVIORAL STRATEGIES AND COACH MANAGEMENT STRATEGIES ON STUDENT-ATHLETES' ALCOHOL USE: A MIXED METHODS STUDY**
Kayla O'Connor '18

91. **HOW THE BIRTH CONTROL PILL INFLUENCES WOMEN'S ATTITUDES AND EXPECTATIONS OF THEMSELVES**
Molly Santora '18

92. **ALCOHOL USE IN STUDENT ATHLETES: THE INFLUENCE OF INJUNCTIVE NORMS, TRAIT URGENCY AND COMPETITIVENESS**
Annabel Stanley '18

93. **SENSORIMOTOR SPEECH CONTROL AND THE INTELLIGIBILITY OF SPEECH**
Jessica Thulin '18

BIOLOGY

1.
SPECIALIZATION FOR YOLK PROCESSING IN TURTLE SPECIES *TRACHEMYS SCRIPTA*

Madeline Barnes '20, Farahana Appiah '21
Faculty Sponsors: Daniel G. Blackburn, Yumming Hu

Scanning electron microscopy (SEM) has allowed us to visualize and better understand the methods by which the turtle *Trachemys scripta* processes yolk in the egg and provides nutrients to the developing embryo. Using SEM, we examined yolk tissue at various developmental stages and were able to notice a pattern in yolk cellularization and the vascularization by blood vessels. In early stages, the yolk consists of free yolk spheres with few nutrient-rich, endodermal cells; these cells assist in yolk digestion. As development continues in the mid-stages, the endodermal cells proliferate, taking up large yolk spheres through phagocytosis and digesting them into smaller droplets within the cell. In late stage eggs, the yolk-filled endodermal cells proliferate around a network of blood vessels, forming "spaghetti strands". These strands provide an efficient means to transport nutrients from the yolk to the growing turtle embryo. This unique pattern of yolk transport and uptake was previously found in several snake species, the lizard species *Sceloporus undulatus*, and the turtle species *Chelydra serpentina*. We are currently examining turtle egg samples and in our ongoing research, we hope to further our study via alligator eggs to determine if this pattern is ancestral for all reptiles.

2.
BUILDING A SEGMENTED BODY: THE CELL DYNAMICS OF SEGMENTATION AND ELONGATION

Nicole Duan '18
Faculty Sponsors: Constantinou[1,2], S., Nagy[3], L., T. Williams[1]
[1] Department of Biology, Trinity College
[2] Department of Zoology, Michigan State University
[3] Molecular and Cellular Biology, University of Arizona

Segmentation is a key feature of arthropod diversity. Most arthropods add segments during development from a posterior region called "the growth zone", which is the site of elongation and segment patterning. While segment patterning is studied in diverse taxa, the cell behaviors underlying elongation are less well known. The prediction for the growth zone is that there is a posterior region of undifferentiated cells dividing continually to provide the tissue required for new segments. We tested this model by examining cell division patterns in the posterior growth zone in a crustacean, *Thamnocephalus platyurus,* that adds segments after hatching. Our findings do not support this model of growth zone elongation. By looking at cells undergoing either S phase or M phase, we find that the number of cells in mitosis in the growth zone is surprisingly low, and the cell cycle in the growth zone is slow but synchronized. Interestingly, our data show that DNA synthesis is spatially organized in the growth zone, with distinct anterior and posterior domains of cell cycling. Cells in the anterior growth zone undergo an apparent synchronization, resulting in all cells of the newly specified segment being in S-phase. The domains of S-phase suggest the cell cycle is compartmentalized in the growth zone. This idea is confirmed by discrete domains of expression of cell cycle regulators, *string* and *cyclin A.* The

cell cycle domains in the growth zone are correlated with expression of the segment patterning genes, *Wnt* and *caudal,* suggesting that cell cycle and segment patterning are tightly integrated. When cells are blocked in S-phase by hydroxyurea, segment addition is disrupted, confirming that cell cycle regulation is integrated with segment patterning in the growth zone. Overall in the growth zone, we find low numbers of cells in mitosis, and a slow but synchronized cell cycle that is tightly linked to segmental patterning.

3.
THE EXPRESSION OF MTOR IN THE OLIGODENDROCYTE LINEAGE
Emma England '20, Katie Lazur '20
Faculty Sponsor: Hebe M. Guardiola-Diaz

Oligodendrocytes (OL) are glial cells found in the central nervous system which myelinate the axons of neurons to speed up neuronal firing rates. These cells are important in nerve impulses because it allows the brain to run efficiently. The objective of this research was observe the expression of the gene mTOR in the lineage of development of oligodendrocytes. This was done by looking at cells with varying ages. Older cells would theoretically have more late OLs, while the early cultures should have primarily early progenitors. With this knowledge, cells were cultured from the brains of newborn rats that were 1-3 days old and then cultured in growth media for varying amounts of time. The cells were stained by using immunocytochemistry and then analyzed. The staining allowed the of OLs of different ages to be seen morphologically. The expression of mTOR was viewed by isolating RNA and inserting the appropriate primers marking the mTOR gene to create cDNA. Analysis of a control group using the actin gene was also conducted. The cDNA was quantified from 0, 2 and 4 day cells to determine the expression of mTOR in the different stages of the OL lineage. After the qPCR analysis, the control gene, actin was shown to be expressed more than the mTOR gene. The results indicate that there is no change in mTOR gene expression throughout the OL lineage.

4.
ALUMINUM STRESS IN TOMATO PLANTS: INVESTIGATING THE ROLE OF THE *ALS1* GENE IN DIFFERNTIAL ALUMINUM TOLERANCE OF DOMESTIC AND WILD TOMATOES USING *ARABIDOPSIS* MODEL
Julia Pitino '18
Faculty Sponsor: Susan M. Bush

Aluminum (Al) toxicity is a major limiting factor of crops in acid soils. Many plant Al tolerance mechanisms involve binding organic acids to Al ions to neutralize and detoxify them, also called chelation. *ALS1* is an Al tolerance gene in plants that codes for a transporter of chelated Al into root vacuoles. In the tomato genus *Solanum,* the domestic species *S. lycopersicum* and wild species *S. penellii* carry slightly different gene variants, or alleles, of *ALS1*. The two alleles differ by five conserved codon changes at the N-terminus protein coding region. Based on the reasoning that wild plant species face higher levels of toxicity and have evolved stronger stress tolerance mechanisms than their domestic counterparts, we hypothesize that the wild *ALS1* allele confers stronger Al tolerance than the domestic allele. The hypothesis can be tested by producing transgenic *Arabidopsis* carrying either *ALS1* allele and comparing their root sensitivity to aluminum. In this project, Al treatment growth experiments were performed with several *Arabidopsis* wildtype and *als1* mutant strains to characterize their Al sensitivity and find an

optimal Al concentration to exhibit differential root growth between wildtypes and mutants. Successful ligation of the wild and domestic *ALS1* genes into a plasmid vector was completed and confirmed using an *E. Coli* transformation. The next step of the project is infecting *Arabidopsis* plants with *Agrobacterium* carrying the *ALS1*-vector plasmid to produce transgenic *ALS1 Arabidopsis* seeds for future Al treatment experiments.

5.

IDENTIFYING AND CHARACTERIZING THE *CDT1* MUTATION IN *ARABIDOPSIS THALIANA*
Vanessa J. Ross '21
Faculty Sponsor: Susan M. Bush

With climate change and all of its possible effects, it is predicted that there will be changes in soil and water sources; these changes have the potential to exacerbate the current stressful conditions of soil, such as high concentrations of aluminum. Because of this threat, there is a need to study these current conditions and their effects on crop species in order to prevent future crop losses. To address this, the *cdt1* mutation in the Salk line of Arabidopsis was looked at in relation to this gene's role in aluminum tolerance. DNA from both wildtype Columbia and *cdt1* mutant Arabidopsis leaves was extracted for genotyping, which was completed using PCR and gel electrophoresis. After the mutant plants were genotyped as homozygous for the *cdt1* mutation, seeds were harvested from the mature plants. Collected Col-0 and *cdt1* seeds were grown on ½ MS agar plates of pH 5.7 at room temperature before being transferred to plates of varying aluminum concentrations for root growth experimentation. Col-0 and *cdt1* seedlings were grown for 7 days on three plates of pH 4.2 media containing 0.0 mM $AlCl_3$ and 0.5 mM $AlCl_3$. Results show that there was no significant statistical difference between the root lengths for each genotype ($p = 0.05212$). Aluminum treatment had a significant effect on root growth within each genotype ($p = 1E-16$). Future work will focus on characterizing the *cdt1* mutation in the GABI-Kat line of Arabidopsis; root growth experiments with these plants will further knowledge about the gene's overall role in aluminum tolerance.

6.

GENETIC MANIPULATIONS INVOLVING SERRATE IN *DROSOPHILA MELANOGASTER*
Tyler Seckar '18
Faculty Sponsor: Robert Fleming

The gene *Serrate* encodes a ligand that can control the activity of the Notch cell-to-cell signaling pathway. Previous studies in the Fleming lab have demonstrated that our genetic constructs of Serrate, such as the Serrate mini-gene, can be expressed and translated into a viable protein ligand. However, for Serrate to interact with its receptor partner, Notch, it must be present at the cell membrane. In an effort to confirm that the Serrate constructs are accurately reaching the cellular membrane, a homozygous stock of *D. melanogaster* was set up with *ptcGal4* driving the expression of membrane bound mouse *CD8* gene product. Due to many unforeseen difficulties in obtaining this homozygous stock, a new scheme is being employed using an attached X chromosome in females crossed with homozygous *ptcGal4* males. The ultimate objective of this work is to secure a homozygous stock of *D. melanogaster* with *ptcGal4* driving the expression of *CD8* to help localize the cellular membrane when analyzing other Serrate constructs. Other

previous studies by Fabiola Yun ('18) have discovered a mutation, known as *M23*, capable of correcting the loss of wing vein phenotype in the artificial *H2Ncleve* construct. The *M23* mutation has been mapped to the 3rd chromosome and a series of crosses have concluded that it is not an allele of the Serrate or Delta ligands. To further localize where on the 3rd chromosome *M23* resides, the mutation has been crossed with a marked *rucuca* strain. The ultimate objective of this work is to specifically map the *M23* mutation to an area of the 3rd chromosome of *D. melanogasoter* in order to better understand the role it plays in the Notch-signaling pathway.

CHEMISTRY

7.
ANALYZING THE EFFECTS OF COCAINE AND A KETOGENIC DIET ON BRAIN NEUROTRANSMITTER CONTENT IN RATS
Ahmad Chughtai '20
Faculty Sponsor: William H. Church

Studies in the past have shown that the dopamine system is linked to the rewarding effects of drugs, and further, have demonstrated the presence of sex differences in behavioral and neurochemical responses to drugs of abuse such as cocaine. This study focused on investigating sex differences with respect to cocaine addiction and measuring how the ketogenic diet impacts the neurochemistry of behavioral reinforcement. Changes in the chemical dynamics of dopaminergic reward pathways were measured in male and female rats following chronic cocaine administration and used to compare animals given the ketogenic diet with animals given the control diet. The following brain regions were analyzed: cortex, nucleus accumbens, striatum, and midbrain. HPLC with electrochemical detection was used to quantitate NE, DA, DOPAC, HVA, 5HT, and 5HIAA in these areas. Results indicated that dopamine activity, as measured by the DOPAC/DA ratio, was altered by chronic cocaine and the ketogenic diet in female rats. These findings suggest that animals subjected to chronic cocaine while on the ketogenic diet have an enhanced response to an acute cocaine challenge.

8.
REDUCING *DICTYOSTELIUM DISCOIDEUM* CELL ADHESION IN MICROFLUIDIC DEVICES BY USING SUPPORTED LIPID BILAYER COATING
Julia Clapis '18
Faculty Sponsor: Michelle L. Kovarik

Due to the small channel size, microfluidic devices are particularly susceptible to fouling by cells or biomolecules. Supported lipid bilayers are a convenient solution to this problem because they spontaneously form on the inside of hydrophilic channels and serve to reduce adhesion of sample components. Our research goal is to understand how the composition of a supported lipid bilayer affects its performance in a microfluidic device for single-cell analysis of the social amoeba *Dictyostelium discoideum*. To study the effect of net bilayer charge on adhesion of *D. discoideum* cells, the net charge of the bilayer was altered. *D. discoideum* cells have a slight negative charge, therefore when the negative character of the bilayer was increased, cell adhesion was expected to decrease. The effect of a positively charged bilayer was also studied. Bilayer compositions varied from 100% zwitterionic phosphatidylcholine (PC) to up to 30% negatively charged phosphatidylglycerol (PG), or up to 50% positively charged ethyl

phosphatidylcholine (ePC), with the remainder consisting of PC. Cell adhesion was measured by allowing cells to adhere to the channels for 15 minutes, then counting the cells before and after rinsing the channels. Cell adhesion was the lowest at 5 and 10% PG, and 30% ePC, but increases at higher concentrations of either positive or negative lipid in the bilayer. By better understanding how lipid composition influences failure by fouling, microfluidic devices can be optimized for single cell analysis.

9.
ANALYSIS OF THE STRUCTURE AND SYNTHESIS OF (±)-PENTACYCLOANAMMOXIC ACID

Joshua Corbo '19, Vanessa Jones '19
Faculty Sponsor: Cheyenne Brindle

Elias Corey and Vincent Mascitti in 2004 published the synthesis for (±)-pentacycloanammoxic acid that is naturally produced by anaerobic ammonium-oxidizing bacterium. Key steps in the mechanism are discussed to show how this synthesis was achieved from an eight-member carbon ring, cyclooctatetraene. An analysis of the final product involved ^{1}H and ^{13}C spectroscopy (NMR) and computational chemistry are presented to understand the molecular structure.

10.
SYNTHESIS AND CONFORMATIONAL ANALYSIS OF PEPTIDES LINKED TO A RIGID, BIMETALLIC RING SYSTEM USING AROMATIC SPACERS

Lauren M. Davidson '16, Niranjana Pokharel '15, Josephine Frempong '18,
Michael L. Phillip '19, Cosmic B. Gober '18
Faculty Sponsors: Timothy P. Curran, Joanne L. Stewart, Department of Chem, Hope College, Holland, MI

Recent investigations from this laboratory have shown that a novel, bimetallic ring system adopts and maintains a rigid conformation. This ring system possesses a ferrocene moiety at one end and a tungsten bis-alkyne complex at the other end. Although an X-ray structure of this molecule has proved elusive, DFT calculations indicate that the two alkynes are roughly parallel to each other and separated by a distance of approximately 3.5 Å. Since the peptide strands in a β-sheet are separated by 3.3 Å, it has been hypothesized that peptides joined to the two alkynes in this rigid organometallic ring will adopt a β-sheet structure. If these molecules do assume β-sheet conformations, then they have the potential to serve as model systems for studying the forces that maintain or disrupt β-sheets, information that would help biomedical researchers investigating diseases (like Alzheimer's disease) that appear to be mediated by formation of β-sheet proteins. This presents an opportunity for inorganic chemistry to possibly shed light on a biochemical problem related to a medical need. To test this hypothesis, molecules having the general structures 1 and 2 have been prepared and examined. In 1 the peptides are linked to the bimetallic ring system via an aniline moiety attached to the two alkynes, while in 2 the peptides are linked to the bimetallic ring system via a benzoic acid moiety attached to the two alkynes. This presentation will detail the preparation of these complexes, and information about their conformational behavior obtained using NMR spectroscopy and DFT calculations.
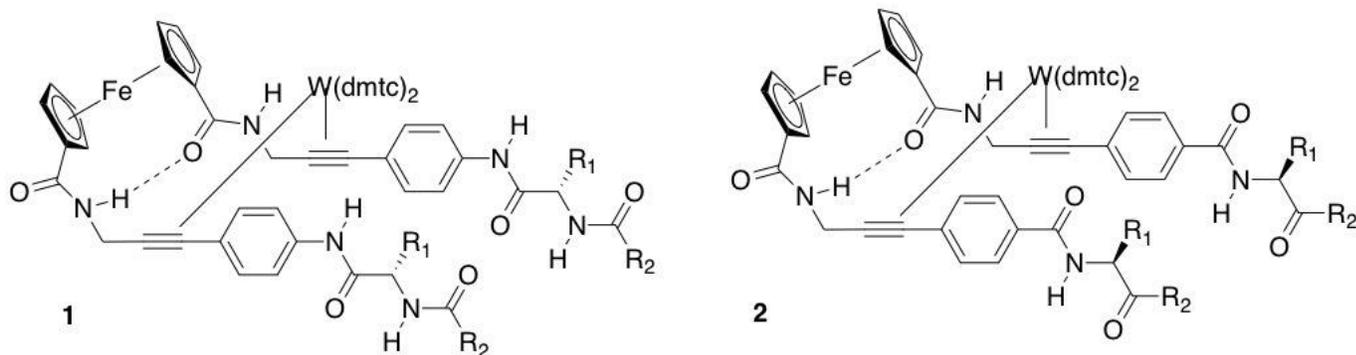
11.
A CUSTOM-BUILT SOFTWARE METHOD OF DATA ANALYSIS FOR SINGLE CELL ANALYSIS
Jason S. Deck '21
Faculty Sponsor: Michelle L. Kovarik

Single cell analysis is necessary to understand cellular heterogeneity. As technology improves, and large quantities of data can be processed in a matter of seconds, it becomes increasingly crucial to measure and then process data from hundreds to thousands of cells in reasonable time frames to determine trends in heterogeneity. In chemical cytometry, single cell analysis begins with cells being funneled through and lyse inside a channel on a microfluidic chip. The lysate is then separated into its components using electrophoresis with detection by laser-induced fluorescence. To extract quantitative information from the resulting data, we plan to use the program MATLAB to organize, plot, and interpret our data from single-cell and subpopulation experiments. Beginning with basic code for plotting and analysis functionality, we modified previously written code to generate images of electropherograms, identify peaks, and calculate areas, widths, and migration times. Several data sets of 5-51 electropherograms were given to the program, and requirements for functionality, like data set size requirements, location of data sets, and number of data sets, were solved. Once the program could successfully plot and analyze data, it was necessary to validate the output. We compared results from running this MATLAB program to data that was previously analyzed through Cutter (v. 7.0) and to direct measurement of peak areas by weighing paper cut-outs of the peaks. It was found that the MATLAB code was incorrectly determining peak areas. Further investigation is required to improve the results of the MATLAB area analyses. Once this issue has been addressed, we will use this program to automate data analysis for research into cellular heterogeneity.

12.
ANALYSIS OF R. B. WOODWARD'S TOTAL SYNTHESIS OF QUININE
Maxwell H. Furigay '19, Michael L. Phillip '19
Faculty Sponsor: Cheyenne Brindle

R. B. Woodward and W. E. Doering published a total synthesis of quinine, an antimalarial drug, in 1944, using a Claisen condensation to bring together key pieces of the molecule. An analysis of the mechanisms involved in the total synthesis is presented with emphasis on key steps in the

reaction. The total synthesis was experimentally affirmed in 2008, and the product was confirmed using ^{1}H and ^{13}C NMR spectroscopy, an analysis of which is also shown.

13.
SYNTHESIS AND CONFORMATIONAL ANALYSIS OF ALANINE PEPTIDE DERIVATIVES OF THE ALLISON LAWRENCE COMPLEX USING PHENYL SPACERS
Cosmic Gober '18
Faculty Sponsor: Timothy P. Curran

The objective of this project is to synthesize and characterize organometallic peptides that have the potential to adopt β-sheet conformations. The desired organometallic peptide contains a bimetallic ring system that has a ferrocene unit at one end, a tungsten bis-alkyne at the other end, and two peptide chains attached to the two alkynes. To synthesize this complex, we needed first to form a ferrocene diamide and an alanine derivative acylated with 4-iodoaniline. These two molecules are coupled together through a Sonogashira reaction. Finally, the resulting dialkynylpeptide is reacted with W(CO)3(dmtc)2 to produce the bimetallic ring system. The intermediate and final compounds were characterized for purity using TLC and HPLC. The identities of the intermediate and final compounds were established by 1H NMR, 13C NMR and MS. Whether the final product adopts a β-sheet conformation can be determined using NMR, X-ray crystallography, and density functional theory (DFT) calculations. Details regarding this work, which is funded by an NSF grant, will be presented.

14.
THE PSEUDOELASTICITY OF SPHERICAL GOLD NANOPARTICLES
Anika Harkins '21
Faculty Sponsor: Lindsey Hanson

Noble metal nanoparticles have unique electrical and optical properties because of their small size. Movement of electrons within the boundaries of the nanoparticle gives the nanoparticle its unique color, and changes in shape affect the color of the particle. As pressure alters the shape and thus the color of nanoparticles, it is important to study how quickly nanoparticles revert to their original shape after pressure is applied. An equation is found to predict the relaxation time of the nanoparticle with different radii of the nanoparticle or temperatures at which the nanoparticle is being studied. This equation is used to predict how long it will take for certain nanoparticles to revert to equilibrium at a specific temperature. The equation is modelled with Excel and can be used to make an estimate of the time scale on which to measure the nanoparticle's return to its equilibrium state. Then, COMSOL software is used to model the stresses that a nanoparticle will be subject to when pressure is applied. The function of these models is to understand the motion of the atoms during deformation, which will provide a timescale at which to measure the return to equilibrium of the particle. In order to experimentally test our predictions, batches of nanoparticles of several different sizes are synthesized, following the procedure from Jana, Gearheart, and Murphy. Size uniformity is measured in each batch. The next steps are to measure the deformation of particles and observe the return to the equilibrium state of the actual particles.

15.
KETOGENIC DIET INDUCED METABOLIC CHANGES INFLUENCING NEUROPROTECTION IN SH-SY5Y CELLS
Lucy Honeycutt '18
Faculty Sponsor: William H. Church

The ketogenic diet is a high-fat, low-carb diet that has been used widely and successfully for the treatment of seizures and has recently gained recognition for its neuroprotective effects against neurotoxins. However, the mechanism by which the ketogenic diet provides neuroprotection is still unknown, though it is thought to be a result of metabolic changes such as increased ATP stores and decreased reactive oxygen species (ROS) production. Previous work on this project has resulted in the development of a ketogenic diet-type cell culture media. The present work will investigate whether this media provides neuroprotection from rotenone toxicity, and, if so, what metabolic changes have occurred within the cells that may be influencing this neuroprotection. Undifferentiated SH-SY5Y human neuroblastoma cells were cultured in either normal media (LSFM), normal media with ketogenic diet added (LSFM KD), low glucose media (LG), or low glucose ketogenic diet media (LG KD). Following 48 hours of media treatment, cells were stressed with 500 nM and 1 μM rotenone for 24 and 48 hours before being analyzed for ATP and superoxide (ROS) content. After 24 hours, cells treated with low glucose media types experienced a dose dependent decrease in ATP production in response to rotenone. A dose-dependent increase was seen in superoxide concentration in ketogenic diet media types, and a decrease was seen in normal media types following 24-hour exposure. Only cells treated with LG experienced an increase in ATP following 48 hours of rotenone exposure.

16.
TRITYL CATION-CATALYZED COMPLEX MOLECULE SYNTHESIS
Vanessa Jones '19
Faculty Sponsor: Cheyenne Brindle

The use of multiple single addition reactions to produce a single large product is an important technique for building molecular complexity. However, reactions can also be one step if certain properties are altered to select for the correct product. We create large products from the sequential addition of two different indoles to an imine, using triarylmethyl cation catalysis. This requires the synthesis of imines from aldehydes. The imines are produced by adding different types of aldehydes to paranitroaniline. The solid produced from this reaction were then recrystallized to ensure purity. This step was then tested using nuclear magnetic resonance. The imine was then reacted with indole to produce a single addition product. This technique allows the complicated product to be produced that would otherwise be nearly impossible to synthesize. These first few steps still have to be perfected, the most successful temperature and concentration must be found for each reaction performed, in order to continue on. This reaction can also be conducted called a "two-step, one-pot" reaction which allows for a double addition product to be created. Future work will include more one-step, two-pot reactions to create more double addition products.

17.

COMPARING PEPTIDE SUBSTRATE REPORTER LOADING METHODS: HOW EXOGENOUS MOLECULES ENTER CELLS AFFECTS THEIR FATE
Grigorii Kalminskii '20, Rahuljeet Chadha '20, Allison J. Tierney '17
Faculty Sponsor: Michelle L. Kovarik

The mechanism through which exogenous molecules enter intact cells of any type may influence the subsequent metabolism of these molecules. The purpose of this experiment was to investigate the metabolism of a peptide substrate reporter for protein kinase B loaded into intact cells of *Dictyostelium discoideum* via pinocytosis, electroporation and myristoylation. Loading methods were first optimized for *D. discoideum* to ensure the most efficient loading, without compromising the cells' viability. Other aspects such as loading time, loading uniformity and intracellular distribution were also characterized. The investigation of intracellular metabolism of the PKB peptide reporter revealed the highest stability after being loaded via electroporation ($t_{half-life}=53+13$ min), while loading via pinocytosis and myristoylation resulted lower stability ($t_{half-life}=19+2$ min and $t_{half-life}=12+1$ min, respectively). Kinase activity was the highest in electroporated cells, while only trace amounts of phosphorylated peptide were detected in cells loaded via pinocytosis and no peptide phosphorylation was observed in cells loaded with myristoylated peptide. Future work on this project will further study how loading methods affect the phosphorylation of the kinase reporter.

18.

CANDIDATE BASED BIOMARKER DETECTION IN PARKINSON'S DISEASE
Eugene Miller '21
Faculty Sponsor: William H. Church

There are currently no biomarkers employed in the diagnosis of Parkinson's Disease (PD). Uric acid and reacts with different reactive oxidative species (superoxide, nitric oxide, and peroxynitrite) and the products of these reactions (allantoin, 6-aminouracil, triuret, respectively) could serve as biomarkers for neuronal degeneration prior to individuals becoming symptomatic. A liquid chromatography/mass spectrometry method of analysis was designed to quantitate these four analytes in plasma samples., The separation and quantitation of these compounds was investigated during this semester. Initial studies involved learning how to use the instrument, determining chromatographic separation conditions and evaluating quantitative strategies. Calibration curves were generated using a solution of 6-aminouracil Consistent measurement of triuret, allantoin, and uric acid was not obtained such that calibration curves could be created for them. Initial evaluation of the project suggests that this method will contribute to the diagnosis strategies for Parkinson's Disease. Standard analytical measurements of the method's rigor will be evaluated over the summer.

COMPUTER SCIENCE

19.
AN APPLICATION OF NEURAL NETWORKS TO CONTINUOUS
AUTHENTICATION
Karishma Asthana '18
Faculty Sponsor: Ewa Syta

Continuous Authentication (CA) is an important security mechanism which has far-reaching implications. It surpasses traditional authentication in that it works against "lunchtime attacks" and "masquerade attacks". However, beyond this, continuous authentication is applicable to more large-scale situations such as implementation in flight decks (in response to the 9/11 attacks) or large vehicles (in response to recent terrorist attacks using trucks). Although CA systems are a powerful security measure, they pose many challenges in terms of trading off between security and usability. In order to address this, we can look to Artificial Neural Networks (ANNs) for biometric authentication. Biometric traits allow for non-intrusive and passive authentication. ANNs are not "statically" programmed, so they can adjust well to different environments and work well with noisy data. The main goal of my project is to develop a proof-of-concept, powered by neural networks, which will continuously authenticate faces. The main scope of my prototype is for the workplace setting. It takes in as input an RFID card scan, which then triggers the authentication to begin. My neural network then looks to match the face found to the ID card scanned, such that the software does not have to compare the face against all faces in a database to determine if it is a valid person. It can instead have a very quick, binary decision of if it matches the scanned card. The neural network utilizes the Adam Optimization algorithm, an algorithm which works well with noisy data. With this algorithm, the neural network achieves 99% accuracy.

20.
K.E.A TRAINER
Isabella Dahilig '18
Faculty Sponsor: Peter Yoon

Kali Eskrima Arnis is a dying indigenous Filipino martial art, formed from self-defense and passed on from generation to generation; this martial arts specializes in weaponry combat, empty-hand fighting, and grappling. My goal is to create an authentic Kali Eskrima Arnis education through a web application of animated tutorials and training sessions for a technique called the "knife generator". Beginning with a model that can eventually be animated in the WebGL framework, I selected an open-sourced 3D male model and implemented a skeletal structure which enables movement in the model using Blender, an application used for three-dimensional objects. In addition, I set up the WebGL framework to display the Blender object and installed the three.js library used for extensive animating techniques. Within the spring semester I was able to establish a proper scene in three.js and load the training models for

animation. In addition, the models were animated in order to simulate the knife generator technique.

21.
ACCELERATING BLOCK-TRIDIAGONAL MATRIX INVERSION ON GPUS
Bemnet Demere '19
Faculty Sponsor: Peter Yoon

Block tridiagonal matrices often arise in quantum physics. For example, the non-equilibrium Greens function involves repeated inversions of large blocks of tridiagonal matrices. Hence, given that those specific types of matrices are in the integral part of the mentioned algorithm and that they may also be of a large dimension, enhancement in the speed of the inversion algorithm of block tridiagonal matrices will have a significant value. The goal of this project is to research on and design strategies to parallelize the inversion algorithm described in Skelboe[1] using CUDA on NVIDIA GPUs. A preliminary experiment shows a speed up to 10x for moderate size block tridiagonal matrices.

[1] Skelboe, Stig. "The Scheduling of a Parallel Tiled Matrix Inversion Algorithm." (2010).

22.
RAETHER MAP
Ngoc (Norah) Do '18
Faculty Sponsors: Ewa Syta, Travelers Insurance Company

Raether Map is an Android application that allows users to locate Trinity Library materials (books, DVDs, CDs) and resources (printers, scanners, study rooms). When working part-time at the Library Circulation Desk, I noticed that the staff members need to help many students with finding books and other library materials. On busy days, like those at the beginning of the semester, it is challenging for two Circulation Desk staff members to help a long line of students in a timely manner. Besides asking for help at the Circulation Desk, students can take advantage of the paper maps or Google Maps. However, there are certain drawbacks to using these maps. The paper maps are not very intuitive to many students and do not keep up with the frequent changes of library materials' locations. On the other hand, Raether is well-mapped on Google Maps. However, Google Maps only shows us where things are. It does not provide a direct search for book's location or flexible search of library materials, such as search by topic or author. My senior project aims to solve this problem. Raether Map is a combination of library catalog and indoor mapping. The application displays the floor plan image of the level its user is currently on. On top of the image is a blue dot updated in real time to represent the user's current location. The flexible search tool allows its user to search for any item whose fields contain the entered query as long as the item is physically available in the library. Once the user hits Enter, all relevant results are displayed in an expandable bar that enables the user to have a full view of the map and at the same time refer to the current item's information if needed. The search tool gets direct access to the library's database system, thus guaranteeing search results' accuracy. When an item is selected and the user is on the floor where the item is located, a blue path is

drawn from the user's current location to the item's location, represented by a red marker. This path is also updated in real time. With these features, Raether Map will immensely reduce the workload for Circulation Desk staffs, give users a more personal and visual book search experience, and adapt to the frequently changing location details of the library materials.

23.
TRAUMA REGISTRY DATA ANALYSIS
Ebenezer Hormenou '18
Faculty Sponsor: Ewa Syta

Saint Francis Hospital and Medical Center has a busy trauma center that sees over 2000 patients a year. The hospital maintains a trauma registry that collects several variables about patient care in a programmed registry management tool. This software outputs the data as a predicable table with little or no analysis or organization. The trauma center staff currently spends many hours formatting and making visualization of the data into a report and would like a time efficient way to create the report. The goal this project is to design an analysis software that will take the raw data from the registry management tool and output a visualization and summary of the data in Microsoft Excel. The analysis software is written in python using statistics libraries such as pandas to manipulate the data, and XlsxWriter to create charts in Excel. This software is able to create a full Excel report with a simple click. Users can specify date ranges for the analysis and compare months or quarters. The output report contains visual summaries and statistical summaries of the key data points.

24.
DIMENSIONALITY REDUCTION TECHNIQUES FOR DATA VISUALIZATION
Ilya Ilyankou '18
Faculty Sponsor: Peter Yoon

In my project, I explored the possibility of visualizing high dimensional data in 3D. I studied and compared popular dimensionality reduction algorithms—Principal Component Analysis (PCA), Multidimensional Scaling (MDS), and Sammon Mapping—and their ability to "shrink" any dataset into three dimensions while preserving as much information about the data as possible. As a result, I created a web application that can take any .csv dataset, analyze it, fill in missing values, and apply one of the above mentioned algorithms. By reducing the number of parameters from many (N > 3) to 3, values of three such parameters can be treated as x, y, and z coordinates, allowing each data point to be plotted in 3D. The application makes use of WebGL (Three.js JavaScript library) to create an interactive visualization where one can zoom and rotate the camera view. Through such interaction, users can better understand how data points are related in space, and find hidden patterns in the dataset. The computations are performed in the back-end using Python's numpy and other libraries.

25.

TRINEVENTS - A HTML BASED SOLUTION TO TACKLE THE EFFECTIVENESS OF EVENT MANAGEMENT AT TRINITY COLLEGE
Alodie Iradukunda '18
Faculty Sponsor: Takunari Miyazaki

TrinEvents- as its name suggests is a web platform that aims at tackling the problem of the effectiveness of the existing ways of managing events at Trinity College. It offers a way to consolidate all processes that one needs to undertake to set up an event, which are currently independent of each other.

Event management at Trinity College is run through the Student Advancement, Involvement and Leadership office which is responsible for handling the running of events notably the provision of event support if requested by an individual wanting to organize an event. This along with the calendar office which is responsible for scheduling events. However, the problem that arises is that there isn't any consolidating place where all these procedures can be found to facilitate the process. There is a lot of time that goes into setting up an event on campus, because there isn't a centralized method that has been put forth to aid the process. TrinEvents comes as a solution to that problem in bringing together those mentioned entities and simplifying that process.

The platform is comprised of two main spheres: event support and event scheduling. The event support portion regroups all the managerial needs to provide technical support for an event. More specifically, if one needs technical support such as projectors or microphones, the platform allows for students to sign up to provide that support as part of their campus jobs. On the other hand, event scheduling regroups all that's necessary to schedule an event based on time, place desired as well as the number of attendees for the desired event.

TrinEvents utilizes different tools to aid its HTML elements to flourish. It uses CSS, Javascript, and PHP to arrive at the final desired product. It also integrates a certain number of features provided by Firebase, a google web application development platform. The resulting product is hence a web application that is accessible from any device regardless of size because of its adaptability. TrinEvents also integrates an authentication feature to provide a level of security of the platform and to allow only use to the Trinity Community. The platform also includes a real-time database feature which allows for users to sign up or register events in real-time. Evidently, there is a need for this solution and will be deployed for use by the Trinity community soon.

26.

RATEMYRESIDENT: A SECURE AND EFFORTLESS MEDICAL RESIDENT EVALUATION SYSTEM
Alex Johnson, '18
Faculty Sponsors: Ewa Syta, Vijay Jayaraman, Saint Francis Hospital

Saint Francis Hospital in Hartford, Connecticut works with and trains medical residents from University of Connecticut's Medical School in 6-week rotations. Saint Francis Hospital is currently having a difficult time getting feedback for the residents from the faculty members with whom they interacted due to busy doctor schedules. My proposal to solve this problem was to

develop website that allows the site director to request evaluations from the faculty members, and allows the faculty members to complete these evaluations on their own time. I used a web-development framework called Ruby on Rails to accomplish this over the past two semesters. The current product is a secure and intuitive website that allows the site director at Saint Francis Hospital to submit evaluation requests, which causes secure links to an evaluation page to be emailed to the corresponding faculty members. Security was an extremely important part of the website from day one, as the information in these evaluations is protected under both FERPA and HIPAA. In the process of building in the security that was needed to protect both the residents who are being evaluated, and the medical information that may be referenced in the evaluations, I learned how difficult it is to identify all potential vulnerabilities in a software product and to remedy those vulnerabilities by adding the necessary security techniques. Since there is no such thing as "perfectly secure" software, Saint Francis Hospital's decision to move from their current system of obtaining resident feedback to the website that I have been developing will require more attention to security and privacy, but will overall improve the educational experience of the residents that the hospital works with.

27.
ECONOMICS THE INTERACTIVE EXPERIENCE
Francis Maugeri '18
Faculty Sponsor: Peter Yoon

Students have different learning preferences, and in every field of study shifting the mediums of teaching can be beneficial to all students. These mediums promote deeper understanding and superior recall. Economics the Interactive Experience serves to fill the medium of interactive visual models for beginner Economics students. The program consists of three major theoretical topics and corresponding models that are essential to introductory economics, The Production Possibilities Frontier, The Circular Flow Diagram, and Supply and Demand modules. Each contain an interactive version of the model. The program was created using Adobe Animate and ActionScript 3.0 and has been used to great success in Irvington Middle and High School in New York.

28.
USING MACHINE LEARNING TO STUDY YOUTUBE COMEDY SLAM
Anastasija Mensikova '18
Faculty Sponsor: Takunari Miyazaki

The YouTube Comedy Slam Experiment was based around providing two videos side-by-side to the participants and asking them to select one that appeared to be "funnier" than the other. The goal of my research was to, first of all, determine the correlation between the "comedic" nature of the videos and their sentiment (the mood polarity), and second of all, to compare the classical Max Entropy Machine Learning (that builds a simple bag of words) to Deep Learning and how their results would differ for this specific research. To acquire the results for the first half of the experiment, where the focus was on examining Max Entropy, each video from the experiment was parsed to extract its title and comments (if any). A classifier was thereafter trained on ~11,000 videos to determine whether or not videos' titles, along with comments, within the remaining dataset of 434 elements could be deemed "funny". The results were compared to the results of analysing the sentiment of the same dataset ("positive" or "negative") using two

classifiers - one trained on Netflix film reviews and one trained on tweets. After compiling all results, it could be gathered that "positive" videos are mostly classified as "not funny". The final training accuracy of all three classifiers was rather high. However, the "Comedy" model did not seem to perform greatly due to the small size and messy nature of the dataset. The latter half of the experiment involved doing the same kind of analysis, but this time using Recurrent Neural Networks. Recurrent Neural Networks are considered to be the best way to analyse text as they allow for consideration of context. In this case the result was opposite – most "positive" ads were classified as "funny", which certainly is more intuitive. Although the final accuracy in this case was slightly lower than that when using Max Entropy, it can be concluded that, if we are to experiment with parameters further and train models for longer on a server, we will achieve stellar results. It is therefore safe to conclude that funny videos from the experiment can also be classified as positive, and that Recurrent Neural Networks are generally better for analysing opinionated text extracted from the media.

29.
SENTENCE ANALYZER – A TOOL FOR STUDENTS LEARNING JAPANESE
Anh Nguyen '18
Faculty Sponsor: Takunari Miyazaki

Students learning Japanese face a unique challenge because there are no spaces between words in Japanese sentences, which makes it more difficult to understand the grammar, and name entities may be mistaken for other kinds of vocabulary. I've developed Sentence Analyzer as a tool to help students quickly recognize name entities, new vocabulary that appear in Japanese texts and improve their comprehension of the grammatical structure of Japanese sentences. Utilizing Dynamic Programming approach, I obtain the initial morphological analysis of a Japanese text from MeCab, a part-of-speech analyzer in Japanese, and process it with a corpus of over 20,000 Japanese last names that I've built and an algorithm that detects name entities that aren't recognized in the initial result. The final analysis can be displayed in either Japanese or English, together with the meanings of each word in the original text translated into English to further help with students' learning process. The primary focus of this project is to enhance human's name entity recognition ability, but it can also be extended to work with other kinds of name entities or name entities in different languages.

30.
COLLEGETHRIFT
Kalyan Parajuli '18
Faculty Sponsor: Ewa Syta

CollegeThrift is an online used goods portal implemented as an android application in which members of an academic community like Trinity College can list their used goods for giveaway, trade or sale. The users will be able to message each other within the app for inquiries and negotiations regarding the sale of items. They can also make and receive payment for the goods through Venmo which is integrated within the app. This app differs from other used goods selling portal available now like Craigslist, ebay, etc. because the users and interactions in this app will be local and limited to a certain particular institution the users are part of, rather than being world-wide or location wide. This app is designed to promote the reuse of goods and resale of books within a campus community.

31.
A DEEP LEARNING POWERED CHATBOT
Shufan Wang '18
Faculty Sponsors: Takunari Miyazaki, Travelers Co.

Many people nowadays use messaging applications such as Whatsapp, Facebook Messengers and are hence accustomed to the experience of communicating via a chat tool. Furthermore, for many business, much of the customer service requires an agent who communicates with the customer. Therefore, Chatbots can have wide applications in areas where interactions with humans are necessary.

Traditional Chabots (such as Siri) are "rule-based" (matching input message and output response by a pre-determined set of rules) and are therefore limited by the rules. For this project, we will attempt at a Chabot architype trained by machine learning for holding dialogues. Natural dialogue generation is a key area of artificial intelligence, which many consider to be the holy grail of artificial intelligence. As of today, it is still an unsolved open problem and a hot area of research.

Recent development in deep learning has encouraged new waves of attempts to design and train the Chatbots. We follow this direction of research and explores employing deep generative models ("artificial brain" of the Chabot) learn the language and held conversations with people. Specifically, we adopt the "sequence to sequence" encoder decoder architecture. By using a large dataset of movie dialogues, we train the recurrent neural network, which learns to generate responses to input messages. We demonstrate our result both quantitatively by showing the decreased cost function value during training and qualitatively by talking to our trained Chatbot.

32.
POLICY NETWORK ON ATARI GAME
Yinghuan Wang '18
Faculty Sponsor: Peter Yoon

Policy Gradient(PG) and Reinforcement Learning(RL) are the frontier of machine learning. PG can help RL solve problems with no immediate rewards which is a traditional puzzle for RL. PG + RL can be applied to Atari games, Go(AlphaGo), even helicopter control. I created the pipeline using numpy then I refactored the policy network using PyTorch which greatly improved learning speed. Initially I wrote the neural network using numpy with RMSProp but later I refactored the neural network using PyTorch framework with Adam and RMSProp. Moreover, the neural network using Adam and RMSProp learns significantly faster than the neural network using numpy and RMSProp.

33.
PERSONALIZED FITNESS PROGRAM BUILDER
Weixi Zhang '18
Faculty Sponsor: Takunari Miyazaki

Closely monitoring training metrics will allow people to compare results to training trends and use this knowledge to steer future training. Athletes will be able to answers questions like, what percentages do you respond well to? What amount of volume allows you to recover adequately and still progress? What has worked well and what hasn't? The project will centralize training data for athletes. Athletes and coaches should be able to build individual workouts using a variety of exercise types and track them. It should be easy to log workouts data, daily nutrition, track achievements. The final product will contain following features: single login across all devices, complete training and nutrition profile, easy to use analytics tools, training program builder (desktop only), personalize training program generator, and data sharing for coaches. The goal at the end of the spring semester is to finish building the platform for coaches and athletes. It should be a cross platform, easily accessible training log for easy data sharing among devices. After receiving a significant number of users in the future, personalized automatic program generator and coach finder will become live.

<u>ENGINEERING</u>

34.
VIRTUAL REALITY MEDIATED ROBOT TELEOPERATION AND GRASPING
Kun Chen '18, Prawesh Dahal '18, Mariam Avagyan '18
Faculty Sponsor: Kevin Huang

Teleoperation, or robotic operation at a distance, leverages the many physical benefits of robots while simultaneously bringing human high-level control and decision making into the loop. Poor viewing angles, occlusions, and delays are several factors that can inhibit the visual realism and usability of teleoperation. Furthermore, poor translation of human motion commands into resultant robotic action can impede immersion, particularly for architectures wherein the remote device and the local device are kinematically dissimilar. In this project, commodity virtual reality (VR) headsets and trackers along with high dexterity gloves are utilized to overcome these technical obstacles, and provide an enhanced, visually immersive, and realistic real-time operator experience. Using glove-like interfaces that provide additional ten degrees of freedom per hand, the user's natural grasping motion can be obtained, and resultant motion commands can be executed by the remote device, in this case the Rethink Robotics Sawyer 7DOF manipulator. The method is general and extendable to platforms with up to two dexterous manipulators, and has implications in use of telerobotics in manufacturing, disaster response and surgery to name a few.

35.
KINETIC ENERGY CONVERTER AND CHARGER
Nicholas P. Constantine '18, Jack H. Stallman '18, Abigail L. McInerney '18,
Eric C. Gendron '18
Faculty Sponsor: J. Harry Blaise

The overall goal of this project was to create a system that could harvest human kinetic energy to provide power to small electronic devices. Primary research was conducted to determine the best method of energy production. Three options were examined; piezoelectricity, rotational magnetic induction through the use of a gyroscope, and linear electromagnetic induction. Ultimately, the later was chosen due to its energy production ability, portability, and diverse functionality.

By using a pair of induction coils with oscillating magnets, human motion is converted to an AC power source. This power is then converted into a DC power source that charges an internal battery. The internal battery is then used to charge a small external electronic device. A secondary design goal of this project was to be able to produce enough power to charge an iPhone battery. This proved to be impractical because the power produced from human motion would require an unrealistic amount of time to fully charge the battery. As a result, the design goals for this project were amended to focus on electronics smaller than an iPhone. Adding a wall charging feature for the internal battery was researched but not designed due to time constraints and the importance of developing the charging circuit. Another goal was to design and manufacture an enclosed, wearable housing for the system. The design was completed in Solidworks and 3D printed using ABS plastic to prevent magnetic field interactions. The overall goal to charge an internal battery by using solely kinetic energy was not met. Our coils were capable of producing the voltage necessary to charge the battery, however, the current produced through these coils was not large enough to charge the battery effectively. We were able to charge the battery using a waveform generator in place of the inductor coils, since it provided a large enough current. We considered using a series of transistors to increase the current, but that required using a separate DC power source to provide a supply voltage to the transistors. Overall, our goal to charge the internal battery with just kinetic energy was not met due to the insufficient power produced and the inability to boost the current without an external power source.

36.
BIOMIMETIC AUTONOMOUS UNDERWATER VEHICLE
Sean Coughlan '18, Alex Laferriere '18
Faculty Sponsors: Joseph Palladino, NASA Connecticut Space Grant Consortium

The goal of this project was to design an autonomous underwater vehicle (AUV) that takes inspiration from nature, specifically cephalopods., This AUV mimics the propulsion and motion of squid using a vectored water jet propulsion system, as well as forward diving planes. The biomimetic AUV is capable of autonomous motion in an aquatic environment, including self-stabilization and obstacle avoidance. This is accomplished through underwater ultrasonic sensors and a 9-axis inertial measurement unit, Additionally, this device includes the capability to monitor water temperature and record data for future analysis. The key design components of this project are: a waterproof and neutrally buoyant hull, the use of a Raspberry Pi microcontroller to program the AUV using the Python programming language, a water jet propulsion system that allows the thrust to be vectored by 15 degrees, and a navigation system that includes a sonar sensor and an inertial measurement unit. Results, so far, are that the AUV is capable of motion and self-stabilization in an aquatic environment, and is also able to react to and avoid objects in its forward field-of-view. Additionally, the biomimetic AUV is capable of monitoring its depth and record water temperature data. In its current state, the biomimetic AUV could serve as a platform for additional water-sampling equipment as well, such as the monitoring of pH.

37.
ROBOT FIREFIGHTING USING CARBON DIOXIDE
Aedhan Healy '21, Hannah Zukowski '21, Rahul Mitra '21
Faculty Sponsor: John D. Mertens

The Trinity College Firefighting Robotics Contest is a two-day event organized annually by the school's engineering department. The ultimate purpose is to design an autonomous robot that is able to find and extinguish a candle in a maze. The team's robot, T.W.A.I.N., was designed using several different components, including an Arduino microprocessor, DC motors, infrared sensors, and a power distributor. The robot needed to efficiently navigate the maze and extinguish the candle using a burst of carbon dioxide. Carbon dioxide gas was stored in a canister attached to a specialized valve. The gas was released when a sensor used to detect the candle's flame read a certain value. Arduino, a programming language, was used to implement the wall following technique that enabled the robot to navigate the maze. An Arduino motherboard also allowed the robot to interface with the various sensors and motors present. Out of the five attempts given at the start of the competition, the team was able to successfully find the candle twice and extinguish it once. The failure of the aforementioned valve after the first two attempts resulted in the team having to modify the design of the robot to now include a fan instead of the valve for the second day of the contest. After conducting an in-depth failure analysis, the team came to a number of conclusions about flaws in the robot. Based on the analyzed technical errors, the team is confident in their ability to improve the entire system for future projects.

38.
AUTOMATIC 3-AXIS CAMERA STABILIZING GIMBAL
Daniel Hughes '18, Daming Xing '18
Faculty Sponsors: J. Harry Blaise, Kevin Huang

Camera stabilizing gimbals are highly specialized and extremely expensive pieces of photography and film equipment. The user base largely consists of industry professionals who demand stable footage on the move in spaces where cranes and other cumbersome devices are inaccessible. Ranging anywhere from $500 to more than $1000, there is a clear barrier into the market, especially for amateur film makers or hobbyists seeking an affordable yet effective self-stabilizing camera gimbal. Due to recent advancements in mobile film technology, stabilizing gimbals for small video devices are in particularly high demand. The aim of this project is to design, manufacture and test a small mobile camera stabilizing gimbal. The device is capable of stabilization about the pitch, roll and yaw axes and is controlled by an Arduino Uno microprocessor. Furthermore, the camera orientation stabilization is actuated via three commodity servo motors mounted to a custom 3-D printed ABS frame, thus affording an economic alternative entirely manufactured for under $300. Beyond everyday applications, this project has potential impact in the realms of professional film-making, aerospace, and defense.

39.
INVESTIGATION OF CONTINUOUS FLASH SUPPRESSION THROUGH VIRTUAL REALITY
Evelyn Luciani '21, Logan Drescher '21, Patty Gaitan '19
Faculty Sponsors: Kevin Huang, Michael A Grubb

Virtual reality (VR) technology affords several improvements to some traditional visual psychophysical test setups. If a researcher aims to present separate visual information to each eye of a human observer, traditional methods require cumbersome hardware, including split

computer screens and four-mirror stereoscopes, in order to precisely and selectively deliver visual images. By making use of a VR headset, Oculus Rift CV1, this work aims to increase portability, decrease specialized equipment, and reduce the barrier of entry into visual psychophysical research. In order to validate this method, a well-known effect is replicated via continuous flash suppression, in which visual information is hypothesized to travel through the brain without fully reaching awareness. The approach consists of simultaneously presenting each eye with different stimuli: a dynamic, color-filled noise patch to one eye, and an upright or inverted smiley face emoji to the other eye. The effect should render the smiley face stimulus completely invisible. The aim is to test whether the visual information reached awareness based on the participant's response of the face's orientation. We are just starting user testing and each participant will complete 400 trials in which there are equal amounts of suppressed and unsuppressed trials. We expect the participants to display 100% accuracy during visible trials and 50% accuracy during suppressed trials.

40.
UNDERWATER ROV
Aaron Porter '18, Brayan Duarte '18, Eduardo Murillo '18, Gregory McKinnon '18
Faculty Sponsor: Kevin Huang

The goal of the project was to design an underwater Remotely Operated Vehicle (R.O.V) that has high maneuverability and ease of use all while being cost efficient. After researching current designs, we've come across a handful of systems that already tackled the improvement of maneuverability. However, these designs tend to be expensive. One of our main goals was to design a low cost underwater R.O.V, while still maintaining its full functionality.

The R.O.V is composed of a total of six motors: four motors placed one the corners of the R.O.V. to aid in pitching and rolling, and two motors on the side to provide forward thrust and yaw. The system was also made to be neutrally buoyant and equipped with a ballast system, which gave the user control of the systems buoyancy. The R.O.V was designed for the user to control the vehicle with a wired Xbox 360 controller. The controller layout was setup to closely resemble the same controls that are found in most racing video games. The controller needs to be connected to a computer which has certain software installed used to connect to the Raspberry Pi powered system. Through the use of an ethernet tether, it also provides minimal delay for operating the R.O.V.

The second, and possibly most complex goal we worked to accomplish was to implement the ability for the R.O.V to self stabilize, while allowing 180° viewing via an onboard camera. Using two servo motors, we were able to assemble a camera systems that allows for 180° viewing on two axes while the R.O.V is stable, which is a feature that most other designs lacked at the time of this project. An IMU was used to provide input to the R.O.V's control system in order for the R.O.V. to to correct its error in position so that it can reach stability.

Due to time and financial restrictions, the components box waterproofing was not effective which stopped any possibility of dunking the R.O.V due to safety concerns. It is hopefully that future capstone teams will consider take over this project in order to build on the progress that has been made in the last two semesters.

41.
BEAT PARKINSON'S (PD) TODAY
Hannah Shaievitz '18, Katharine Haghdan '18, Tasha Adams '18, Delaney Harrop '18
Faculty Sponsors: J. Harry Blaise, William H. Church

This poster details the two-semester capstone research and design of the Beat Parkinson's Disease (PD) Pro system. The project was introduced to the team by Professor William Church in the Trinity College Neuroscience Department. Professor Church knew of Ms. Michelle Hespeler, a Parkinson's patient who had started a boxing rehabilitation program, Beat PD Today, for individuals suffering from the disease. Ms. Hespeler was looking to quantify the progress of her participants in order to disseminate the program and to get it accepted by insurance companies for them to cover the high cost of class for participants. Because of this, our goal is to develop a system to quantify the progress of PD patients in the Beat PD Today program. PD is a neurodegenerative disorder characterized by a decline in motor function overtime, but exercise has been proven to decrease this rate of decline. The problem definition includes developing a system to quantify the progress of Parkinson's Disease patients in the Beat Parkinson's Disease Today boxing therapy program. The system measures various motor functions in order to show that the program is indeed beneficial to its participants. In order to make the most compact and efficient system, our team decided to break up the system into four subsystems to evaluate four different motor related functions: punch force, arm range of motion, punch pullback speed, and foot position for balance. The punch force design includes one load cell in the center of the system used to extract the maximum force. The balance system uses four load cells to identify the users center of pressure. The range of motion and pullback speed subsystems use two inertial measurement units (IMU) each to extract position and speed respectively. Data collection is important for Beat PD Today because it will allow this alternative therapy method to have quantitative results to ensure progress and affirmation and acceptance from insurance companies.

42.
MORPHING AIRPLANE WING WITH VARIABLE LIFT FORCE
Raneem Sharaf '19, Yuriy Syromyatnyk '18
Faculty Sponsor: Joseph L. Palladino

An airplane wing model capable of changing shape in-flight was designed, built and tested in a sub-sonic wind tunnel. The goal was to see if the airfoil shape could be changed sufficiently so that lift force could be dynamically controlled. One application would be to decrease lift during landing without the need for spoilers.

The bottom surface of the wing was changed using two stepper motors that move an internal frame, deforming the wing skin and increasing the wing's thickness. A motorized system to change the angle of attack of the airfoil in the wind tunnel was also designed and built., and lift and drag forces on the wing were measured using a force transducer which was incorporated with the motorized mounting system. The forces on the wing were measured for different speeds and angles of attack. Lift and drag forces were calculated twice, with and without expansion of the lower surface. Both results were compared to each other and to the Clark Y airfoil to see the effects of increasing the thickness of the airfoil on the lift and drag coefficients.

Measurements show that moving the bottom wing surface a mere of 0.5 inches was sufficient to decrease lift by 15% . These results show that an internal structure is capable of morphing the wing shape so that lift force can be varied in flight.

43.
DESIGN AND IMPLEMENTATION OF A SMART DIGITAL STETHOSCOPE
Skyler Szot '21, Alisa Levin '21, Anthony Ragazzi '21
Faculty Sponsor: Taikang Ning

The stethoscope was first invented more than 200 years ago and, to date, the practice of auscultation still follows the same original design and inevitably is subjective to the hearing ability and experience level of an individual medical practitioner. Heart diseases are of primary concerns for patients of all ages, and cardiac auscultation has been the most commonly utilized bedside diagnosis to detect heart murmurs caused by abnormal cardiovascular alternations. Our goal is to develop a smart digital stethoscope with modern electronics and computing technologies to provide accurate information to assist cardiac auscultation and significantly reduce misdiagnoses. Our solution to this involves an amplifying circuit which collects an analog voltage signal from an electronic stethoscope, converts this signal to digital in Arduino, sends it via Bluetooth to an android device, and an android app which stores and processes the data. On the hardware side, the signal collected from the stethoscope is amplified with an OP297 with a gain of 100, sampled on Arduino as digital, and sent to a Bluetooth 2.1 slave module at a frequency of 2kHz. On the software side, our solution has the capacity to graphically display heart sounds, toggle the display of indicators like systole and diastole generated through artificial intelligence, and store and replay previously generated data. The additional smart/AI component is implemented with an in-house developed a peak detection algorithm. The target app provides the framework to implement further signal analysis in the future. With this mobile implementation, physicians can now utilize an additional visual aspect to make more accurate heart murmur diagnoses. The Bluetooth mobile app will help to make accurate automatic cardiac auscultation more accessible to medical professionals, and potentially more data sharing capabilities for ease of second opinion.

44.
LIQUID NITROGEN PROPULSION SYSTEM
Dana Wensberg '18, Anthony Egeln '18, Louis Cappucci '18
Faculty sponsor: John D. Mertens

The primary goal of a propulsion system is to generate thrust. Expelling mass at high speeds creates thrust. Propulsion systems usually start with a reservoir of propellant, and these systems accelerate these propellants to very high speeds through the use of combustion reactions. These combustion reactions add tremendous heat energy to the working fluid, and this excess heat energy is translated into increased velocity, and thus more thrust, very frequently through the expansion of the working fluid into a gaseous phase. This expansion into a gaseous phase causes a large increase in specific volume, requiring a proportional increase in fluid velocity to maintain the principle of continuity. In this project, we expand nitrogen from its liquid phase into a gaseous phase using the transfer of heat from heated pipes into the working fluid. The transfer of heat from the pipes into the working fluid facilitates a phase change, and thus a large increase in

velocity. Using this technique, we measured varying thrusts of up to 22 N corresponding to flow rates between 0.25 kg/s and 1.8 kg/s.

ENVIRONMENTAL SCIENCE

45.

A FIELD INVESTIGATION OF MERCURY IN SOILS ACROSS THE WHITE MOUNTAIN NATIONAL FOREST, NEW HAMPSHIRE: IMPLICATIONS FOR BOREAL FOREST ECOSYSTEMS
Kevin Oleskewicz '19, Joseph Ruggiero '19
Faculty Sponsors: Jonathan Gourley, Andy Colter, U.S. National Forest Service

Airborne mercury (Hg) deposition across higher altitudes within New England mountain ranges has been linked to increased Hg levels in the blood of the threatened Bicknell Thrush. We hypothesize that mercury in mountain soils will be maximized within the sub-alpine, boreal forests across the White Mountain National Forest. Precipitation totals generally increase with elevation and one might expect the highest levels of Hg to be found in the soils near the highest peaks across the range. However above tree line, the combination of high run-off and the lack thick organic soil development prohibits Hg accumulation. Boreal forests just below local tree-line (4000-4500 ft) are often wet due to frequent cloud cover and provide an organic rich soil that is ideal for Hg sorption. The presence of abundant organic matter in boreal forests also increases the potential for Hg-methylation. We sampled eight vertical profiles across the White Mountain National Forest to investigate the distribution of Hg in mountain soils. We use a Milestone DMA-80 to quantify the total mercury in each sample and the results in general support our hypothesis. Hg concentrations increase as elevation increase and values plateau just below local tree line between 3500-4500 ft.

46.

X-RAY DEFRACTION ANALYSES OF SULFATE MINERALS RESPONSIBLE FOR CRUMBLING CONCRETE IN NORTHEASTERN CONNECTICUT
Joseph Ruggiero '19, Lucian Cascino '18
Faculty Sponsors: Jonathan Gourley, Christoph Geiss

Pyrrhotite ($Fe_{1-x}S$) is a structurally complicated and reactive sulfate mineral that is believed to responsible for the premature deterioration of concrete. Often referred to as internal sulfate attack, the transformation of pyrrhotite to expansive minerals (e.g. ettringite and thaumasite) can lead to structure failure. In northeastern CT, quarry aggregate containing significant pyrrhotite (>1%) was used to build hundreds (if not thousands) of new construction projects from the early 1980s to as recently as 2016. Current methods to identify pyrrhotite have not been effective in providing quantitative results. Consequently, there is not an established standard for the minimum concentration of pyrrhotite in concrete structures. Petrographic analyses via polished section observations are time consuming and not reliable for samples that may contain very low (<1%) concentrations that could still be susceptible to degradation. X-ray diffraction (XRD) analysis is a method that can be useful to identify pyrrhotite, ettringite and thaumasite, but since concentrations are often low, XRD should be combined with other complementary independent analyses including direct sulfur and magnetic susceptibility measurements. With high enough

resolution, it may be possible to use XRD scans to subtract out non-pyrrhotite sulfate minerals and attempt to precisely quantify pyrrhotite concentrations in afflicted concrete.

47.

INVESTIGATING PYRRHOTITE CONTENT IN METAMORPHIC ROCKS FROM NORTHEASTERN CONNECTICUT
Lexi Zanger '19, Sam March '21
Faculty Sponsor: Christoph Geiss

In recent years, basements across northeastern Connecticut have failed prematurely do to internal sulfur attack. This issue is found in foundations that were poured with a pyrrhotite containing aggregate. In this project, we will conduct a detailed investigation of pyrrhotite content in the metasedimentary rocks of northeastern Connecticut, specifically the variability of pyrrhotite in a geologic formation known as Brimfield schist. After collecting bedrock samples from outcrops, we analyzed the magnetic properties and sulfur content. To do this we measured magnetic susceptibility between room-temperature and 700°C, which identified the magnetic minerals present in the sample. Pyrrhotite is ferromagnetic at room temperature and turns paramagnetic at 325°C. The associated change in magnetic susceptibility is semi-quantitative and highly diagnostic of pyrrhotite. We complimented the magnetic analyses by determining the total sulfur content of each sample through purge-and-trap chromatography. By identifying the presence of pyrrhotite we can create a detailed map of pyrrhotite content. Preliminary results show pyrrhotite is present in varying quantities in Brimfield schist and absent from adjacent geologic units.

HEALTH FELLOWS

48.

PRELIMINARY ASSESSMENT OF THE ACCURACY AND RELIABILITY OF THE ELITE BALANCE PROTOCOL IN MEASURING POSTURAL STABILITY FOR CONCUSSION DIAGNOSIS
Christopher LoBianco '19
Faculty Sponsors: Maryann McGuire RN, MPH, Matthew Solomito, PhD, Connecticut Children's Medical Center

As a functional rather than structural brain injury, a concussion is diagnosed using a series of qualitative and quantitative tests that measure deficits in cognitive, somatic, and emotional performance. One area of assessment is postural stability, or balance control, which is currently measured using either force plate analysis or clinician assessments of balance. A new protocol, the Elite Balance Protocol, was created using custom built software and the Wii Balance Board. This new system incorporates a novel piece of hardware, the Wii Board, and improved assessment methodology that measures both static (standing) and dynamic (motile) stability. The main purpose of this research study was to evaluate the accuracy and reliability of the new system. Clinical data was collected at both the Center for Motion Analysis lab (CCMC) and the Ferris Athletic Center (Trinity College) using concussed patients and athletes as test subjects. For each subject, three trials were conducted for both the static and dynamic tests of the Elite Protocol. Three statistical tests were conducted based upon this data: an ICC analysis of inter-trial reliability, a linear correlation analysis to identify any "learning effect" linked to improved performance over time, and a calculation of descriptive statistics for the sample. Based upon these preliminary results, the Elite Balance Protocol (1) has a high degree of accuracy that

prevents a traditional inter-trial reliability analysis, (2) has no identifiable "learning effect" and (3) has no "normative performance range" characteristic of healthy patients. These results indicate that further data collection is needed to identify differences between concussed and control (healthy) patient populations.

49.
THE EPIDEMIOLOGY OF PEDIATRIC WINDOW FALLS IN CONNECTICUT
Jay Moran '19
Faculty Sponsors: Maryann McGuire, RN, MPH, Brendan Campbell, MD, MPH, FACS,
Pediatric Trauma Surgery, Connecticut Children's Medical Center

Approximately 2.2 million children are treated annually for fall related injuries and more than half of these injuries occur in children between the ages 0 to 4. In fact, 12 children will die annually from window falls. Research conducted by Cincinnati Children's Medical Center (CHMC) found that minority males were at the greatest risk to fall out of a window. The objective of the study is to describe the epidemiology of pediatric window falls seen at Connecticut Children's Medical Center (CCMC) over a 10-year period. Demographic data was collected from the CCMC Trauma Registry and the EPIC database. Approximately 131 cases were pulled from the Trauma Registry at CCMC and variables included location of fall, age, sex, ethnicity/race, fall height and type of injury. Fall height included 3 ft. -15 ft. or >15 ft. Geographic locations of the window falls were mapped using street addresses and zip code data via ArcGIS mapping analysis. 66% of the cases were males and the average age was 5.5 years old. The most common body parts injured were the extremities (34.3%) and the head/face (42.8%). Additionally, the most common injuries were fractures (45.6%) and lacerations (25.2%). In Hartford, more children fell out of single-family households (62%) compared to apartment complexes (38%). Prevention should target single families households with children all throughout Hartford and implement a protocol to educate future tenants with children about injury prevention in relation to window falls and safety. The most effective prevention methods includes implementing policy on window regulation, educating parents on window safety, and softening the surface outside of each window to decease the severity of potential injuries.

50.
THE RELATIONSHIP BETWEEN PATIENT PORTAL ADOPTION AND HEALTH OUTCOMES
Phuong L. Nguyen '19
Faculty Sponsors: Maryann McGuire R.N., M.P.H, David Finitsis, PhD., Hartford Healthcare Cancer Institute

Electronic patient portal is a powerful tool for patients to monitor their health and actively engage in their treatment. However, the relationship between portal adoption and health outcomes such as self-efficacy, patient empowerment, and health status has not been well-established in the existing literature. This study aimed to fill in the gap of knowledge by looking into the correlation between portal usage, patient satisfaction, and self-efficacy. Seventy patients (with multiple diagnoses) receiving infusion treatment at community hospital infusion center were interviewed about their experience using patient portal or their reasons for not using the patient portal. Patients were then given a survey that asked questions about level of self-efficacy and satisfaction with the quality of healthcare. An independent samples T-test was performed.

Portal users were not significantly different from non-users in terms of their self-efficacy. However, they experienced higher satisfaction with the healthcare service than did the non-users. The statistical power of the analysis indicates that this study is underpowered and would benefit from a greater sample size. Because of the cross-sectional design of the study, the direction of the relationship between portal adoption and patient satisfaction could not be inferred. Therefore, the next logical step would be to have a longitudinal study with a multivariate analysis to establish causality between variables and the contributing effect of other factors.

51.
QUALITY IMPROVEMENT OF ADHD CARE IN PEDIATRIC PRACTICE
Jasmine Patel '19
Faculty Sponsors: Maryann McGuire R.N., M.P.H, Catherine Wiley M.D., Connecticut
Children's Medical Center and Community Health Center

Attention-deficit/hyperactivity disorder (ADHD) is the most common neurobehavioral disorder developed during childhood and is characterized by core symptoms of inattention, hyperactivity and impulsivity. The American Academy of Pediatrics (AAP) has published six clinical recommendations for the evaluation of ADHD in children and adolescents. The guidelines relevant to the project include diagnosing ADHD as it meets the criteria of the DSM-IV, identifying potential co-morbidities in accordance with ADHD and appropriate behavioral management of children with ADHD. Aims of this quality improvement project are to determine the number of patients with completed Vanderbilt ADHD Diagnostic Rating Scale and address how the practice might alter current approaches in order to increase this overall percentage, in addition to identifying the co-morbidities and behavioral managements of all patients. There were 90 patients with an ADHD diagnosis between the ages of 4 and 18 belonging to the East or West Hartford primary care clinic. Data was collected by individually reviewing patient charts with the intention of finding Vanderbilt assessments and inputting scores into EPIC. An ADHD report was created and included the patient's date of diagnosis, identified co-morbidities and behavioral management. Out of 86 patients included in the data analysis, 18 patients had an easily accessible diagnosis date and 61% of these patients were diagnosed before the age of 12, while 39% were diagnosed past the onset age of 12. Demographic data shows that Vanderbilt distribution differed across sex and location of the primary care clinic. The data also presented the mean age and type of informant completed out of the 18 patients with Vanderbilt's. The presence of psychiatric co-morbidities and use of behavioral management services for all 86 patients were also revealed. Based on the results, there is a delayed diagnosis of ADHD, comorbidities comparable to national findings and lack of behavioral managements services within the practice. The challenges of a paper based system stress the importance of moving forward into using electronic records and future work depends on whether these changes will ultimately increase rates of Vanderbilt completion.

52.
EXAMINING THE PREVALENCE OF DEMORALIZATION AND SUBJECTIVE
INCOMPETENCE IN PATIENTS WITH MOVEMENT DISORDERS
Molly Ryan '18
Faculty Sponsors: Maryann McGuire R.N., M.P.H., Duarte Machado, M.D., Hartford Healthcare
Movement Disorders Center

Demoralization has been described as the state of mind of an individual deprived of spirit or courage; experiencing feelings of hopelessness and uncertainty about the future. The co-occurrence of subjective incompetence (SI), the clinical hallmark of demoralization, and distress leads to the development of demoralization. Although demoralization has been observed in other clinical settings, however, it has not been studied exclusively in movement disorders and clinical observations strongly suggest that demoralization is a common problem among this patient population. A prospective cross-sectional survey consisting of several validated survey tools were used to assess the prevalence and impact of demoralization and subjective incompetence in patients diagnosed with movement disorders, as well as caregiver burden and demoralization. Participants were patients, and their caregivers, seen by Dr. Duarte Machado at the Movement Disorders Center at Hartford Healthcare. Participants provided written informed consent and completed the survey tools as part of an office visit; all patient responses were answered directly on an iPad using the REDCap online database. Although data collection is not yet complete, the preliminary results include 40 patients and 12 caregivers (n=52) and indicate between a 10-42.5% prevalence of demoralization among movement disorder patients, as scored by the DCPR-D and Kissane Demoralization Scale, respectively. Of the 40 patient responses collected thus far, 26 patients had moderate levels of SI, 10 reported moderate levels of depression, and 19 indicated at least a mild degree of anxiety. In general, 50% of all patients, compared to 66.6% Parkinson's disease patients, reported a moderate level of functional impairment. This study will continue until the sample is large enough for statistical power (n=160), however, these preliminary results indicate that the presence of demoralization is likely to adversely affect a patient's quality of life, and further complicating successful treatment of these disorders and contributing to caregiver stress.

53.
ASSOCIATION OF STRESSFUL LIFE EVENTS AND FREQUENT PREMATURE VENTRICULAR CONTRACTIONS
Dawei Wang '18
Faculty Sponsors: Maryann McGuire, RN, MPH, David M O'Sullivan, PhD, Edmond Cronin, MD, FHRS, CCDS, Cardiac Electrophysiology Department at Hartford Hospital

Objective: It has been noticed that stressful life events may occur prior to the onset of Premature Ventricular Contractions (PVCs). The aim of the present study will investigate any association of stressful life events and frequent PVCs by surveying a cohort of participants who have had PVCs and another cohort having had supraventricular tachycardia (SVT, control). Methods: Patients with minimum occurrences of 1,000 PVCs on standard 24-hour Holter monitoring were considered to have frequent PVCs. The potential participants (n = 150 in each of the two cohorts) who have been referred to Hartford Hospital's Cardiac Electrophysiology service for evaluation of frequent PVCs or SVT will be retrospectively identified from the electronic medical record over the most recent five years. The participants will be prospectively surveyed using the Questionnaire version of the List of Threatening Experiences (LTE-Q) regarding the occurrences of their stressful life events prior to the symptoms. Data from returned surveys will be evaluated; the impact of stressful life events on patients with frequent PVCs and SVT will be compared by performing chi-squared tests, and any results yielding a p value of <0.05 will be deemed statistically significant. Hypothesis: The frequency of stressful life events between patients with frequent PVCs and those with SVT will be different; specifically, patients with frequent PVCs are more likely to have experienced stressful life events compared to patients with SVT.

Discussion: Frequent PVCs are currently of obscure etiology. Efforts to identify the causative factors will be useful and may lead to new treatment options.

NEUROSCIENCE

54.
LONG-TERM BEHAVIORAL EFFECTS OF PRENATAL EXPOSURE TO THE KETOGENIC DIET
Amr Arqoub '18, Kiera Flynn '21
Faculty Sponsor: Luis Martinez

For women with epilepsy, the decision of which treatment options to pursue during pregnancy has critical implications both for their own health as well as their developing fetus. Fetal exposure to specific anti-epilepsy drugs (AEDs) confers a great risk for congenital malformations. The ketogenic diet (KD), a diet composed of mainly fats and low but varying levels of proteins and carbohydrates, is a non-AED therapy shown to be highly effective in treating epilepsy. However, this therapy's effectiveness as an alternative to AEDs during pregnancy has not been tested. The present study aimed to investigate the lasting effects of prenatal exposure to the KD on social and anxiety-like behaviors in mice. In this study, adult female and male CD1 mice were randomly assigned to either a KD or a control diet (CD) and then mated with an individual of the opposite sex from the same diet treatment. The young adult offspring of these mice were assessed for sociability and anxiety-like behaviors. We found that KD prenatal treatment did not cause negative effects on sociability. Moreover, we found gestational exposure to KD to show significant improvements in depressive-like behaviors. With this knowledge, mothers will be able to make more informed decisions when considering KD as an alternative treatment to AEDs during pregnancy.

55.
ADOLESENT AND ADULT INPATIENT PSYCHIATRIC NORMS FOR THE MONTREAL COGNTIIVE ASSESSMENT
Lori Berger '18
Faculty Sponsor: Sarah A. Raskin, Kevin Young PhD, ABPP

The Montreal Cognitive Assessment (MoCA) is a brief cognitive screening test designed to measure the cognitive decline of individuals suffering from mild cognitive impairment (MCI), but has also shown sensitivity to Alzheimer's disease, Parkinson's disease, and schizophrenia. This screening instrument is used as a tool in cognitive assessments in inpatient psychiatric institutions, however, there is no normative data established for individuals with psychiatric diagnoses. Cohort specific norms are critical in interpreting cognitive test findings, and the effects of ethnicity, age and education need to be considered to maximize utility. A retrospective chart review of 635 inpatients at the Institute of Living in Hartford Connecticut was performed. Each individual had been given the MoCA as part of a standard inpatient workup. Statistical analysis was performed on individuals with psychiatric diagnoses, with groups separated by ethnicity and psychiatric diagnosis. Results showed that while ethnicity predicted performance, psychotic disorders was the only diagnosis that demonstrated poor performance. Results indicated that there may need to be separate normative data by ethnicity for the MoCA, and that further studies need to be performed in order to determine the diagnostic utility of the MoCA.

56.
INFLUENCE OF ALCOHOL ON TIME-BASED PROSPECTIVE MEMORY AND ELECTROPHYSIOLOGICAL MEASURES IN COLLEGE-AGED INDIVIDUALS
Christy Chan '18
Faculty Sponsor: Sarah A. Raskin

College students have higher rates of alcohol-use disorders (AUDs) than that of same-aged non-college students, with an estimated 31% of U.S. college students meeting the diagnostic criteria for alcohol abuse (Borsari *et al.*, 2007; Knight *et al.*, 2002). College age is also a critical period for brain development, including regions responsible for the development of prospective memory (PM), making the brains of college students vulnerable to the effects of alcohol. This study investigated the influence of alcohol on the underlying brain activity associated with PM in light- and heavy-alcohol-drinking college students. PM was measured with the Memory for Intentions Screening Test (MIST), which assesses both time- and event-related PM. The physiological measure was administered via computer and electroencephalography (EEG) in a time-based PM paradigm. Levels of alcohol use were measured with the Alcohol and Drug Use Survey. Participants were divided into three alcohol consumption categories – nondrinkers, light drinkers, and heavy drinkers. We found a relationship between these alcohol use classifications and PM, such that participants who were classified as light drinkers were less likely to perform well in comparison to that of non- and heavy drinkers. Participants' ability to recall the retrospective memory (RM) tasks suggested that the PM items were successfully encoded even though they may not have been carried out, and we did not observe a relationship between alcohol use classifications and RM.

57.
KEEPING YOUR ATTENTION: LONG AFTER THEY'RE GONE, ABRUPT ONSETS REFLEXIVELY MODULATE VISUAL PROCESSING
Gabriela Christensen '21, John Albanese '21
Faculty Sponsor: Michael A. Grubb

In a complex environment, it is impossible for the brain to process all information; therefore, attention is appointed to certain stimuli, specifically those which maximize goal-directed action. Attentional control is typically classified as either voluntary or involuntary; however, a third category called selection history challenges this traditional dichotomy, in that it is not necessarily goal-driven or physically salient. Moreover, a selection history formed in one task can cause attentional biases that disrupt the voluntary allocation of attention in a future task. In order to examine whether a selection history, created by exogenous cues that once grabbed attention involuntarily, can affect the allocation of attention in a future task where the cues themselves are nonexistent, a two-alternative, forced-choice task was utilized, in which observers decided the apparent orientation of one of two gratings. Each trial in the first half of the experiment contained an exogenous cue, used to draw covert spatial attention, with the cue appearing equally near the location of the target grating (valid) or the distractor grating (invalid), yet twice as often on one side of the screen than the other. In the second half of the experiment, exogenous cues were removed entirely, thus permitting the study of selection history's impact on decisions made in the second half. Evidence suggests that exogenous attentional cues successfully draw attention. Also, evidence shows a selection history effect in the second half of the study, as accuracy increases on the side where the cue was more frequently present, even though the cue was no longer currently there. Finding the connection between exogenous cues and selection

history can give further insight into the reasoning behind a person's decisions, based upon how their past experiences manipulate attention. Further work seeks to replicate these results and determine the longevity of this selection history.

58.

THE PREVALENCE OF TRAUMATIC BRAIN INJURY IN ADULT FEMALE VICTIMS OF DOMESTIC VIOLENCE
Olivia DeJoie BS/MA '18, Anna Lee '20, Chloe Ouchida '21
Faculty Sponsor: Sarah A. Raskin

Domestic violence (DV) often includes blows to the head and strangulation. As a result, traumatic brain injury (TBI) can be a result of DV. Individuals who have experienced TBI may present with a variety of symptoms, such as impaired memory and attention, emotional instability, and sensitivity to visual or auditory stimuli. This study was done to determine 1) the percent of DV survivors who screen positively for TBI, 2) whether healthy participants perform better on cognitive measures that DV survivors, and 3) whether depression, anxiety, and quality of life differ between the two groups. A battery of cognitive, mood, quality of life, and PTSD measures was administered to 52 participants (28 DV survivors and 24 healthy participants). Fifty-seven percent of DV survivors screened positively for TBI, and commonly reported symptoms including fatigue and headaches. Measures of depression, chronic stress, and environmental quality of life were significantly different between the DV survivors and healthy participants. Verbal fluency was also found to be impaired in DV survivors. This study highlights the major risk of TBI from DV, as well as the various cognitive and mood differences between DV survivors and healthy age-matched participants.

59.

HARMONIC SIGNALS WITHIN RESTING STATE fMRI
Rachel L. Fox '21
Faculty Sponsor: Dan Lloyd

Harmonic signals are composed of a fundamental frequency whose signal is multiplied to form overlapping frequencies, which when sonified and played together form a sound not unlike the plucking of a guitar string. Resting state fMRI data – collected while the subject rests in the scanner – was provided by the Human Connectome Project. The fMRI data per person consists of about 1,200 images, and approximately 180 subjects will be analyzed. The fMRI data frequencies and voxels will be processed in Matlab using Fourier analysis and down sampling in the Harmonic Product Spectrum to find the fundamental frequency and following harmonics in the set of data. The frequencies are then graphed into a histogram to indicate the fundamental frequency by the tallest peak and the following harmonics by smaller, separate peaks. Once the frequencies of these have been defined, they can be graphed to their x, y, and z coordinates on Matlab to find their location of the differing harmonics in the subject's brain. The fundamental frequency thus far has been found in varying degrees over the entire brain, though there were higher concentrations in some regions that others. This research into finding harmonic signals in brain waves using fMRI has not been done before, and may influence the way neuroscientists view the brain, examine its signals, and interpret its frequencies. Further exploration would include overlaying the locations of several harmonic signals onto one brain, instead of just the fundamental frequency, and see how their locations overlap. Overlaying the harmonic locations in several subjects' brains will also show if these locations are generalized or specific to

individuals, and the specific locations in the brain where these harmonic signals occur will be examined to ask why these signals are, or need to be, harmonic.

60.

THE KETOGENIC DIET SHIFTS THE CEREBROSPINAL FLUID METABOLOME AND HAS DIFFERENTIAL EFFECTS IN RESPONSIVE VS. NON-RESPONSIVE PEDIATRIC EPILEPSY PATIENTS
Natalie Freedgood '18
Faculty Sponsor: Susan A. Masino

The high-fat low-carbohydrate ketogenic diet (KD) has shown significant anticonvulsant effects in treating refractory epilepsy in children. The difficulty with understanding how the KD works in treating epilepsy has to do with the challenges in conducting controlled studies in this population. In this study we investigated the effects of the KD on refractory childhood epilepsy by analyzing their cerebrospinal fluid metabolome using metabolomic analyses. Cerebral spinal fluid (CSF) was collected from 25 children with drug refractory epilepsy from the Karolinska Hospital in Stockholm, Sweden. CSF samples were sent to Metabolon for analysis of metabolites. 271 metabolites were identified. Patients with 100% (n=5) or 0% (n=5) seizure reductions were then further assessed. Statistical analyses included a principle component analysis, a random forest analysis, ANOVA, and t-tests. Principal component analysis showed a strong effect of ketogenic diet treatment on metabolites, particularly lipids, ketone bodies, carnitine derivatives, and sugars. Comparing responders and non-responders for the hallmark metabolic effects of ketogenic diet, there was a greater elevation of ketone bodies and a larger drop in glucose in responders. Exploratory random forest analysis compared during-ketogenic treatment data between responders and non-responders to find other metabolites that could be relevant to differential seizure responsiveness. Top scoring metabolites included multiple lipids, amino acids, carbohydrates, and xenobiotics. These data show that ketogenic diet feeding strikingly modifies the central metabolome, and that responders may have a stronger metabolic response to ketogenic diet feeding.

61.

THE EFFICACY OF COGNITIVE REHABILITATION IN IMPROVING PROSPECTIVE MEMORY OF INDIVIDUALS WITH ACQUIRED BRAIN INJURY
Lilla Kis '18
Faculty Sponsor: Sarah A. Raskin

This study examined the effect of cognitive rehabilitation on improving prospective memory (PM) measures of individuals with acquired brain injury (ABI). Deficits to PM, the ability to remember to perform future intended actions, are reported to have the greatest impact on daily life following an ABI. Sixteen adults with ABI and eighteen healthy adults were recruited. At the onset of the study, all participants received neuropsychological testing to assess attention, retrospective memory, prospective memory, and quality of life. Participants with ABI then underwent six weeks of either cognitive rehabilitation (n = 12) or an active control condition (n = 4) for two hours per week, after which neuropsychological testing was repeated. Individuals with ABI performed significantly worse than healthy controls on all sub-scores of the Memory for Intentions Screening Test (MIST), as well as the summary score, indicating significant impairments in PM function. There were no significant changes on the MIST in either the cognitive rehabilitation group or the active control group following treatment. However, the

cognitive rehabilitation group showed significant improvement in the instrumental activities of daily living (IADL) score of the Comprehensive Assessment of Prospective Memory (CAPM) following treatment, indicating an improvement in PM functioning in daily life.

62.
NEUROMUSCULAR PHYSIOLOGY OF THE ESCAPE WITHDRAWAL BEHAVIOR OF THE CHINESE MUD SNAIL, *CIPANGOPALUDINA CHINENSIS*
Ashley Kupferschmid '20
Faculty Sponsor: Charles Swart

Behaviors that allow an escape from danger are critical to survival. Snails can withdraw into their shells when threatened and can remain withdrawn for many hours if necessary. Long-term contraction of muscles during this behavior should be very energetically expensive. A special low-energy, Calcium-independent muscle contraction condition known as "Catch State" is known in bivalves (clams, oysters etc.) but has not been explored in snails. This project aims to describe the neuromuscular physiology of the withdrawal escape behavior in the freshwater snail, *Cipangopaludinachinensis*. To do so, several variables are tested and measured, including muscular anatomy, electrophysiology, neurotransmitter activity and muscle fiber type.

63.
EFFECTS OF THE KETOGENIC DIET ON BEHAVIORAL RESPONSES TO COCAINE IN MALE AND FEMALE RATS
Meghan Lees '18
Faculty Sponsors: Luis Martinez, David Ruskin, Susan A. Masino

The ketogenic diet (KD) is a high fat, low carbohydrate and adequate protein formulation that has traditionally been used as a treatment for epilepsy; however, there is growing evidence that this diet has broader therapeutic potential due to its diverse, positive effects on nervous system function. Recent drug addiction studies suggest that activation of the brain adenosine system decreases behavioral responses to many drugs of abuse, including cocaine. Given that one consequence of the KD is an increase in brain adenosine, we sought to address whether the KD has potential as a novel therapy for drug addiction. In this study, male and female Sprague-Dawley rats were placed on a strict 6.6:1 (fat:[carbohydrates+protein], by weight) KD or control diet at 5 weeks of age and then maintained on those diets for 3 weeks prior to behavioral testing. During testing, rats received daily i.p. injections of cocaine (15 mg/kg/ml) or saline vehicle for one week, were abstinent for a subsequent week, and then all animals received a final challenge injection of 15 mg/kg/ml cocaine. Our results indicate that both males and females on the KD showed reduced cocaine induced stereotyped responses in both the week of repeated cocaine injections as the well as the final challenge day. These results suggest that the KD may indeed hold potential as a therapy for drug addiction. Future studies will focus on how the KD affects the reward pathway using conditioned place preference to cocaine, as well as exploring the neural mechanisms underlying the behavioral effects of this diet.

64.

ASSESSING POST-CONCUSSION BALANCE USING THE ELITE BALANCE PROTOCOL (EBP) AND VALIDATING THE USE OF THE WII BALANCE BOARD TO TRACKING THE RECOVERY OF A CONCUSSION
Kathryn Marsden '21, Anna Hackett '20, Zachary C. Bitan M.A. '18
Faculty Sponsor: Sarah A. Raskin

Recent studies have shown that static balance alone is not enough to adequately assess postconcussion balance and recovery; this is because static balance is not sensitive enough to the affected systems of a concussion. Therefore, it has been proposed that a dual task (cognitive load and balance) be used. Dual tasks require the participant to split his/her attention between balance and a cognitive load. Thus, testing in a dual task condition has been shown to be more sensitive to the kinds of deficits seen after concussion. This study will be a prospective, non-randomized study that seeks to validate the use of the Elite Balance Protocol (EBP) as a tool to assess postconcussion balance. This will be done by comparing individuals' post-concussion balance performance to the established EBP reference data set for non-concussed collegiate athletes. The data will be collected using a Nintendo Wii balance board and Matlab. It is hypothesized that the results will indicate an overall trend for increased sway area when subjects performed the dual task balance compared to single task balance conditions. If proven to be true, patients can be tracked throughout the recovery of their concussion until their area of sway is comparable to their baseline or a normal EBP range, thus, allowing for a clinical tool to assess and track the recovery of a concussion.

65.

THE IMPACT OF THE KETOGENIC DIET ON REPETITIVE GROOMING IN MICE
Jean Lewis Nikuze '21
Faculty Sponsors: Susan A. Masino, David Ruskin

Autism Spectrum Disorder (ASD) is a group of diseases whose main symptoms are repetitive behaviors and problems of sociability. More than 3.5 million Americans live with ASD, and it has no cure. In order to find a treatment for ASD, researchers have been using the ketogenic diet, which contains more fats than carbohydrates. It forces metabolism to be based on fats and increases adenosine levels. Research has demonstrated that the ketogenic diet is a potential alternative for ASD treatment because its metabolic effects also impact the nervous system. For instance, in previous experiments, autistic mice became more sociable after being fed ketogenic diets. In order to understand other benefits of the ketogenic diet on ASD treatment, we studied its impact on the ASD symptom of repetitive behaviors. We put normal and autistic mice in test chambers and recorded the time that they spent grooming. In this case, grooming was the repetitive activity that we were observing. We found that the ketogenic diet significantly decreased grooming in female mice but there was no apparent impact in males.

66.

THE USE OF FMRI TO INVESTIGATE PHYSIOLOGICAL FUNCTIONING ASSOICATED WITH PROSPECTIVE MEMORY PREFORMANCE BEFORE AND

AFTER COGNTIVE REHABILITATION IN INDIVIDUALS WITH ACQUIRED BRAIN INJURY
Meaghan Race '18, Lilla Kis '18, Sarah Vimini '19, Allie Bieling '19, Gianna Barbadillo '21
Faculty Sponsors: Sarah A. Raskin, Michael Stevens, Ph.D., Institute of Living

Acquired brain injury (ABI) affects approximately 3.5 million Americans each year and is associated with cognitive and emotional changes. Prospective memory (PM) deficits are important predictors of functioning in daily life for individuals with ABI. Previous studies have shown that cognitive rehabilitation therapy via PM training has a high rate of success in improving quality of life, independence and productivity for ABI survivors. There is limited information on utilizing imaging techniques in relation to changes in cognition and behavior following rehabilitation; however, previous studies suggest that imaging provides evidence that cognitive treatment could be related to changes to underlying brain plasticity. The aim of this study was to evaluate what brain areas were activated during prospective memory task stimuli in ABI individuals compared to healthy adults. Furthermore, a post-scan was used to determine if there were changes in the cortical regions used for the PM task following cognitive rehabilitation therapy compared to pre-therapy. 34 participants were recruited (18 with ABIs and 16 healthy adults) and given a series of neuropsychological tests and an fMRI at baseline. Participants with ABI then participate in six weeks of PM cognitive rehabilitation individualized based on their pre-testing performance. Following treatment, the ABI participants received the neuropsychological battery and a follow-up fMRI. The results of this pilot study suggest strong statistical evidence for sub region activation in frontal, cingulate, parietal, premotor, and temporal cortexes relative to pre-treatment baseline levels for ABI participants. Further investigation is being conducted to determine significance between CRT and ACC group pre- and post-treatment.

67.
THE EFFECTS OF KETOGENIC DIET ON APOMORPHINE-INDUCED REPETITIVE MOTOR BEHAVIOR IN MICE
Lillian Russo-Savage '18
Faculty Sponsor: David Ruskin

The ketogenic diet (KD) reduces repetitive grooming behaviors in different models of autism in mice. Dopamine receptor agonists can induce repetitive stereotyped behaviors in mice: KD increases brain adenosine levels, which is known to have an antagonistic relationship with dopamine. The present study explores the possibility KD could decrease repetitive behaviors induced by the dopamine receptor agonist apomorphine in different mouse strains. Roughly 150 male and female mice of four different strains (C57 control, C57 adenosine receptor 1 knockout [C57KO], BTBR, and EL) known to express different levels of repetitive behaviors associated with autism spectrum disorder were placed on either a control diet (CD) or KD for 3 weeks prior to behavior testing. After habituation to the test apparatus and 10 minutes of baseline filming, the mice were injected with the dopamine receptor agonist apomorphine (3.0 mg/kg), and filmed for another hour for later scoring for repetitive stereotypies. Apomorphine induced stereotyped behavior in all mice. Both baseline scores and post-apomorphine scores were significantly higher in KD compared to CD in the C57 control as well as BTBR strains. Regardless of diet, the post-treatment scores were significantly higher in the C57KO strain compared to the C57 control strain, while the EL strain scores were significantly lower than the C57 control strain. These

findings do not support our hypothesis that the KD will reduce the stereotyped behavior induced by apomorphine. However, our finding that the KD had a significant effect in the C57 control mice but did not in the C57KO mice does support the hypothesis that the A1R is a key modulating factor in the mechanisms of the KD.

68.
DISCRIMINATING COVARIATION BETWEEN IMPULSIVITY AND ALCOHOL USE AND ITS IMPACT ON REGIONAL HOMOGENEITY USING A MULTIMODAL FUSION APPROACH
Molly Ryan '18
Faculty Sponsors: Dan Lloyd, Shashwath Meda, Godfrey Pearlson, Olin Neuropsychiatry Research Center, Institute of Living

Heavy alcohol use is common among adolescents and young adults and has been linked to impulsive behavior. Several studies have indicated that alcohol use leads to altered neurodevelopment of the frontal regions. Specifically, structural analyses show significant grey matter volume reduction as result of heavy alcohol use, while functional MRI studies have also indicated functional changes resulting from heavy alcohol consumption. An increasing interest in global functional connectomics has lead to an increase in usage of resting state fMRI, however, few studies have focused on local functional connectivity. One measure of local functional connectivity, called regional homogeneity (ReHo), is a voxel based measure of brain activity evaluating the synchronization between the times series of a given voxel and it nearest neighbors. Using a data driven and multimodal approach, we evaluated the covariation between impulsivity and degree of alcohol consumption and its impact on local functional connectivity, as measured by ReHo, in college students. The objectives of this study are threefold: (1) to examine the covariation of impulsivity and alcohol consumption on regional homogeneity, (2) to investigate the effect of alcohol use on regional homogeneity, as well as (3) how self-reported measures of impulsivity predict the synchronization of joint independent components of ReHo. Our results showed 8 joint independent components, which were all highly correlated. The domains of 'Impulsive-Action' (t= -6.35, p<0.00) and 'Approach' (t= -4.18, p< 0.00) are both positively correlated with levels of alcohol consumption, and structural component was 8 was associated with the parahippocampal gyrus, cuneus and cingulate gyrus. Given these findings, it is still somewhat unclear how impulsivity maps onto functional networks, as well as how exactly the synchronization of joint structural and functional networks is affected by heavy alcohol use.

69.
DIFFERENTIAL DIAGNOSIS OF HIGH-GRADE OSTEOSARCOMAS USING BMPR2 AND CTSK ANTIBODIES
Molly Schineller '18
Faculty Sponsor: Susan M. Bush, Cindy Allander, Dr. Marc Hansen (University of Connecticut Health Center)

Osteoblastic, chondroblastic, and fibroblastic osteosarcomas are subtypes of high-grade cancerous bone tumors which may respond differently to various treatment combinations. As precision medicine rises in prevalence, an accurate diagnosis of tumor subtype is increasingly critical in order to prescribe an optimal treatment plan. Osteosarcomas are currently subtyped histologically based on key morphological characteristics, but this process can be subjective;

development of a more objective method is imperative. Immunohistochemistry (IHC) is a technique which uses fluorescently-labeled antibodies to mark the presence of antigens on various cell locales. The discovery of an antibody that expresses differentially across subtypes could have enormous implications on the potential diagnostic use of IHC. The present study examines high-grade bone tumor samples to explore the expression of two primary antibodies: BMPR2 (found in the membrane during endochondral bone formation) and CTSK (found in lysosomes of cells reforming bone after degradation). While results from this study have not yet been quantified, preliminary findings on this method prove optimistic.

70.
INCREASED CONTAGIOUS ITCH IN CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD)
Molly Schineller '18
Faculty Sponsor: Molly Helt

It has been previously demonstrated that contagion of yawning and laughing is significantly reduced in individuals with Autism Spectrum Disorder (ASD) in comparison to age-matched typically developing (TD) children, but contagion of itch has not been studied in this population. In this study, 55 children with ASD and 55 TD children, all aged 9-14, were exposed to video clips depicting actors yawning, laughing, and itching. While children with ASD demonstrated the expected decrease in contagious yawning and laughing, they unexpectedly demonstrated a higher number of contagious itches. Further testing determined almost no correlation between autism severity and contagion of itch. It was additionally hypothesized that children with ASD would demonstrate fewer itches in response to stimuli close to the face rather than those distant from the face, due to the reduced gaze fixation typically seen in the disorder. Children with ASD did not, however, demonstrate a significant difference in itch frequency related to the location of the stimulus itch. Potential implications on mirror neuron theory and the origin of mimicry deficits in ASD are explored.

71.
SYNTHESIS AND EVALUATION OF ACETYLCHOLINE MOLECULARLY IMPRINTED POLYMERS
Nathaniel Thiemann BS/MA '18
Faculty Sponsor: Timothy P. Curran

A biosensor detects a target analyte with a recognition element, and translates that recognition into an electrical signal through a transduction element. Biosensors, like the glucose monitor, are commonly used to take real time measurements of a target analyte in biological environments. Biosensors for acetylcholine have been created in the past by coupling the enzyme, acetylcholinesterase, as a recognition element with various methods for signal transduction. However, immobilized acetylcholinesterase based recognition elements are expensive to produce and feature short lifespans. However, molecularly imprinted polymers are highly stable synthetic materials that can be tailored to have high affinity for a target analyte. Molecularly imprinted polymers are also relatively cheap to make, and have previously been used as recognition elements in biosensors for other neurotransmitters. An attempt was made to synthesize acetylcholine molecularly imprinted polymers using the functional monomers acrylamide, methacrylamide, and itaconic acid. Polymers that successfully formed were evaluated with a

binding assay to analyze whether they were imprinted for acetylcholine or not. Samples collected from the binding assay were analyzed via flow injection analysis to quantify the concentration of acetylcholine in each sample of the binding assay. Acetylcholine was recovered primarily in the loading and wash stages of the binding assay. More work is needed to determine the best way to elute acetylcholine from the experimental acetylcholine molecularly imprinted polymers. A functional acetylcholine molecularly imprinted polymer could potentially be used as a novel recognition element in acetylcholine biosensors. Acetylcholine biosensors themselves have multiple potential applications in areas such as cholinergic transmission research, biomedical devices, or water/food quality filters.

72.
MEMORY FOR INTENTIONS TEST (MIST) AND DIAGNOSIS THREAT IN TRINITY COLLEGE STUDENTS WITH A HISTORY OF CONCUSSION
Clotilde White '18
Faculty Sponsor: Sarah A. Raskin

Research on long-term cognitive effects of concussions, such as deficits in attention and memory, has become increasingly relevant, as the number of reported concussions is approximately 1.6 million to 3.8 million people a year and growing (Daneshvar, 2011). While individuals who sustain concussions typically recover fully in approximately 7 – 10 days (Teel, 2017) a small number experience lasting effects, including reported deficits in attention and memory (Rabinowitz, 2014; Ledwidge, 2016). It is still unknown why this minority continues to experience deficits, but it is likely a combination of unique physical, physiological, psychological and social factors (Daneshvar, 2011). Diagnosis threat is a social phenomenon that occurs when a situation puts individuals at risk of confirming negative stereotypes about themselves, and their stereotyped group, due to a diagnosis such as a brain injury (Suhr, 2002). The current study evaluates how diagnosis threat effects college students who have a history of concussion in a test-taking environment. Students in this study will be evaluated based on their performance on the Memory for Intentions Test (MIST) (Raskin, 2009). It is hypothesized that students who are experiencing diagnosis threat will perform worse on the MIST compared to students who 1) do not have a history of concussion and 2) those who have a history of concussion but who are not experiencing diagnosis threat. These results would indicate that college students with a history of concussion may perform worse on tests in the classroom compared to other students due, in part, to negative expectations. These results might suggest novel ways to reduce poor performance in the classroom by students who have experienced concussions.

Key Words: Concussion, Memory for Intentions Test (MIST), Stereotype Threat

PSYCHOLOGY

73.
ALTERNATIVE WAYS TO MEASURE METACOGNITION: OFFLINE VERSUS ONLINE ASSESSMENT
Michelle Treglia '18
Faculty Sponsors: Dina Anselmi, David Reuman

Both offline and online measures have advantages and disadvantages as ways of measuring metacognitive skills. The present study compared data using an offline measure of metacognition, The Metacognition Five (MC5) to an online think-aloud and reflect when prompted measure. The online measure used *The Oregon Trail,* a computer game used in social studies curriculum. The participants were 8th grade students who were asked to play *The Oregon Trail* once as a "novice" and then again as an "expert" (after having played six additional times on their own). The results suggest there is a stronger correlation between the offline measure and the "novice" players than between the offline measure and the "expert" players. Furthermore, especially for "expert" players, the online measure more strongly correlates with success playing *The Oregon Trail* for both "novice" and "expert" than the offline measure. Lastly, there is no significant difference between "novice" and "expert" players for metacognition. "Experts" traveled significantly farther than "novices" but had fewer survivors than the "novices" but the differences were not significant.

74.
DEVELOPMENTAL DIFFERENCES IN METACOGNITION AND MOTIVATION
Jillian Ramsay '18
Faculty Sponsors: Dina Anselmi, David Reuman, Chris Ewing, Andrea Heller, Tim Roarty

Metacognition is the awareness and control of one's own thought process and has been attributed to successful learning. This study investigated the developmental differences in metacognition and motivation across 6th, 7th, and 8th grade students. Students were given various metacognitive and motivational self-report questionnaires to examine differences among students in different grade levels. Each student completed two sets of these questionnaires for social studies class and for math class. We found that students in each grade level differed in their use of metacognitive steps, but did not differ in their overall metacognition use. As predicted, seventh and eighth graders exhibited more domain-generality in their metacognition use, while sixth graders demonstrated domain-specificity. Finally, sixth and seventh graders reported higher self-efficacy in math and overall less test anxiety than eighth graders. These findings can provide information for teachers regarding the most developmentally appropriate ways to teach metacognition and help students become successful learners.

75.
GENDER DIFFERENCES IN METACOGNITION AND MOTIVATION
Adelaide Jenkins '18
Faculty Sponsors: Dina Anselmi, David Reuman, Hartford Magnet Trinity College Academy (HMTCA)

This study was a continuation of the ongoing Trinity metacognition project investigating the metacognitive awareness and skills of middle school students. The present study examined whether there were gender differences in the ways metacognition is used in two different subject areas: social studies and math. It also investigated whether gender has an effect on how students use metacognition in these two school subjects. Students in the sixth, seventh, and eighth grade were surveyed about their metacognitive and motivational awareness in math and social studies. Results showed that female students used metacognition more than male students in both math and social studies, and that male and female students both adopt a domain-general approach to metacognition, meaning that they use the same skills to help them learn in both school subjects.

It was also found that male and female students are both motivated to learn in math and social studies, but female students showed higher engagement than male students in social studies. Female students also believed that they could enhance their abilities in social studies through time and effort more often than males. In math, males and females both believed that they could enhance their abilities through time and effort. These results suggest that female students are more likely than male students to use metacognitive skills to help them learn across school subjects, and that male and female students are usually motivated to the same degree, except female students are higher in engagement and ability beliefs than male students only in social studies.

76.
WHAT DO YOU MEAN I GOT A D+? EFFECTS OF FEEDBACK TYPE AND QUALITY ON METACOGNITION, MOTIVATION, AND ACADEMIC PERFORMANCE IN HIGH SCHOOL STUDENTS
Daisuke Katsumata IDP
Faculty Sponsors: Dina Anselmi, David Reuman

Numerous studies have established feedback as being among the most effective ways to improve student achievement. However, not all studies have defined feedback in the same way, so the effectiveness of feedback has depended on how it has been defined and the context in which it was provided (Hattie & Timperely, 2007). This study investigated if changes in student academic achievement, motivation, and metacognition vary based on the type of feedback students were provided on assignments. Students were given either grades alongside traditional forms of minimal written feedback, or no grades alongside elaborate but targeted written feedback. The students in the study came from two sections of a high school world history class at Hartford Magnet Trinity College Academy. All feedback was provided by the same teacher over the course of a four-week instructional unit. The effectiveness of the type of feedback on the students was assessed before the unit began and at the end of the unit by measuring scores from a comprehension-based test and questionnaires that asked about student metacognition and motivation. Student perceptions on the usefulness of feedback were also collected to assess the level of engagement students had with the feedback they received.

77.
IMMIGRANT STATUS AND PSYCHOLOGICAL WELL BEING
Joanne Chambers '19, Isabella Chen '19, Stefania Ruibal '19
Faculty Sponsor: Dina Anselmi

The purpose of this study was to look at differences between first and second generation immigrants, in terms of subjective happiness, belonging, and acculturation (i.e., westernization). We hypothesized that participants categorized as second generation immigrants (children of emigrated parents) would report higher levels of subjective happiness and belonging, as well as have a generally higher level of acculturation when compared to first generation immigrants (different country of birth, emigrated to the U.S.). We sampled 801 Trinity College students, and of the 125 respondents, we were able to categorize 42 students as either "first generation immigrants" or "second generation immigrants" based on demographic questions. Our online survey further consisted of three scales: the General Belongingness Scale (Malone, Pillow, and Osman, 2012), the Subjective Happiness Scale (Lyubomirsky & Lepper, 1999), and a modified

Westernization Scale (Stigler, Dhavan, Van Dusen, Arora, Reddy, Perry, 2010). Our results showed that there was no significant difference between first and second generation immigrants in terms of feelings of belonging and happiness, however, second generation immigrants showed higher levels of acculturation than first generation immigrants.

78.
WHY SELFIES?
Olivia Consoli '19, Jamie Dingus '19, Ally Slowe '19
Faculty Sponsor: Dina Anselmi

Online social networking sites like instagram may play many roles for college students ranging from communication to entertainment. Our study looked at the selfie use increase in twenty nine first year and senior women at Trinity College. Three different types of posting situations were evaluated; same selfies, pictures with peers and pictures with romantic partners. We hypothesized that Instagram users with lower self-esteem would post more selfies, pictures with peers and pictures with romantic partners than Instagram users with higher self-esteem. Second, we hypothesized that freshman women in college will post more selfies, pictures with peers and pictures with romantic partners than senior women in college. Our last hypothesis was that women who are more narcissistic would post more selfies, pictures with peers and pictures with romantic partners on Instagram than less narcissistic women. The Rosenberg Self-Esteem Scale and the Hypersensitive Narcissism Scale (HSNS) were used to assess the relationship between self-esteem, narcissism and selfie use. None of our hypotheses were found to be significant.

79.

INFANT MORTALITY AND MATERNAL HEALTH IN HARTFORD, CT
Chelsea Armistead '18
Faculty Sponsor: Dina Anselmi

Infant mortality is the death of an infant within the first year of life. These deaths are measured annually as a rate per every 1,000 live births and is a key indicator about maternal and infant health in a society (CDC, 2017). The United States infant mortality rate is very high when compared to other equally wealthy nations. Black infants die at a much higher rate than other racial groups, including in Connecticut. The city of Hartford's Department of Health and Human Services strives to reduce infant mortality by providing quality prenatal and postpartum care programs and services. In 2013, the Maternal and Child Health Division (MCHD) developed a Strategic Plan with specific objectives to monitor these deaths in hopes of reducing them. The present study analyzed the vital records of live births (N = 11,552) and infant mortalities (N = 105) from 2010 to 2015 to chart progress on several specific goals of the MCHD by comparing Pre-Plan (2010-2012) and Post-Plan (2013-2015) groups. The comparisons show that MCHD has met goals in several but not all areas for data available up to 2015. It is recommended that

extending the Strategic Plan and where possible analyzing data more quickly, would encourage better tailored objectives that can be reached in a timely manner.

80.

PERFORMANCE ON THE AFFECTIVE ODDBALL SILHOUETTE TASK IN PRESCHOOL-AGED CHILDREN EXPOSED TO INTIMATE PARTNER VIOLENCE
Caroline Howell '18
Faculty Sponsors: Dina Anselmi, Dr. Damion Grasso, UConn Health Department of Psychiatry

Early and chronic exposure to IPV can interfere with the typical development of a child and impact their behavioral, emotional, and social functioning (Sternberg, Baradaran, Abbott, Lamb, & Guterman, 2006). However, early violence exposure does not impact all children in the same way, and many more children witness violence than are reported to have lasting problems (Briggs-Gowan, Carter, & Ford, 2012). Research suggests that early trauma-related symptoms (TRS) partially or fully mediate the developmental pathways from early IPV exposure to later emotional health (Briggs-Gowan et al., 2012). The specific ways in which TRS affect an individual can be better understood by comparing differences in threat reactivity. Hyper- and hypo-reactivity to threat have been found to predict specific TRS in adults with anxiety disorders (Lang & McTeague, 2009). The current study looks at whether threat reactivity in the acute period following IPV exposure is a marker for trauma-related symptoms in pre-school aged children. The study aimed to establish whether individual differences in threat reactivity can differentiate children with TRS outcomes in the aftermath of IPV exposure from comparison children without a history of IPV exposure. Participants include children 4 to 6 years of age who have been exposed to physical IPV in the last 12 months, as well as their mothers. Autonomic reactivity (heart rate, skin conductance, and respiration) of the child participant was measured while they performed the Affective Oddball Silhouette Task. I examined differences in defensive mobilization across participants in response to conflict images versus positive and neutral images. Conclusions cannot yet be drawn from this data due to the low sample size at this point in the study (*N*=10), but preliminary findings suggest ambiguous/inconclusive results. Further research is needed to standardize the images used in this task, and to continue with efforts to better understand the influence that threat reactivity has on TRS, as well as the role that TRS play in the developmental pathways from early exposure to later emotional health.

81.

EXPLORING GENDER IDENTITY IN CISGENDER INDIVIDUALS
Jacob Vargas '18
Faculty Sponsor: Dina Anselmi

Despite burgeoning interest in the transgender population, much of our understanding of the cisgender experience has gone uncontested. The purpose of the current study was to tease out the variation in the gendered experience of cisgender individuals. One-hundred seventy-one undergraduates (58 males, 113 females) completed questionnaires on sex-typing, gender congruence, transgender prejudice, and transgender knowledge, in addition to a private interview on their gender identity. Results revealed that females were more sex-typed than males and that higher sex-typing did not correlate with higher prejudice, although males displayed overall higher transgender prejudice than females. Participants with less transgender knowledge reported

higher levels of transgender prejudice. An informal coding of qualitative data revealed no differences between femininity and masculinity for those participants who expressed some form of gender atypicality. These results have implications for the relationship between the cisgender and transgender communities, as well as for current thinking on normative gender identities.

82.
AN EXPLORATION OF THE LINK BETWEEN FOOD TASTE PREFERENCES AND PERSONALITY
Ania Aliev '18
Faculty Sponsor: Randolph Lee

Previous studies have found several links between food taste preferences and aspects of personality (Byrnes and Hayes, 2013; Meier et al., 2012; Sagioglou and Greitemeyer, 2016; Stone and Pangbornâ, 1990). This study attempted to replicate these findings. This study hypothesized that those preferring sweeter foods would be more agreeable, whereas those preferring bitter foods would show higher levels of psychopathic and sadistic traits. Also, those preferring spicier foods would score higher on sensation seeking. Participants completed the Revised Personality Inventory (NEO PI-R), Buss-Perry Aggression Scale, 12-item Dark Triad measure, Sensation Seeking Scale-Form V, and a food-liking questionnaire. Also, participants took part in several food preference tests: a) they were asked to adjust sugar-free lemonade to their liking (from sour to sweeter), b) they were asked to adjust the spiciness of salsa, c) they were asked to adjust the saltiness of salt-free chicken broth. We found that there were several potential links between food taste preference and personality. Firstly, it was found that those preferring sweeter foods were more agreeableable. Furthermore, those who prefer spicier scored significantly higher on sensation seeking, therefore implying an association. Additionally it was found that sour food liking had a negative association with psychopathic traits. There was no effect shown between sweet food-liking and prosocial function. Finally, there was no effect shown between bitter food-liking and psychopathic and sadistic traits. The results imply that personality does influence food taste preferences to an extent.

83.
ASSOCIATIVE LEARNING ACCELERATES THE TEMPORAL DYNAMICS OF COVERT EXOGENOUS SPATIAL ATTENTION
Devin Butler '19
Faculty Sponsor: Michael Grubb

Introduction: Abrupt onsets trigger the reflexive allocation of covert attention, speeding visual information processing and improving discriminability at exogenously attended locations. In the lab, neutral stimuli (e.g., small circles) are typically used to study exogenous attention. Abrupt onsets encountered in daily life, however, often carry meaning (e.g., in Gmail, onsets in the lower right visual field not only capture attention, but also signal incoming Instant Messages, thanks to a learned association). Does the behavioral signature of covert exogenous spatial attention change when elicited by meaning-imbued onsets?

Methods: On each trial, covert attention was manipulated with a peripheral onset, and two Gabor patches were briefly presented at 8o eccentricity (left/right of fixation). In line with a response cue, observers reported the target Gabor's orientation (clockwise/counterclockwise of vertical).

Exogenous cues were valid (small circle presented near target location) or invalid (presented near distractor location); cue validity was 50%, cue-target SOA varied (33-133ms), and the cue was equally likely to be black or white in color. One color became meaning- imbued: following correct responses, observers were shown a randomly selected Emoji at fixation, but only when the peripheral onset had been rendered in the meaning-imbued color. Thus, observers learned to associate one type of onset (black or white peripheral circle, counterbalanced across observers) with the presentation of a novel, visually-pleasing stimulus; the other onset type provided a meaning-non-imbued baseline for each observer. A centrally- presented "X" followed all incorrect responses.

Results: Both types of onsets modulated task performance (evidenced by increased accuracy and faster RTs for valid, relative to invalid, cues), but meaning-imbued onsets accelerated the timecourse: cueing effects were significantly larger at early SOAs for Emoji-predictive onsets, compared to non-predictive onsets.

Conclusion: The temporal dynamics of covert exogenous spatial attention are accelerated when attentional allocation is triggered by a meaning-imbued onset.

84.
LINGUISTIC BEHAVIORS IN TELEVISION INTERVIEWS
Esmé Douglas '18
Faculty Sponsor: Elizabeth Casserly

When the average person watches a television interview, they pay attention to the overall topic of the conversation. However, there are many subtle aspects of linguistic behavior that happen nearly every second without entering our awareness . This study evaluates many different linguistic behaviors, such as, pauses in speech (both long and short), interruptions, stutters, and word choices in interviews. It examines how they change across dimensions, such as, the genre and the formality of the television show, the age of the guest, and the profession of the guest. Each interview clip was fully transcribed and was annotated for these various linguistic behaviors. Then the data from the transcriptions was analyzed across the dependent variables and the independent variables to discover when certain behaviors are happening more or less frequently. Our research found significant results regarding interruptions and short pauses. This provides insight into how the language in an television interview reflects what is going on underneath the surface of the general topic of conversation. We have learned that the specific host of the television show does not matter much, but the genre of the show does, as does the profession of the guest.

85.
AMERICANS' ATTRIBUTIONS ABOUT A MASS SHOOTING AND ITS PERPETRATOR: THE ROLE OF THE PERPETRATOR'S CULTURAL BACKGROUND
Zoe Ferguson '18
Faculty Sponsor: Robert Outten

Prior research has found that compared to people who are White and/or Christian, Arabs and/or Muslims tend to be perceived more negatively by people in Western societies. Informed by

literature on cultural stereotyping (Kearns et al., 2017; Devos & Ma, 2008) and the ingroup projection model (Wenzel et al., 2007), we examined if the cultural background of a person who commits a mass shooting can affect people's perceptions of the act and the perpetrator. Specifically, we tested whether Americans ($N = 751$) who read about a mass shooting in New Zealand where the perpetrator's name was stereotypically Arab-Muslim (i.e., Mohammed Naazim al-Tariq), rather than White-Christian (i.e., James Clarke) would be 1) significantly more likely to define the act as terrorism and 2) ascribe negative character traits to the perpetrator (e.g., immoral). We also tested whether participants who were exposed to the Arab-Muslim name would be significantly less likely to assign positive characteristics to the perpetrator (e.g., wholesome) and 4) be less likely to assign character traits synonymous with mental illness to the perpetrator (e.g., depressed). We found support for three of the four hypotheses. Namely, exposure to an Arab-Muslim sounding name made people significantly more likely to interpret the act as terrorism, and significantly less likely to assign positive characteristics and characteristics synonymous with mental illness to the perpetrator. We discuss the implications of these findings for future social science research and public policy initiatives geared toward reducing perceptual biases.

86.
MIRROR MIRROR ON THE WALL: INFLUENCES ON SHORT-TERM VERBAL MEMORY
Brii Kuzmickaite '18
Faculty Sponsor: Elizabeth Casserly

Growing up in the West means growing up in an environment that has mirrors everywhere. Despite this, scientific evidence regarding how they affect behaviour is sparse. This project aimed to find out how mirrors influence long-term verbal memory and also to observe the differences directly, in different environments.

Only a few animals (chimps, orangutans, etc.) have been observed to recognise themselves, using the mirror-mark test. In human children, mirror recognition seems to start around the age of 18 months but can vary. Those two areas – self-recognition in human development and across species – are the most researched, whilst other areas are inconclusive. We summarise findings regarding the positive effects of mirrors, such as increased prosocial behaviour, and negatives, such as mirror use causing distress.

This study is a follow-up to a pilot study designed to document mirror-related behaviour in the laboratory. Participants were asked to memorise a monologue near a mirror while their behaviour was recorded. We found that people avoided looking at the mirror directly, although most faced it without looking, and that accuracy varied mostly as a function of time taken to memorise.

Participants were asked to memorise two different passages either in front of a mirror, or without one. After a distraction task, they had to verbally recall what they remember, which was coded using a recording of the session. The results show that the presence of a mirror negatively affects memory, as average accuracy was lower despite counterbalancing.

87.

WHY CAN'T YOU GUYS BE LIKE THEM? MODEL MINORITY MYTH SALIENCE HEIGHTENS WHITE AMERICANS' NEGATIVE PERCEPTIONS OF BLACK AMERICANS AND REDUCES SUPPORT FOR AFFIRMATIVE ACTION
Timothy Lee '18
Faculty Sponsor: Robert Outten

A tenet of the model minority myth (MMM) is that people of Asian descent have stronger achievement motives compared to other racial minorities—particularly Blacks Americans; as such, Asian Americans tend to be academically and economically successful. Given the prevalence of MMM, it is imperative to examine if exposure to information consistent with MMM has broad implications for interracial dynamics. Informed by racial triangulation theory (Kim, 1999), we examined whether merely exposing White Americans to information consistent with MMM leads them to perceive Black Americans to be of significantly lower-status and indicate less support for affirmative action. First, participants were randomly assigned to read an article that either depicted Asians as having a higher median household income than both Whites and Blacks (MMM salient condition), or Whites as having a higher income than Blacks, with no information concerning Asians (MMM not salient condition). Next, participants completed measures of perceived status of Black Americans and support for affirmative action. As predicted, Whites who viewed racial household income statistics that included Asian Americans perceived Black Americans to be of significantly lower-status and indicated less support for affirmative action than Whites who viewed racial household statistics that excluded Asians. These results highlight that information consistent with MMM could serve as a convenient tool to manipulate interracial dynamics.

88.
EFFICACY OF DIFFERENT REFUSAL STRATEGIES FOR NON-MEDICAL PRESCRIPTION STIMULANT REQUESTS
Eliza Marsh '18
Faculty Sponsor: Laura Holt

One-third of college students have used prescription stimulants non-medically and nearly 62% of college students were offered prescription stimulants by their senior year of college (Garnier-Dykstra, et al., 2012). Since most students obtain these drugs from a peer with a legitimate prescription, in the current study I assessed the efficacy of different refusal strategies prescribed students might use when a peer requests their stimulant medication. Students from three college campuses (N=1286) participated in an online survey in which they responded to five hypothetical situations where they were asking a friend for his/her stimulant medication. In each scenario, participants rated five types of refusals a prescribed student might give: direct refusal, excuse, alternative, and internal and external explanations. I also examined whether adding politeness (apologizing) to the refusals changed how they were perceived. Analyses indicated that refusals containing internal explanations (not having enough medication) and external explanations (parents counting pills) were perceived to be most effective at stopping future requests and at preserving the requester-refuser relationship. Participants assessed refusals as being least effective in scenarios where a close friend was requesting medication and made the prescribed student feel guilty for not sharing his/her medication. Adding politeness to the refusals led them to be perceived as more effective in some cases (direct refusals and explanation internal) and less effective in other cases (explanation external, alternative and excuse). These findings will help to inform interventions aimed at preventing prescription stimulant diversion.

89.

ATTIDUES ABOUT THE SELF, SOCIETY, AND CAMPUS LIFE AT TRINITY COLLEGE
Sam Muse '18
Faculty Sponsor: Robert Outten

Group status influences perceptions of the self, others and one's social context. For example, members of high-status groups (e.g., rich people, White Americans) tend to express greater perceived control, greater support for the status quo and display less empathy (i.e., psychological outcomes consistent with high-status; Kraus, Piff & Keltner, 2009; Willis-Esqueda, Delgado & Pedroza, 2017). Utilizing the framework of Social Identity Theory (SIT: Tajfel & Turner, 1986) that states one's group relative position in a social hierarchy is an important determinant of a group members' beliefs and psychological outcomes, we assessed individuals social dominance orientation, perceived control, empathy levels, and support for the status quo. At Trinity College, Greek life members are higher-status relative to non-Greek students. For my thesis, we are examining whether those in Greek life at Trinity are more likely than non-Greek students to exhibit psychological outcomes consistent with high-status. The idea being that Greek life members' relative high-status non-Greek life members will in part, account for Greek life members reporting greater preference for social hierarchies, greater perceived control, greater blind devotion to Trinity and less empathy. Contrary to our predictions, there were no significant differences between Greek and non-Greek members in regards to any of the psychological outcomes consistent with high-status group membership.

90.

THE INFLUENCE OF PROTECTIVE BEHAVIORAL STRATEGIES AND COACH MANAGEMENT STRATEGIES ON STUDENT-ATHLETES' ALCOHOL USE: A MIXED METHODS STUDY
Kayla O'Connor '18
Faculty Sponsor: Laura Holt

Collegiate athletes have a higher prevalence of binge drinking and negative outcomes related to substance use (Martens, LaBrie, Hummer, Pederson, 2008). Division III athletes, in particular, have been shown to engage in high levels of problem drinking (Millroy et al, 2014). Protective behavioral strategies and coach management strategies have been associated with fewer problematic drinking behaviors (Seitz, Wyrnick, Rulison, Strack, Fearnow-Keeney, 2014; Whiteside and Lynman, 2001; Martens, Wattson, Royland, Beck 2005). The aim of the current study was to replicate previous findings while also assessing the influence of player-coach relationship on the effectiveness of coach management strategies (Pitts, Chow, Yang 2017). 118 Trinity College student-athletes completed a web-based survey, and 13 Trinity College varsity head coaches partook in interviews. Results showed that athletes who used more protective behavioral strategies reported fewer binge drinking episodes, less in and out of season drinking, and fewer alcohol consequences. Interestingly, greater enforcement of drinking-related policies by coaches in season was associated with more out of season drinking. A interaction was found between coach enforcement strategies, perceived player-coach disagreement, and out of season drinking. Specifically, enforcement was associated with more out-of-season drinking at higher

levels of player-coach disagreement. Implications of these findings for athlete drinking preventive interventions will be discussed.

91.
HOW THE BIRTH CONTROL PILL INFLUENCES WOMEN'S ATTITUDES AND EXPECTATIONS OF THEMSELVES
Molly Santora '18
Faculty Sponsor: Elizabeth Casserly

This study seeks to understand what influences women's feelings and attitudes about pregnancy prevention through looking at the usage and/or attitudes surrounding the birth control Pill over time. We aim to understand how women of different generations learned about this invention, and how the concept of the Pill changed women's expectations of themselves and their lives. This study compares three different generations of women – women currently under 30, women between ages 30 – 55 and women above 55 – to see how or if attitudes change over time. We hypothesize that women's trust, comfort level, and positive attitudes of the Pill will increase as age decreases, and that younger women had more sources to learn about contraception than older women did. We acquired quantitative data on three generations of women through an online survey. We also conducted focus groups of 3 - 5 women each, 1 – 2 per age group for a more qualitative understanding of attitudes. Our results showed, most importantly, that women across age groups did not significantly differ on their opinions for the most socially appropriate age for women to start thinking about marriage or when to have children. We also found that women in the younger age group had significantly more access to a variety of methods of birth control than the higher age group, as well as a more complex form of sexual education in school. Additionally, the young group was the only group to report that their pediatricians were the first doctors to talk to them about contraception. Overall, the data reveal some areas of consistency across generations, while other areas show signs of change since the Pill's first introduction to mainstream American society in 1960.

92.
ALCOHOL USE IN STUDENT ATHLETES: THE INFLUENCE OF INJUNCTIVE NORMS, TRAIT URGENCY AND COMPETITIVENESS
Annabel Stanley '18
Faculty Sponsor: Laura Holt

Previous research has shown student-athletes are at greater risk for heavy alcohol use and that trait urgency (i.e., acting impulsively in response to negative or positive affect), injunctive norms (i.e., perceived approval from teammates and coaches about alcohol consumption), and drinking motives are associated with substance use. In my study, I aimed to not only replicate these associations with athletes from a small, private Division III institution, but also examined several new questions, including whether captains' approval of drinking predicted athlete drinking and whether the association between drinking motives and actual drinking (and drinking-related

problems) depended on a team's level of competitiveness (i.e., overall winning percentage of the past five seasons). 124 Trinity student athletes were recruited to complete an online questionnaire. I hypothesized that (a) athletes higher in trait urgency would endorse stronger motives to drink and more alcohol use, (b) athletes would perceive greater approval for drinking from teammates and captains compared to coaches, and (c) athletes' sport-related positive reinforcement and sport-related coping motives would be positively related to substance use and higher competitiveness would moderate this effect. The results showed that trait urgency had a direct effect on drinking frequency and an indirect effect on drinking frequency via team cohesion and positive reinforcement. Injunctive norms were highest for teammates and lowest for coaches; ratings for captains fell in between. Finally, results showed an interaction between coping motives and winning percentage and positive reinforcement motives and winning percentage in predicting in season drinking. That is, athletes who were on teams with higher winning percentages and who endorsed higher motives (either coping or positive reinforcement) reported the highest rates of drinking.

93.
SENSORIMOTOR SPEECH CONTROL AND THE INTELLIGIBILITY OF SPEECH
Jessica Thulin '18
Faculty Sponsor: Elizabeth Casserly

This study investigated the role of visual sensory information on speech intelligibility. Previous research has shown that individuals with the numbing agent Orajel on their lip and tongue exhibited impaired speech intelligibility. This impairment worsened in the presence of a mirror. The present study investigated whether this negative effect on intelligibility would occur even under normal (non-Orajel) speaking conditions. Specifically, we examined auditory intelligibility under a baseline condition without a mirror and an experimental condition with the presence of a mirror. Speech was collected under both of these conditions and played back to listeners in a separate auditory discrimination two-alternative forced choice task. In this task, participants were presented with two spoken versions of a word on a computer screen and asked which version was easier to understand. Results showed that participants significantly preferred speech from the no-mirror condition over the mirror condition. Although one might assume that adding visual sensorimotor feedback would make speech easier to understand, the results showed that speech produced without the presence of a mirror was more intelligible. This result is consistent with previous research in that additional sensorimotor feedback, particularly the presence of mirrors, made speech intelligibility worsen. Therefore, the presence of a mirror negatively impacts speech intelligibility even in a normal state.