



**BROWN**

**SUMMER RESEARCH SYMPOSIUM**

**2019**



**Presented by The College**

Sayles Hall  
11 am – 1 pm

Thursday, August 1  
Life Sciences and Humanities

&

Friday, August 2  
Physical and Social Sciences and  
Student Teams

# SUMMER RESEARCH SYMPOSIUM

SAYLES HALL

## THURSDAY, AUGUST 1

LIFE SCIENCES AND HUMANITIES INDIVIDUAL  
PRESENTATIONS

- 11:00 - 11:05    **Welcome**  
Oludurotimi Adetunji, Associate Dean of the College for  
Undergraduate Research and Inclusive Science
- 11:05 - 11:10    **Brief Remarks**  
Jill Pipher, Vice President for Research  
Elisha Benjamin Andrews Professor of Mathematics
- 11:10 - 1:00    **Research Poster Presentations**

## FRIDAY, AUGUST 2

PHYSICAL SCIENCES, SOCIAL SCIENCES, AND TEAM  
PRESENTATIONS

- 11:00-11:05    **Welcome**  
Oludurotimi Adetunji, Associate Dean of the College for  
Undergraduate Research and Inclusive Science
- 11:05 - 11:10    **Brief Remarks, Presentation of Mentor Award**  
Rashid Zia, Dean of the College
- 11:10 - 1:00    **Research Poster Presentations**

Light lunch will be provided both days.

# SYMPOSIUM ORGANIZERS

Oludurotimi Adetunji

Associate Dean of the College for Undergraduate Research and Inclusive Science

Janice Rego

Program Coordinator

Jessica Minker

Symposium Intern

## ACKNOWLEDGEMENTS

Christina Paxson

President

Richard Locke

Provost

Rashid Zia

Dean of the College

Brown University Library Center for Digital Scholarship

## PRESERVING YOUR RESEARCH

Students who opt to upload their posters to the Brown Digital Repository can do so using the self-deposit tool, available at

<https://repository.library.brown.edu/deposits/srs/>

The deadline to upload posters is September 1<sup>st</sup>, 2019.

# ROOM LAYOUT

[STAGE]

A1	B1	C1	D1	E1	F1
A2	B2	C2	D2	E2	F2
A3	B3	C3	D3	E3	F3
A4	B4	C4	D4	E4	F4
A5	B5	C5	D5	E5	F5
A6	B6	C6	D6	E6	F6
A7	B7	C7	D7	E7	F7
A8	B8	C8	D8	E8	F8
A9	B9	C9	D9	E9	F9
A10	B10	C10	D10	E10	F10
A11	B11	C11	D11	E11	F11
A12	B12	C12	D12	E12	F12
A13	B13	C13	D13	E13	F13
A14	B14	C14	D14	E14	F14
A15	B15	C15	D15	E15	F15
A16	B16	C16	D16	E16	F16
A17	B17	C17	D17	E17	F17
A18*	B18*	C18*	D18*	E18*	F18*
A19*	B19*				

[ENTRANCE]

[LOBBY]

\* = Friday only

# THURSDAY, AUGUST 1ST INDEX

A1 Stephanie Adaniya	B15 Eugene Hrabarchuk	D13 Crystal Parry
A2 Caitlin Aguirre	B16 Jonathan Huang	F17 Ratna Patel
A3 Jessica Anderson	B17 Demitri Jackson	D14 Iris Peng
A4 Bethany Arabic	C1 Reed Jaworski	D15 Barbara Pereira Vera
A5 Destiny Arnold	C2 Talon Johnson	D16 Marie Piatski
A6 Fares Awa	C3 Noelle Jung	D17 Alisa Pugacheva
A7 Marie Baker	C4 Roshini Kalagara	E1 Sarah Pugliese
A8 Amalia Bay	C5 Leila Kim	E2 Yael Quiles Ramirez
A9 Gregorio Benitez	C6 Jane Kruskop	F15 Gabriel Rivera
A10 Ismael Bousso	C7 Jenny Lee	E3 Maria Rodriguez
A11 Yael Braverman	C8 Adrian Lee	E4 Priyanka Roy
A12 Jack Briano	C9 So Min (Rachel) Lee	E5 Yasmin Roye
A13 Jasmine Brite	C10 Savannah Lewis	E6 Alyssa Rust
F10 Pablo Caban-Bonet	C11 Ellen Li	E7 Ian Sabula
A14 Hannah Cahill	C12 Troy Li	E8 Lori Sahakian
A15 Agnes Cheng	C13 Grace Li	E9 Destinee Semidey
A16 Kelly Clark	C14 Ian Light	E10 Daniel Shleifer
B1 Zachary Cook	F14 Uriel Lopez-Serrano	E11 Faith Simmonds
F11 Rosa Cordero-Cruz	C15 Kristina Lowndes	F16 Cecilia Slane
B2 Madalyn Critz	C16 Vivian Lu	E12 Tali Sorets
B3 Abigail Cuevas	C17 Hanley Ma	E13 Maxwell Spurrell
B4 Lucas Paulo de Lima Camillo	D1 Sonoor Majid	E14 Cassandra T-Pederson
B5 Emma Diamond	D2 Omar Martinez	E15 Jason Tsai
B6 Rose Domonoske	D3 Claire McEwen	E16 Thomas Usherwood
F12 Gabrielle DoVael	D4 William McNelis	E17 Kensley Villavasso
B7 Allie Elkhadem	D5 Loreilys Mejias-Rivera	F1 Samer Wahood
B8 Noel Getachew	D6 Braxton Morrison	F2 Anthony Walley
B9 Victoria Gillam	D7 Gloria Nashed	F3 Christina Washington
B10 Anuva Goel	D8 Ramses Ngachoko	F4 Hastings Williams
B11 Madison Gowett	D9 Ariel Nieves	F5 Jordan Wise
B12 Annie He	A17 Anna Odell	F6 Derek Xu
F13 Katelynn Hester	D10 Dayshalis Ofray	F7 Xinzhu (Tina) Yang
B13 Will Hinckley	D11 Tessa Palisoc	F8 Zane Yu
B14 Samuel Hinthorn	D12 Wesley Parker	F9 Linda Zhang

# FRIDAY, AUGUST 2 INDEX

A1 Hameed Abdul  
A2 Michelle Adler  
E11 Abdullah Ahmed  
A3 Dana Altoaimi  
A4 Teresa Amor  
F10 Wills Andersen  
E12 David Baek  
F2 Ryan Bain  
F18 Cintia Barbosa DeCastilho  
A5 Charles Bares  
E13 Caitlin Barrett  
E14 Haley Barthel  
E15 Deniz Bayazit  
F7, F8, F9 Livia Belman-Wells  
A6 Shoham Benmelech  
E15 Matthew Berg  
A7 Julia Berkson  
E16 Aliosha Bielenberg  
D16 Ella Brett-Turner  
A8 Solana Buchanan  
A9 Ye Won Byun  
A10 Joseph Cavanagh  
E12 Shi-Yo Chen  
F12 Jay-Young Cho  
A11 Junggho (Daniel) Choi  
D17 Shiloah Coley  
A12 Allie Coonin  
D18 Elizabeth Cruz  
A13 Eashan Das  
F6 Nediya Daskalova  
A14 Evan Dastin-van Rijn  
A15 Ben Davidson  
A16 Wylie De Groff  
E17 Siddhi Deshpande  
F17 Nam Do  
A17 Eric DuBois  
F3 Lexie Ekstrom  
E17 Jenna Ellington  
E18 Kimberlyn Ellis  
F1 Jessica Eskander  
A18, F16 Grace Fan  
E1 Christiana Faucher  
E2 Patricia Fernandez  
E11 James Fife  
A19 Batia Friedman-Shaw  
E3 Daneris Fuentes  
B1 Laila Gamaledin  
E18 David Garcia  
B2 Madelyn Gatchel  
F2 Andrea Gilmore  
B3 Miriam Gordon  
F13 Addie Harrison  
F3 Claire Hawkins  
B4 Elizabeth Healy  
B5 Kimberly Hernandez  
F4 Jacquelin Ho  
F13 Gisela Hoxha  
E4 Galen Hu  
E5 Eric Ingram  
B6 Nola Iwasaki  
B7 Zev Izenberg  
F15 Sebastien Jean-Pierre  
F5 Jessie Jing  
B8 Zach Kapner  
B9 Gee Kim  
B10 Jeong Woo Kim  
B11 Solomon Klein  
F6 Maria Kloiber  
B12 Nishanth Jumar  
B13 Eindra Kyi  
F7, F8, F9 Christian Landis  
B14 Luc Langolis  
B15 Brendan Le  
B16 Bunlong Leang  
F5 Catherine Liao  
F14 Vivian Ling  
B17 Andrea Llamas Sanchez  
B18 Xavier Loinaz  
E6 Kelsie Lopez  
B19 Edwina Lorient  
C1 Jacqueline Luke  
C2 Luke MacHale  
C3 Andrea Malpica  
E15 Rebecca Matthew  
C4 Willie McClinton  
C5 Samantha McGraw  
E7 Emely Medina  
F10 Kameron Medine  
C6 Lisette Melendez  
E13 Gillian Melikain  
F11 Bria Metzger  
C7 Jacob Migneault  
C8 Eric Mischell  
E8 Isabelle Moseley  
C9 Kitty Moy  
F7, F8, F9 Prince Ncube  
C10 Casey Nelson  
C11 Bonnee Nie  
F11 Terren Nunes  
C12 Katie O'Leary  
C13 Carlos Olivares Reboredo  
F14 Emily Papiez  
C14 Andrew Park  
F13 Gil Parnon  
C15 Ben Peebles  
C16 Samantha Pennino  
C17 Zoe Phillips  
F7, F8, F9 Halle Purdom  
E11 Fatemeh Radaei  
F4 Lizmaylin Ramos  
E9 Emily Rehmet  
C18 Jesse Remeis  
D1 Jolie Ren  
D2 Jennifer Riggin  
D3 Elizabeth Rogan  
E15 Ariel Rotter-Aboyoun  
D4 Austen Royer  
F3 Natalie Rugg  
D5 Jorge Ruiz Gonzalez  
F10 John Rush  
F13 Madison Russell  
F11 Violet Sackett  
D6 Esteban Safranchik  
D7 Andrea Salazar  
D8 Jamila Smith  
E16 Charlie Steinman  
D9 Vida Steiro  
D10 Brandon Stubbs  
F12 Stephen Sun  
E10 James Sylvester-Costello  
F11 Paige Torres  
F1 Elaine Tran  
D11 Adam Tropper  
F13 Berke Turkey  
F14 Victoria Vafae  
D12 Malik Walker  
F7, F8, F9 Axel Weber  
D13 Sophie Weiss  
D14 Angela White  
F16 Corinne Williams  
F17 Julia Windham  
F18 Yiheng Xie  
E14 Alexander Zhao  
D15 Holly Zheng

# SUMMER RESEARCH SYMPOSIUM POSTERS

Thursday, August 1

Life Sciences and Humanities Individual Presentations

## LIFE SCIENCES INDIVIDUAL PRESENTATIONS

Stephanie Adaniya

Poster: A1

Home Institution: Brown University

Summer Research Program: Research Assistant

Faculty Mentor: Phyllis Dennery (Department of Cell Biology, Molecular Biology and Biochemistry)

### **Role of Heme Oxygenases on Pulmonary Expression of Circadian Genes**

Heme oxygenase (HO), the rate-limiting enzyme in heme degradation, has an inducible isoform (HO-1), which is induced in response to oxidative stress, as well as a constitutive isoform (HO-2). Our previous in vitro studies have shown that HO-1 knockout (KO) cells and HO-2 knockdown cells each display significant changes in various cellular activities, such as expression and periodicity of circadian genes, respectively. Here, we present the in vivo complement to previous in vitro HO KO data and discuss the role of the isoforms of HO on the expression of circadian genes in the lung and their implications for understanding the pulmonary response to oxidative stress.

Caitlin Aguirre

Poster: A2

Home Institution: Wellesley College

Summer Research Program: Undergraduate Research- Delaney Lab (Chemistry dept.)

Faculty Mentor: Sarah Delaney (Chemistry)

### **Effects of the Spiroiminodihydantoin (Sp) Lesion on DNA Translational Positioning in Nucleosomes and NEIL1 Glycosylase Efficiency**

Approximately 3 billion base pairs of Deoxyribonucleic Acid (DNA) make up the human genome encoding the genes that make us who we are. DNA is compacted ~7-fold and strategically organized into chromosomes. The most fundamental unit of chromosomal compaction, Nucleosome Core Particles (NCPs), are made up of 146 base pairs of DNA wrapped twice around histone octamer proteins. DNA is vulnerable to oxidative stress by exogenous and endogenous agents which may potentially cause permanent mutations, cancer, cellular aging or apoptosis. The Delaney and Núñez Labs are most interested in investigating how the Spiroiminodihydantoin (Sp) lesion, a mutation caused by DNA oxidation, affects the translational positioning of double stranded DNA around a histone octamer and the efficiency of mammalian glycosylase, NEIL1, to remove the Sp lesion from NCPs. This investigation utilized hydroxyl radical footprinting to evaluate the translational position of DNA around histone proteins as well as glycosylase time course assays.

Jessica Anderson

Poster: A3

Home Institution: Xavier University of Louisiana

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Thomas Bartnikas (Department of Pathology and Laboratory Medicine )

### **How Metal Transporters Contribute to Levels of Manganese in the Body**

Manganese is essential to human metabolism; however, excess can be toxic. Metal transporters Slc39a14 and Slc30a10 are present in hepatocytes and enterocytes, key functional cells in the liver and small intestine. Slc39a14 brings manganese into cells. Slc30a10 excretes manganese into bile and small intestine for excretion. The purpose of this study is to determine the role of Slc30a10 and Slc39a14 transporters in manganese homeostasis. Tissues collected from wild type, single gene knock out, and double gene knock out mice were analyzed via inductively coupled plasma atomic emission spectroscopy to determine metal concentrations. Results show decreased liver manganese concentrations in double knockout mice. More tissues and blood will be analyzed in the future.

Bethany Arabic

Poster: A4

Home Institution: Simmons University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Robbert Creton (Department of Molecular Biology, Cell Biology and Biochemistry), Sara Tucker (Department of Molecular Biology, Cell Biology and Biochemistry)

### **Novel Assays to Test Treatments for Visual Disorders**

According to the World Health Organization, approximately 1.3 billion people live with some form of visual impairment. As a result, new treatments for visual disorders are needed. Before these potential treatments become available, they must be tested on model organisms, like zebrafish (*Danio rerio*). This study presents novel assays, which capture the visually-guided behavior of zebrafish larvae, in response to both visual and acoustic stimuli. The assay was utilized to determine if vision loss in zebrafish larvae was achieved after exposure to UV and visible light. In the future, this assay could be used to test treatments for visual disorders.

Destiny Arnold

Poster: A5

Home Institution: Rhode Island College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Chun-Shiang Chung (Department of Surgical Research), Alfred Ayala (Department of Surgical Research)

### **Contribution of SHP-1 Signaling to Sepsis-Induced Changes in Macrophage Function**

Sepsis, an overreactive immune response to infection, remains the leading cause of death in critically ill patients. Programmed cell death-1 (PD-1), checkpoint protein, and PD-1 ligand-1 (PD-L1), gene knockout has reduced inflammatory response in septic mice, implicating a role for PD-1 and potentially it's signaling through SHP-1 activation. We hypothesize that inhibiting SHP-1 with



known antagonist TPI-1 will reduce inflammation. Murine macrophage cells were pre-treated with TPI-1 then stimulated with lipopolysaccharide (LPS) and cultured for 6, 12, and 24-hour increments. Cells and culture-supernatants were collected for cytokine determinations using ELISA and SHP-1 phosphorylation levels assessment using Western Blots. There was significantly less SHP-1 activation and cytokine production in cells pre-treated with TPI-1, implicating TPI-1 as a possible treatment for sepsis.

Fares Awa

Poster: A6

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Barbara Stonestreet (Pediatrics - Women & Infant's)

**Exposure to endotoxin reduces cerebral cortical vessel density in preterm fetal sheep**

Perinatal brain injury can result in a wide array of neurodevelopmental impairments and sometimes fetal death. Oftentimes, this brain injury is caused by an exposure to inflammation, which, confounded with prematurity, can leave the fetal brain vulnerable to damage. One component to proper fetal development is the maturation of a healthy neurovasculature. However, inflammatory stressors can interfere with this development and cause brain injury. In our study, we observed the adaptation of the neurovasculature following chronic inflammation in preterm ovine brain.

Inflammation was caused by continuous low-dose LPS infusions. Following five days of LPS exposure, we used immunohistochemistry to evaluate vessel density, astrogliosis, astrocyte coverage around the blood vessels, pericyte coverage and pro-inflammatory marker expression, specifically IL6 and IL1beta, in the cerebral cortex and white matter.

Marie Baker

Poster: A7

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Sean Monaghan (Division of Surgical Research)

**The Impact of U1-70K Isoform Changes in Endothelial Cell Barrier Dysfunction in Acute Respiratory Distress Syndrome**

Novel isoforms of U1-70K, a protein in the U1 complex of the spliceosome, have been identified due to alternative RNA splicing in animal models of acute respiratory distress syndrome (ARDS). We hypothesize that these novel isoforms alter the splicing of endothelial barrier proteins (PECAM-1, VE-Cadherin, and VEGF-alpha), resulting in endothelial barrier dysfunction. Our aim is to determine if hypoxic and/or acidotic conditions, like those present in ARDS, cause cultured lung endothelial cells to elevate expression of the U1-70K isoform using western blot analysis, and subsequently assess the degree of barrier dysfunction via ECIS (Electric Cell-substrate Impedance Testing). If an isoform of U1-70K causes the barrier dysfunction, this could be a target for intervention or a marker of disease severity.

Home Institution: Brown University

Summer Research Program: Summer Research Assistantship in Biomedical Sciences

Faculty Mentor: Dr. Chung-Kuei Huang (Liver Research Center, RI Hospital and Warren Alpert Medical School of Brown University)

### **The Combinational Therapy of Targeting Aspartate Beta-Hydroxylase and Cisplatin in Cholangiocarcinoma**

Cholangiocarcinoma is a serious disease that doesn't have sufficient effective therapies. CCA patients are resistant to chemotherapies that are normally used for other malignant tumors. Preliminary data conducted by Dr. Huang and his lab has identified that 2-oxoglutarate (2-OG) and a 2-OG dependent enzyme, aspartate beta-hydroxylase (ASPH) are involved in chemoresistance. This project proposes to analyze whether targeting ASPH in addition to chemotherapy treatments can conceivably eliminate CCA tumors

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Eleftherios Mylonakis (Infectious Disease Division), Fanti Sechante (Infectious Disease Division)

### **Identifying CDI 90-day Readmission Risk Factors: A Rhode Island Database Study**

*Clostridioides difficile* (C. diff) is the top hospital acquired pathogen in the nation with tremendous burden on both patients and the healthcare system. C. diff infection (CDI) was considered to be a sole healthcare facility onset (HO) infection but the changing epidemiology of C. diff has further categorized the infection into that of community onset (CO) and community-onset healthcare facility associated (CO-HCFA). With general readmission to inpatient settings a national concern, there is an incentive to lower rates of readmission with CDI. Utilizing data from the largest healthcare database in Rhode Island, this study will look to pinpoint factors associated with elevated risk of 90-day readmission with CDI following discharge with either CO, CO-HCFA, or HO.

Home Institution: Morgan State University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Wafik El-Deiry (Department of Pathology and Laboratory Science)

### **Mechanism Of Sensitization of Pancreatic Cancer Cells to ONC201 and TRAIL Cell Death Targeting Therapeutics**

Pancreatic cancer has a patient survival rate below 10%. Recent research explored a novel treatment in pancreatic cancer that induces TNF-related apoptosis-inducing ligand using ONC201. Recent unpublished work supports efficacy of combination of ONC201 with TRAIL or TRAIL receptor agonists. Endogenous TRAIL protein has a short half-life in vivo. TLY012 is a PEGylated form of

TRAIL that has a 48-hour half-life. We are assessing the efficacy of the combination treatment of ONC201 and RhTRAIL or TLY012 using pancreatic cancer cell lines. In studies conducted in the lab, ONC201 plus other forms of TRAIL showed cell death of pancreatic cancer cells. In my rotation I reproduced testing it through multiple cell lines. The study is significant due to potential for translation.

Yael Braverman

Poster: A11

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: David Badre (CLPS), Apoorva Bhandari (CLPS)

### **Characterizing the reliability of pattern-analysis based estimates of representational geometry and dimensionality**

An open question in cognitive neuroscience concerns the geometry of prefrontal cortex (PFC) representations. The responses of a brain region to different stimuli may be described as points in a multi-dimensional space defined by axes reflecting the activity of individual neurons in that region. The geometry of these points shapes how downstream brain regions may use the representation. In humans, multi-voxel pattern analysis is the primary method for studying representational geometry. We systematically and comprehensively characterize the reliability of multi-voxel-patterns, and pattern-based estimates of representational geometry (distances in multi-dimensional space) across the whole brain. We trained participants to efficiently perform a task based on the parity problem, which requires a high-dimensional representation, while imaging their brain with fMRI. From this data, we computed the split-half reliability of multi-voxel patterns, estimates of representational geometry, and estimates of dimensionality. Our results provide an evaluation of pattern-based methods for studying representational geometry.

Jack Briano

Poster: A12

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Eric Morrow (MCB)

### **Determining the Haploinsufficiency of ACC1 in Mouse Brain Tissue**

17q12 deletion syndrome is a rare genetic disorder present in approximately 1% of individuals with autism that were tested for the syndrome, caused by a heterozygous deletion containing 15 genes. In humans, 17q12 deletion syndrome has widespread physical and cognitive effects. These include an enlarged cranium, metabolic issues, diabetes, renal cysts, intellectual and learning disabilities, mood disorders, schizophrenia, and autism. One of the 15 genes deleted is Acetyl-CoA carboxylase 1 (ACC1), which is necessary for de novo fatty acid synthesis. It has been previously shown that heterozygous deletion of ACC1 has no significant effect on ACC1 expression in hepatic or renal tissue, and the purpose of this study was to determine if this also holds true for the brain.

Jasmine Brite

Poster: A13

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Craig Lefort (Division of Surgical Research)

**Real Time Visualization of Protein-Protein Interactions during Neutrophil Adhesion**

Neutrophils go from rolling along to adhering to the blood vessel wall during recruitment to a site of infection or injury. The goal of this project is to visualize the interaction between neutrophils and the inflamed blood vessel wall. Plasmid vectors and CRISPR were used to fluorescently label integrins known to be important such as CD11b, CD11a and CD18. Neutrophils are introduced into a protein-primed microfluidic system to mimic natural neutrophil movement within the vasculature. The next step is to use FLIM/FRET microscopy, which allows for the imaging of integrin clustering to see the mechanism of integrin interaction during blood vessel wall adhesion. Using these instruments, we can determine which integrins are essential for neutrophil recruitment.

Hannah Cahill

Poster: A14

Home Institution: University of Virginia

Summer Research Program: Research Assistant for Hart Lab

Faculty Mentors: Anne Hart (Neuroscience), Mathieu Bartoletti (Neuroscience)

**A Genetic Screen for Suppression of Neurodegeneration Induced by GGGGCC Repeat Expansions in a C. elegans ALS model**

Amyotrophic lateral sclerosis (ALS) is characterized by the progressive degeneration of motor neurons, resulting in chronic muscular atrophy and death. In 25-40% of familial ALS cases, an inappropriate nucleotide expansion in the C9ORF72 gene was found in patients. Unbiased genetic screens are powerful tools to identify additional genes that affect neurodegeneration. We used a C. elegans model that expresses the nucleotide expansion and causes neurodegeneration. Decreased degeneration in the sensory neurons of C. elegans may help identify possible suppressor genes and yield insight into biological processes that protect against neuronal death in humans. A better understanding of the mechanisms behind ALS is crucial for the development of therapeutics.

Agnes Cheng

Poster: A15

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Judith Bender (Department of Molecular Biology, Cell Biology & Biochemistry)

**Determinants of histone H3 lysine 9 methyltransferase chromatin targeting in Arabidopsis**

In Arabidopsis thaliana transcriptional silencing involves a positive loop between histone H3K9 methylation and CMT DNA methyltransferase, but it's unknown how the methyltransferases initially locate targets. The Bender laboratory previously determined that SUVH4 is the dominant and general actor, with supporting SUVH5 and SUVH6 having activity at distinct hotspots. This project explores what controls targeting preferences using a domain swap approach. SUVH proteins have conserved methyltransferase domains and DNA binding domains, and an unconserved region with a disordered structure. By swapping the unconserved regions between SUVH5 and SUVH6, this

project tests whether that unconserved, disordered region determines unique target preferences between enzymes that are otherwise similar. This will give insight into the specificity and diversity of SUVHs.

Kelly Clark

Poster: A16

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Nicola Neretti (MCB)

**Understanding how TGF-beta and HMGA1 regulate the inflammatory profile of senescent cells.**

Cellular senescence (CS) is a state of irreversible cell cycle arrest that exacerbates aging through the secretion of proteins that regulate inflammation, called the Senescence Associated Secretory Phenotype (SASP). My project investigates regulation of SASP by analyzing gene expression variability within populations of senescent cells. By analyzing single cell RNA-sequencing data, I have found a strong anticorrelation between TGF-beta signaling and HMGA1 expression among senescent cell populations, where TGF-beta signaling promotes an anti-inflammatory profile, while HMGA1 is associated with a pro-inflammatory phenotype. Moreover, I have found through analysis of publicly available ChIP-seq data that HMGA1 binds near genomic regions containing clusters of interferon and interleukin genes, which encode for pro-inflammatory cytokines, suggesting relevance for HMGA1 in the regulation of SASP.

Anna Odell

Poster: A17

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: James Kellner (Ecology and Evolutionary Biology)

**Large-Scale Tracking of the Velocity of Vegetation Movement Across Elevational and Latitudinal Gradients**

Climate change and its consequences on the world's biomes have become an increasing concern in the 21st century. Vegetational responses to climate change are poorly understood, with the rate of movement and whether it's keeping track with temperature change being largely unknown. Here we use the high resolution Landsat satellite record to track the migration of the "green line" -- the line that characterizes the transition from vegetated to unvegetated areas based on the Normalized Difference of Vegetation Index (NDVI) data -- worldwide from 1985 to 2018, focusing on migration of vegetation up mountain ranges and toward higher latitudes. We show that the position of the green line has changed across gradients of altitude and latitude over the previous three decades.

Zachary Cook

Poster: B1

Home Institution: Brown University

Summer Research Program: I am Donald A. King Fellow awarded by the Huntington's Disease

Society of America. I also am employed by the Tatar labs where I conduct my research.

Faculty Mentor: Marc Tatar (Ecology and Evolutionary Biology)

### **Exploring Lead Compound Viability of Experimental Drug FTBMT and the Interactions of the Steroid Hormone Aldosterone in a Huntington's Disease Model**

The aim of this study is to investigate whether the compound FTBMT, an agonist of human GPR52, has biological activity in *Drosophila* expressing the Huntington's phenotype. Huntington's disease modeled in *Drosophila* can be suppressed by genetically reducing DopEcR, a homolog of GPR52. Here, I aim to show DopEcR can be modulated by FTBMT and thereby ameliorate Huntington's pathology in the fly. Additionally, I aim to explore whether Aldosterone, a steroid hormone associated with fibrosis and mediated by DopEcR, agonizes the expression of the Huntington's phenotype in *Drosophila*. Positive results will advance the potential to pharmacologically target human GPR52 as a treatment for Huntington's disease and will further our understanding of Huntington's Disease pathology and the pathways mediating its phenotypic expression.

Madalyn Critz

Poster: B2

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Kevin Bath (Neuroscience)

### **The Effects of Early Life Stress in a Mouse Model of Eating Disorder**

I am using a mouse model to show the effects of Early Life Stress on eating behaviors in adulthood. Subjecting very young mice to certain forms of chronic stress has been shown to raise depressive and anxious behaviors in those mice during adulthood. I will be using Kevin Bath's mouse model of ELS to compare stressed mice to control mice through cycles of food restriction and high-fat refeeding. This experiment is meant to model anorexic and binge-type eating disorders. I am hypothesizing that ELS mice will be more susceptible to these behavioral disorders than controls.

Abigail Cuevas

Poster: B3

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Sunil Shaw (Pediatrics), Joseph Bliss (Pediatrics)

### **Adhesion-associated genes in *Candida parapsilosis***

*Candida parapsilosis* is a pathogen that is emerging as a significant cause of systemic infections in vulnerable populations such as premature infants. My mentor's lab has previously shown that *C. parapsilosis* can transition between non-adhesive and adhesive states depending on growth conditions and that adhesion is mediated by the fungal protein, Als7. My project uses quantitative PCR to test for association of candidate genes with the adhesive phenotype. Here we provide evidence suggesting that some highly adhesive strains use alternative adhesion pathways, independent of Als7. We also show that the transglycosylase Phr1 is strongly associated with adhesion, and hypothesize that it may play a key role in modifying the surface glycome of yeast to

enable strong adhesion.

Lucas Paulo de Lima Camillo

Poster: B4

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Stephen Helfand (MCB)

**Hsp90 suppresses transposition in *Drosophila melanogaster***

Transposable elements (TEs) are mobile genetic elements that disrupt proper genetic function leading to age-related disorders. We investigated the role of the chaperone, heat-shock protein 90 (hsp90) in transposition using adult *Drosophila melanogaster*. Activation of early transposition in the fat body was measured with a gypsy-TRAP reporter system in two different hsp90 hypomorph mutants. Measurement of TE expression was performed using fluorescence microscopy and RT-PCR. Both assays showed increased levels of transposition at an early age. We also observed dose-dependent increase in TE expression in flies treated with geldanamycin, an hsp90 inhibitor. In conclusion, the evidence presented suggests that hsp90 plays a role in suppressing transposition in *Drosophila*.

Emma Diamond

Poster: B5

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Peter Belenky (Molecular Microbiology and Immunology)

**Fiber as a Prebiotic: Host Physiology and *Candida albicans* Colonization in Response to Diet and Antibiotics**

*Candida albicans* is a common gut commensal, but under dysbiotic conditions such as low fiber intake or antibiotic use, it can act as an opportunistic fungal pathogen. We are interested in how the gut microbiome affects *Candida* colonization. In colonization-susceptible mice, we see a bloom of muciniphilic gut bacteria and a concomitant destruction of the gut mucosal lining. We hypothesize that fiber can reduce *Candida* colonization by blocking the destruction of the mucus, thereby promoting barrier function. After examining host gut physiology and gut barrier gene expression under different dietary conditions, we observe that fiber can reduce *Candida* colonization in the gut. This data has clinical implications for diet as a preventative measure against gut dysbiosis and subsequent illness.

Rose Domonoske

Poster: B6

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Barbara Stonestreet (Pediatrics)

**Western Blot Analysis for the Mechanism of IAIP Treatment of Hypoxic Ischemia**

In previous studies, the treatment of hypoxic ischemic rats with inter-alpha inhibitor proteins

showed improvement in brain damage, but the mechanism of the treatment is largely unknown. By analyzing the neural micro vessels of rats, both treated and untreated, we can see how the blood brain barrier is affected. Specifically, I am examining the levels of Claudin and Zed occludin using Western Blot analysis.

Allie Elkhadem

Poster: B7

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Mary Carskadon (CLPS)

### **Attentional Bias to Food Cues in Healthy Weight, Overweight, and Obese Adolescents**

Despite the attention obesity receives in the news as a public health concern, there is still much unknown about the cause and effects of obesity. One factor that may be involved is known as attentional bias, the idea that an individual is more likely to pay attention to one thing in comparison to others, and we tested this through a modified Stroop task. Fifty adolescents completed the task in a ten day forced desynchrony protocol. This project aims to further probe whether there are differences in attentional bias to food cues between weight groups. Similarly, we investigated sex difference and if there is a difference in reaction time depending on the type of food (sweet/salty, savory, fruits/vegetables).

Noel Getachew

Poster: B8

Home Institution: University of Maryland, Baltimore County

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Gaurav Choudhary (Vascular Research Laboratory)

### **Characterizing Pulmonary Vessels In Preclinical Models Of Pulmonary Arterial Hypertension**

Pulmonary Arterial Hypertension (PAH) is defined as elevated blood pressure in the lungs associated with vascular remodeling and occlusive plexiform lesions in the distal pulmonary arterioles. Increased resistance to the blood flow as a result of vascular remodeling in the lungs of PAH individuals ultimately results in the right ventricle to fail, leading to morbidity and mortality associated with PAH. It is essential to have in vitro and preclinical models of this disease to understand the mechanisms underlying vascular remodeling to develop new treatments. The overall goal of this project is to (a) characterize primary endothelial cells isolated from rat lungs and (b) the vascular remodeling in the lungs of animals with PAH compared to controls. Using immunofluorescence staining, I am determining the purity of isolated endothelial cells by confirming that the cells are positive for endothelial cells markers. I am also performing blinded, morphological analyses of pulmonary vasculature on lung sections from controls vs. PAH rats to assess for vascular remodeling associated with PAH. These experiments will lay the foundation for using these models to perform mechanistic studies in the future.



Victoria Gillam

Poster: B9

Home Institution: Howard University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Richard Clements (Cardiology)

**Analyzing fission and fusion signaling changes after cardioplegic arrest**

Cardioplegia solutions (CP) are used to arrest and protect the heart during cardiac using cardiopulmonary bypass (CP) which provides time for surgeons to repair blocked coronary blood vessels or cardiac valves. Although highly cardioprotective during ischemic insults, cardioplegia solutions are not optimal and ischemic insults can result in depressed cardiac function following surgery. Our lab has found that addition of activators of Ca<sup>2+</sup>-activated K<sup>+</sup> channel (BKCa) to standard CP solutions greatly improves myocardial recovery after CP/CPB. BKCa channels cause a large flow of K<sup>+</sup> into mitochondria when opened and may line the inner-membrane of the mitochondria within the heart. Drugs NS19504 and Rottlerin are prominent activators of BKCa channels, In cells subjected to hypoxic CP/R mitochondria fractionate into smaller mitochondria, but NS19504 or rottlerin treatment during fractionation cause mitochondria to retain their morphology. In this study we tested if CP/R +/- BKCa activation caused any changes in biochemical pathways associated with mitochondrial fission and fusion. Pathways assessed by western blot included the mitochondrial fusion regulator OPA1, and the fission associated proteins MFF and DRP1.

Anuva Goel

Poster: B10

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Suzanne De La Monte (Pathology and Laboratory Medicine, Neurosurgery)

**Characterization of Agent Orange Neural Toxicity**

Agent Orange is a potent herbicide that was widely used during the Vietnam War for defoliant purposes. Following the war, there have been numerous studies concerning the association between exposure to Agent Orange and increased risk of cancers, birth defects, diabetes, and peripheral neuropathies, among other conditions. However, little is known about the exact mechanism by which the two compounds in Agent Orange - 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) - cause these physiological effects. The goal of this project is to understand the mechanism of these two compounds through the use of in vitro experiments on human neuronal cell cultures and brain tissue slices. Furthermore, the project aims to gather data on the clinical features of Agent Orange-associated peripheral neuropathies manifested in veterans to further shed light on the toxin's mechanism.

Madison Gowett

Poster: B11

Home Institution: Binghamton University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Peter Belenky (Molecular Microbiology and Immunology)

### **The Impacts of Antibiotics and Dietary Fiber on the Commensal Gut Microbes**

#### ***Akkermansia muciniphila* and *Candida albicans***

Commensal gut microbes, like the bacterium *Akkermansia muciniphila* and yeast *Candida albicans*, can be impacted by antibiotics and diet. During antibiotic stress *A. muciniphila* abundance spikes, increasing host susceptibility to *C. albicans* infection in the gut, which can spread to other organs. Our previous data shows low fiber diets or antibiotic treatment increases *A. muciniphila* abundance, promoting *C. albicans* colonization. We hypothesize that dietary fibers increase *A. muciniphila* susceptibility to antibiotics, decreasing the amount of *A. muciniphila* in the gut during antibiotic treatment. We determined how various fibers impact *A. muciniphila* susceptibility to antibiotics. Future works will identify what dietary fibers can be used to prevent *A. muciniphila* blooms in the gut during antibiotic treatment to decrease *C. albicans* colonization.

Annie He

Poster: B12

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Wael Asaad (Department of Neurosurgery)

### **Investigating the role of the orbitofrontal cortex (OFC) in model-based vs. model-free learning**

Obsessive-compulsive disorder (OCD) individuals have a hyperactive OFC, a brain area involved in higher-level processing of decision making. A capsulotomy procedure is performed to lessen OCD symptoms, allowing patients to engage in daily activities. The purpose of this study is to learn about the role of the OFC in learning. We are testing the hypothesis that the OFC facilitates model-based learning more than model-free learning. Before and after an ablative procedure to the internal capsule, patients perform a computer task, maneuvering to a target within a virtual gridspace. Preliminary results show that patients undergoing the surgery experienced increased difficulty with model-based learning as compared to model-free learning when tested post-operation vs. pre-operation. Ongoing data collection seeks to support the hypothesis.

Will Hinckley

Poster: B13

Home Institution: CSULB

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Alison DeLong (MCB)

### **Elucidating the Role that PP2A-B Subunits Play in Regulating Leaf Size in *Arabidopsis thaliana*.**

Understanding plant signaling is becoming increasingly important in the face of climate change. The ability to genetically control crop size will require knowledge of existing signaling mechanisms. The DeLong lab previously used CRISPR to isolate an *Arabidopsis thaliana* PP2A-b72 subunit triple mutant (b13-2/b16/b17) that has larger leaves than Wild-type plants. Collaborators noted that the triple mutant overproduces the hormone ethylene. These are contradicting phenotypes, as ethylene inhibits cell expansion and plant growth. We hypothesize that the triple mutant is ethylene insensitive. We will analyze dark-induced leaf senescence, an ethylene-triggered phenotype, in the triple mutant. A delayed senescence phenotype would support the hypothesis that the triple mutant is ethylene insensitive, and indicate PP2A plays a role in regulating leaf size.

Samuel Hinthorn

Poster: B14

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Sorin Istrail (Computer Science)

### **Finding Pearls in the Literature Ocean: Cis-Lexicon Ontology Search Engine for Gene Regulatory Networks of the Regulatory Genome**

Cis-regulatory-modules are the “computational unit” of the gene regulatory network. CRMs are where transcription factors bind and activate the production of more transcription factors or other proteins. CRMs can be hard to find. Machine learning techniques have been used to predict their location in the genome, and there are databases available that catalogue these predicted CRMs, however these methods have only been able to achieve about a 50% accuracy when translating to actual functionality, which makes the data almost useless for accurately characterizing CRMs.

For CRMs that have been verified by the experimental techniques specified by the Davidson Criteria, however, we can be certain of their function in the genome.

Biology papers are freeform, and the same term can be “promiscuous” and have different uses depending on context, which makes teaching a computer to recognize whether a given paper uses a specific experimental technique to identify a CRM an incredibly difficult task. General purpose machine learning techniques such as naive Bayes, support vector machines, and basic neural networks all failed to identify a satisfactory number of the known cis-Regulatory papers and identified far too many false positives to be worth an annotator’s time.

Eugene Hrabarchuk

Poster: B15

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Dr. Kevin Bath (CLPS)

### **The Effects of Exposure to Early Life Adversity and Maternal Kicking on Neural and Behavioral Development**

Early life adversity (ELA) is associated with increased lifetime risk for neuropsychiatric disorders

believed to be the result of an altered trajectory of brain development. Understanding the impact of ELA on neural and behavioral development could elucidate the effects of increased risk and identify possible mechanisms.

We modeled ELA in mice by restricting maternal resources which alters maternal stress load and quality of care for developing pups. We identified a subset of moms that engaged in a kicking phenotype resembling abusive-like behavior. Pups reared under control conditions, limited resources, and limited resources with kicking were analyzed. Our results indicate exposure to restricted resources and kicking altered risk-related neural and behavioral outcomes. Expression of neurotransmitter receptors may underlie these observed changes.

Jonathan Huang

Poster: B16

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Gilad Barnea (Neuroscience)

### **Genetic Targeting of Precise Intersectional Neuronal Populations Using trans-Tango**

trans-Tango is a synthetic ligand-receptor system for transsynaptic neural circuit tracing and manipulation in *Drosophila*. The ligand is expressed at presynaptic terminal membranes within a predefined neuronal population, causing activation of the receptor, expressed panneuronally, in postsynaptic neurons. Receptor activation prompts transcription of a reporter gene. Here we describe a method of designing this reporter gene for intersectional targeting of subsets of neurons within the postsynaptic population, using the Flp-FRT recombinase system. Flp-dependent recombination of the reporter gene allows for differential reporter expression in postsynaptic neurons. This provides genetic access to precisely defined neuronal populations, enabling novel behavioral experiments and investigation of individual neuronal characteristics using techniques such as optogenetics and calcium imaging.

Demitri Jackson

Poster: B17

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Lundy Braun (Africana Studies and Pathology)

### **Interconnection of Homelessness, Prisons and Health**

This research poster is a progress check-in of my internship with Rhode Island Hospital's Center for Primary Care as well as my supplemental work that has gone along with it. This supplemental work includes weekly homeless outreach, SOAR (SSI/SSDI Outreach, Access, and Recovery) training/certification, and the bulk of my internship; administering surveys to the patients at the Center for Primary care. On this poster you will see my personal reflections, methods, difficulties, and the ways that all the aspects of my summer internship intersect. I may not be done with all of my research by the time this poster session takes place, however I plan to continue this research and study into a Independent Study in the fall.

Reed Jaworski

Poster: C1

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Jun Feng (Cardiothoracic Surgery Research Lab)

**The Protective Effects of NOX Inhibition on Human Coronary Artery Endothelial Cells under going Cardiothoracic Surgery**

We have found that over activity of ROS leads to overproduction of superoxide, which results in several different forms of vascular diseases, e.g. atherosclerosis. This extra activity has been found to be present in patients with diabetes, giving way to the worse vascular health of diabetic patients. Therefore, when open heart surgery is required, it can be noted that diabetic patients have much worse outcomes than non-diabetic patients, especially when cardioplegic arrest and cardiopulmonary are considered. We believe that inhibition of a specific group of ROS, the Nox homologues, could lead to better outcomes following myocardial ischemia and cardiovascular surgery.

Talon Johnson

Poster: C2

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Gerard Nau (Division of Infectious Diseases)

**Investigating NFkB Inactivity due to Francisella tularensis**

Francisella tularensis is a gram-negative bacteria which infects macrophages. The organism is able to evade the host's immune response in part by the inhibition of the transcription factor NFkB. GdcA is a protein released by Francisella which is proposed to target a step in the NFkB activation pathway. In order to identify possible anti-virulence drug targets, a proximity-based fusion protein assay was used to flag GdcA substrates.

Noelle Jung

Poster: C3

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Monica Garcia-Solache (Medicine)

**Analysis of Fitness Costs Associated with Ampicillin Resistance in Enterococcus Faecalis**

Despite broad clinical use of ampicillin to treat enterococcal infections, Enterococcus faecalis has remained mostly susceptible to this antibiotic. In the resistant isolates, the main mechanism to acquire resistance is to over-express or mutate PBP4, an important cell wall building protein. This project studied the fitness costs associated with ampicillin resistance in the E. faecalis. We hypothesized that development of ampicillin resistance reduces bacterial fitness due to less efficient cell wall synthesis. The methods employed are: 1) Incremental exposure to ampicillin of E. faecalis JH2-2 with susceptible PBP4 to select for ampicillin resistance, 2) Bacterial fitness testing by measuring and comparing growth rates and survival under conditions of starvation and desiccation.

Growth rate was determined with an Epoch2 instrument. Plating serial dilutions of the growth curve cultures and colony counting determined bacterial survival. Conducting growth curve experiments on JH2-2 and LS4828 (resistant PBP4) lend a result that JH2-2 has stronger growth than LS4828. JH2-2 took 6.5 hours to reach steady growth phase while LS4828 took 8 hours. The CFU counts of JH2-2 were larger by a factor of 10 during the steady phase as well.

Roshini Kalagara

Poster: C4

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Michael Reznik (Neurology)

**Elevated admission troponin predicts unfavorable outcomes after intracerebral hemorrhage in patients with atrial fibrillation**

Intracerebral hemorrhage (ICH) often carries cardiac implications, and serum troponin has been suggested as a biomarker for patients with ICH and other stroke subtypes. We aimed to determine associations between troponin and outcomes specifically in ICH patients with atrial fibrillation (AF). We performed a single-center retrospective cohort study comparing ICH patients with normal or elevated ( $>0.05\text{ng/mL}$ ) admission troponins, then used multivariable regression to determine associations with 3-month outcome. Of 311 ICH patients, 55 (18%) had elevated troponins. We found that patients with both AF and elevated troponins had significantly worse outcomes (OR 6.0, 95% CI 1.6-22.9), an association that was not present with either factor alone. Troponin may therefore represent an especially useful biomarker in ICH patients with underlying AF.

Leila Kim

Poster: C5

Home Institution: Brown University

Summer Research Program: Brown Department of Ecology & Evolutionary Biology Undergraduate Research

Faculty Mentors: Elizabeth Brainerd (Ecology & Evolutionary Biology), John Capano (Ecology & Evolutionary Biology)

**Shoulder girdle rotation in sea turtle ventilation and locomotion**

A turtle's shell is a fused ribcage that contains the shoulders and pelvic girdles within it. Semiaquatic turtles rotate these girdles to locomote and can breathe while moving. Sea turtles, however, cannot breathe and swim simultaneously and it is unclear how their pectoral girdles are used to swim. In this study XROMM, a 3D x-ray technology, was used to look inside the shell and compare pectoral girdle motions of loggerhead sea turtles to a semiaquatic river cooters. We observed that sea turtles hold their girdle relatively still during locomotion, and, unexpectedly, rotate it during ventilation. Our data suggest that sea turtle evolution changed how they use their pectoral girdle and may explain their conflict between ventilation and locomotion.

Jane Kruskop

Poster: C6

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Anne Hart (Neuroscience)

**Testing a candidate suppressor gene in a model of spinal muscular atrophy in *C. elegans***

Spinal muscular atrophy (SMA) is a neuromuscular disorder and the leading genetic cause of death in children. Amyotrophic lateral sclerosis (ALS) is an adult-onset neuromuscular disorder that affects some of the same neurons as SMA. Identification of genetic similarities between different neurodegenerative diseases can provide insight into the underlying mechanisms of neurodegeneration.

Our lab has identified suppressor genes, whose loss ameliorate defects in ALS models. I am examining if the loss of an identified suppressor gene impacts defects in an established *Caenorhabditis elegans* SMA model, using survival and motor neuron synaptic function assays. Testing a suppressor gene's ability to ameliorate defects in similar neurodegenerative disorders can help improve our understanding of ALS, SMA and neurodegeneration.

Jenny Lee

Poster: C7

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Judy Liu (Department of Molecular Biology, Cell Biology, and Biochemistry)

**Analyzing Synaptic Vesicle Trafficking Regulated by *Dclk1***

Dr. Liu's lab conducts research on the causes of epilepsy-- a condition causing multiple unprovoked seizures, which occur when many neurons are excited simultaneously. Synaptic vesicle trafficking affects the firing of action potentials, so when the cytoskeleton is dysregulated, improper action potential activation can occur. My summer project is primarily based on Dr. Liu's 2012 paper, where she found that *Dcx* and *Dclk1* regulate kinesin motor protein, *Kif1a*, and cause defects in microtubule transport when knocked out. For my summer project, I looked into whether *Dclk1* itself regulates synaptic vesicle trafficking. After transfection with the appropriate plasmids and via live cell imaging, I observed and measured quantitative values, such as distance and velocity. These values were statistically evaluated to determine if a significant difference exists between wild type neurons and *Dclk1*-deficient neurons.

Adrian Lee

Poster: C8

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Alison DeLong (Molecular Biology, Cell Biology & Biochemistry)

**Using CRISPR-mediated deletions to knock out protein phosphatase genes that control plant size.**

Ethylene is a plant growth regulator that is quite important for various stages in plant life such as fruit ripening and seed germination. The biochemical pathway for ethylene biosynthesis is regulated by reversible protein phosphorylation, and our main focus for this project is the regulatory subunits

of Protein Phosphatase 2A (PP2A). We previously isolated CRISPR-induced mutations in genes encoding PP2A B72 regulatory subunits. These mutations confer an ethylene-overproducing phenotype, but the mutant alleles are not nulls. New constructs that program deletions in genes PP2A-B16 and PP2A-B17 have been made and transformed into wild-type Arabidopsis plants. The current project aims to isolate plants carrying null alleles in PP2A-B16 and PP2A-B17 to characterize their ethylene biosynthesis phenotypes.

So Min (Rachel) Lee

Poster: C9

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Erica Larschan (Molecular Biology, Cell Biology and Biochemistry)

**Examining the Role of CLAMP in the Heat Shock Response in *Drosophila Melanogaster***

Controlling gene regulation is very important for an organism's survival, especially under stressed environments. Chromatin binding proteins, like CLAMP and GAF make the chromatin accessible for transcription and are important for gene activation. GAF is known to be important in regulating Hsp70, a gene encoding heat shock proteins that are produced under heat stress. Because CLAMP and GAF are both known to bind to GAGA repeats, we suspect CLAMP may also play a role in regulating the heat shock response. This project focuses on whether Hsp70 transcription during heat stress is regulated by changes in distribution of CLAMP and GAF on chromatin in *Drosophila melanogaster*.

Savannah Lewis

Poster: C10

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Erica Larschan (MCB), William Jordan (MCB)

**Seeking single males: X-identification and dosage compensation in *Drosophila***

Understanding mechanisms in *Drosophila* dosage compensation can help better understand genetic diseases. Two key factors in *Drosophila* are Male Specific Lethal Complex (MSL), which increases transcriptional output of a male's single X-chromosome to equal XX females, and Chromatin-Linked Adapter for MSL Proteins (CLAMP), which binds genome-wide, but recruits MSL only to the X-chromosome. Defining features of X-chromosomes and autosomes aren't well-known, so a vector-based luciferase reporter assay was employed to investigate them. We hypothesize MSL activity will be observed where CLAMP binding sites are close together, and activity won't be observed when sites are synthetically perturbed. We also anticipate MSL activity when CLAMP binding sites are synthetically added to autosomes. These results will help answer the larger question of X-identification.

Ellen Li

Poster: C11

Home Institution: Brown University



Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Elizabeth Brainerd (EEB)

### **Movement Coordination and its Relationship to Suction Feeding in Knifefish**

Knifefish are fascinating because of their ability to suction feed. Suction feeding occurs when the jaw depresses and the mouth expands laterally, causing a drastic change in volume that acts like a vacuum, sucking the prey in. We look at suction feed by tracking the movement of landmarks on the skeleton of fish through x-ray films of the feeding event. By overlaying these tracked points on to a CT scan, we are able to create a 3D animation of the actual suction feeding event. A suction feeding strike is quantified by the peak pressure in the mouth during the event and thus the amount of power generated. My goal is to access the relationship between power generation and movement coordination.

Troy Li

Poster: C12

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Dioscaris Garcia (Orthopedics), Christopher Born (Orthopedics)

### **Silver Carboxylate Antimicrobial: A Novel Wound Care Therapeutic for the Antibiotic-Resistance Era**

Post-operative Cutibacterium acnes (*C. acnes*) and Methicillin-Resistant Staphylococcus aureus (MRSA) surgical site infections are increasingly difficult to prevent and treat. In an effort to provide a viable option to this evolving problem, this project evaluates the efficacy of a silver-carboxylate eluting titanium dioxide-polydimethyl siloxane (PDMS) coating on wound-care products. The Kirby-Bauer diffusion assay was utilized to evaluate the coating at various silver carboxylate concentrations by measuring the zone of inhibition of each condition against each pathogen over 72-96 hours. In addition, commercially-available antimicrobial sutures and bandages to assess the effectiveness of current products. Latest results suggest that the silver-carboxylate coating is a better alternative to commercially available products due to its extremely broad antimicrobial ability and efficacy.

Grace Li

Poster: C13

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Gerwald Jogl (Molecular Biology, Cell Biology and Biochemistry), John Sedivy (Molecular Biology, Cell Biology and Biochemistry)

### **Exploring liquid-liquid phase separation in LINE-1 ORF1 N-terminus mutants**

Long Interspersed Nuclear Element-1 (LINE-1) is the only active autonomously replicating retrotransposon in humans, comprising 17% of the genome. Although typically transcriptionally repressed, LINE-1 sees increased expression with age, contributing to genomic instability, damage, and likely age-associated diseases. The LINE-1 element encodes two proteins: ORF1, an RNA-binding chaperone that trimerizes via an N-terminal coiled-coil domain, and ORF2, which contains endonuclease and reverse transcriptase domains. Previous work has shown that LINE-1

retrotransposition is dependent on the positively charged N-terminus of ORF1. At high concentrations, ORF1 also exhibits liquid-liquid phase separation (LLPS), which could be a mechanism of LINE-1 ribonucleoprotein particle transport and assembly for retrotransposition. Here we show biochemical studies of ORF1 LLPS with mutations targeting the positively charged N-terminus.

Ian Light

Poster: C14

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: David Rand (Ecology & Evolutionary Biology)

### **Phenotypic Investigations into Wild-Caught Fly Populations**

Two populations of *Drosophila Melanogaster*, with individual established iso-female inbred lines, were investigated for differences in hypoxia (low oxygen) tolerance, response, and survivorship. These fly populations are wild-caught populations from different regions of Africa with different elevations and, thus, different ancestral oxygen tensions. By investigating these lines we can look for potential signals of adaptation to low oxygen and the phenotypic impact these adaptations may have. Additionally, sequence analysis on the mitochondrial genomes of these flies was carried out to investigate how similar or different the mitochondrial genomes are within and between the populations.

Kristina Lowndes

Poster: C15

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Theresa McKim (Neuroscience), Theresa Desrochers (Neuroscience)

### **The impact of working memory capacity on tracking sequences of variable length and duration**

Sequential behaviour is a part of our everyday lives. The goal of making breakfast is accomplished by executing sub-tasks, like toasting and buttering bread. Tracking such a sequence may require that the steps are held in working memory to keep recently accessed information available for manipulation. To study the potential interaction between sequential monitoring and working memory, participants will complete a delayed match to sample task measuring working memory and a sequential task to track image sequences of variable duration and length. We predict that higher working memory capacity will correlate with reduced reaction times to begin the sequence. By studying their relationship, we will determine whether working memory plays a role in how the brain tracks sequential information.

Vivian Lu

Poster: C16

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Debaleena Basu (Department of Neuroscience), Theresa Desrochers (Department of Neuroscience; Department of Psychiatry and Human Behavior; Robert J. and Nancy D. Carney Institute for Brain Science, Brown University)

### **Exploring the role of sleep in sequence processing**

Adequate sleep is critical for proper physiological functioning, and previous studies have shown that sleep disturbances adversely affect cognitive performance. Sequence processing is a cognitive process underlying many daily tasks, for example, making a cup of coffee. The question of how sleep parameters relate to performance in sequential tasks is currently unresolved and forms the main motivation for this project. I designed and collected self-reported sleep questionnaire data from participants who passively viewed a series of images. Participants had no explicit knowledge that the images were sequentially arranged. Our study will show whether variations in reported sleep parameters affect passive tracking of sequential stimuli, and give insights on the influence of sleep on implicit cognitive processes.

Hanley Ma

Poster: C17

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Susan Gerbi (Molecular Biology, Cell Biology, and Biochemistry), Hemakumar Reddy (Molecular Biology, Cell Biology, and Biochemistry)

### **Elucidation of Ecdysone-Mediated Induction of DNA Re-Replication in *Sciara coprophila* Salivary Gland Polytene Chromosomes**

When a cell divides, its genetic information (DNA) is duplicated only once. Sometimes, this control is overridden, resulting in DNA amplification at certain loci—a hallmark of cancer. We aim to elucidate how DNA amplification is triggered, using the fly *Sciara* as a model system. The steroid hormone ecdysone induces *Sciara* DNA amplification. We will test by co-immunoprecipitation if this occurs through a direct interaction between the ecdysone receptor (EcR) and the DNA replication machinery. As a first step, we perform Western blotting to validate our antibodies against EcR and other components of the pre-replication complex. The anti-EcR antibody will also be used for chromatin immunoprecipitation to determine if EcR binds *in vivo* adjacent to an origin of DNA amplification.

Sonoor Majid

Poster: D1

Home Institution: University of Nebraska-Lincoln

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Yang Zhou (Molecular Microbiology and Immunology)

### **Transgenic overexpression of phospholipid scramblase 1 using *Rosa26* locus targeted conditional knock-in strategy in mice**

Phospholipid scramblase 1 (Plscr1) is the most studied member of the phospholipid scramblase protein family whose main function is the bidirectional and non-specific translocation of

phospholipids between the inner and outer leaflets of the plasma membrane. Activation of Plscr1 allows for the externalization of phosphatidylserine (PS) in the outer membrane, which acts as a dock for many biological processes including coagulation, apoptosis, and activation. Our previous data demonstrated that null mutations of murine Plscr1 augment lung Type 2 immune responses. We hypothesize that Plscr1 is a potent inhibitor of innate immunity, and Type 2 immune responses would be diminished in Plscr1 overexpression animals. The aim of this study is to generate Plscr1 overexpression (Plscr1 OE) mice using a newly developed Rosa26 locus targeted conditional knock-in strategy. Specifically, LysM Cre mice were crossed with Plscr OE mice to allow spontaneous overexpression of Plscr1 in myeloid cells. In addition, Cre-ERT2 (estrogen receptor T2) mice were crossed with Plscr OE mice, and tamoxifen was administered to induce Plscr1 expression. We characterized Plscr1 expression in lungs and livers of these animals using RT-PCR, Western blots, and Immunohistochemistry. These mice will be used in future studies to determine the role of Plscr1 in Type 2 immune responses.

Omar Martinez

Poster: D2

Home Institution: University of Rhode Island

Summer Research Program: Summer Research Assistantship in Biomedical Sciences

Faculty Mentor: Brenda Rubenstein (Chemistry)

### **Predicting bacteria using Molecular Dynamics and Machine Learning**

As bacteria continues to evolve, its resistance towards antibiotics like penicillin will improve resulting in an impermeable superbug. With the use of Molecular Dynamics Simulations and Machine learning algorithms such as Scikit learn would allow us to view the activity of certain ligands with MD trajectories that would aid in discovering better characteristics for noncovalent proteins and ligand interactions. This information collected would aid in creating antibiotics that would have an effect on the resistance bacteria has on penicillin.

Claire McEwen

Poster: D3

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Joo-Hyun Song (CLPS)

### **Effects of Attentional Load on Motor Learning and Recall**

In previous work, our lab has demonstrated that when learning a motor task, performing a secondary visual search task counterintuitively does not result in a deficit in motor performance. We posit that the secondary task is used as a sort of “context” for retrieval of the motor task after a washout period. However, it is unknown whether this secondary task could still be used as a contextual memory clue if it requires enough attention to cause a dual-task performance deficit. By the end of this summer, I will have investigated the extent to which a secondary task can function as context for the learning of a primary task.

William McNelis

Poster: D4

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Rebecca Burwell (CLPS)

### **Connections between Perirhinal Cortex, Postrhinal cortex and Hippocampus**

This project sought to elucidate how the perirhinal cortex (PER), postrhinal cortex (POR) and hippocampus are connected. There is widespread agreement that each of these regions are involved in forming and storing memories. PER has been linked to encoding object information and POR to spatial memory and contextual information. The way that streams of information from the PER and POR are integrated to form and store complex memories remains unclear. Distinct florescent retrograde tracers were injected into POR and hippocampus of several rats and the numbers of cells in the PER that were labeled from each and both of these tracers were counted to determine the connectivity of these regions in an animal model.

Loreilys Mejias-Rivera

Poster: D5

Home Institution: University of Puerto Rico Rio Piedras Campus

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Alexey Fedulov (Surgical Research)

### **The effect of talc on transcriptome of the macrophages to explain their compromised tumoricidal activity against ovarian cancer cells**

Talcum powder is associated with increased risk of ovarian cancer, mechanism is unknown. We tested the macrophage transcriptome after talc and estrogen exposure and found a substantial change in gene expression (vs. control particles). Talc alone was the major contributor to gene expression changes. Pathway analysis revealed inhibited expression of genes involved in immunosurveillance and tumoricidal activity. Hence, talc exposure may impair the ability of the macrophages to scavenge and curb malignant cells. Co-culture of ovarian cancer cells and macrophages pre-treated with talc and estrogen resulted in an increased cancer cell survival. These findings indicate that talc alone and in combination with estrogen induces gene expression changes in macrophages that make them less efficient against malignant cells.

Braxton Morrison

Poster: D6

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Carl Saab (Neurosurgery), Christopher Black (Neurosurgery)

### **Elucidating Mechanisms of Pain Processing Using Behavioral and Electrophysiological Assessment**

I test three hypotheses:

1. Laminae II/III PV neurons inhibit nociceptive relay neurons in vivo.
2. Theta waves in the in the thalamus and neocortex are correlated with painful stimuli.

3. Mice can be trained in novel behavior to self-report nociceptive stimuli.

I insert surgical implants into the brain and spinal cord of TRPV1-ChR2 mice and take recordings in awake, behaving mice. These mice have primary nociceptive afferent neurons stimulated by blue light (470nm). I train the mice to provide a lick report in response to brief pulses of the 470nm light for a reward. With the lick reports and recordings of reflexive responses, I temporally correlate moments of pain perception with neural data from the spine-brain continuum.

Gloria Nashed

Poster: D7

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Elena Oancea (Molecular Pharmacology, Physiology, and Biotechnology)

**TRPV2, a novel melanosomal protein, may be a positive regulator of pigmentation and mediator of melanosome transfer**

Transient Receptor Potential Vanilloid 2 channel (TRPV2) is one of the most heavily expressed ion channels in skin cells, yet its function in these cells remains unknown. The primary goal of this project is to first establish where exactly TRPV2 is located in skin cells and then to determine its function and ultimately the mechanism behind its action. Preliminary data in the Oancea lab has found that silencing the expression of TRPV2 in human melanocytes leads to a decrease in their pigmentation. Thus, my hypothesis is that TRPV2 regulates the pigmentation of melanocytes by mediating the transfer of melanosomes, the organelles responsible for producing melanin pigment, from these cells.

Ramses Ngachoko

Poster: D8

Home Institution: Amherst College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: David Badre (Department of Cognitive, Linguistic, and Psychological Sciences), Apoorva Bhandari (Department of Cognitive, Linguistic, and Psychological Sciences)

**Behavioral Consequences of Learning Conjunctive Representations**

Humans can effortlessly modify our responses to environmental stimuli given the context and the task at hand. An important cognitive neuroscience question is how task-relevant stimuli are represented to enable such flexibility. On one hand, we build low-dimensional, abstract representations of stimuli that enable us to generalize knowledge from one task to another, enabling rapid learning of new tasks. Contrarily, our behavior is highly context-sensitive, suggesting that we build high-dimensional representations that integrate information from multiple-dimensions, enabling us to learn arbitrary tasks. We leveraged the psychological refractory period (PRP effect) to examine the consequences of low and high dimensional representations on our ability to multi-task. We trained subjects on tasks that encouraged either low or high dimensional representations of the same stimuli. Subjects were then asked to multi-task - concurrently performing two new tasks on the trained stimulus sets. We hypothesize that low-dimensional representations of the stimuli will

constrain multi-tasking as the same neural resources will be required for both tasks. Conversely, high-dimensional representations will enable subjects to more efficiently multi-task, by enabling separate neural pathways for the two tasks. We predict that the group trained to develop high-dimensional representations will show smaller PRP effects, revealing a more parallel-processing strategy compared to the low-dimensional group. Our study will provide an insight into representational strategies that support multi-tasking.

Ariel Nieves

Poster: D9

Home Institution: City University of New York Hunter College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: David Berson (Neuroscience)

**Reconstruction of Excitatory Bipolar Cell Input to Mouse ON Alpha-like Retinal Ganglion Cells with Electron Microscopy**

Retinal Ganglion Cells (RGCs) are neurons that encode light information from intermediate cells in the retina before sorting it to specific brain regions for higher visual processing. Diversity in RGCs can contribute to what synaptic connections can be made and its implied behavioral function. However, these synaptic connections have not been thoroughly investigated. Using electron microscopy, we characterize two similar and previously combined RGCs, we hypothesize RGCs can be further characterized by excitatory bipolar cell (BC) ribbon synapses. Ribbons are manually marked and compared to an archive of previously traced BCs to determine subtype input. If differences in morphology constitute synapses with different BC subtypes, then established RGCs can be further characterized with greater specificity.

Dayshalis Ofray

Poster: D10

Home Institution: Brown University

Summer Research Program: Research Assistant

Faculty Mentor: Kevin Bath (CLPS)

**Sexually dimorphic effort for reward and neural underpinnings in mice**

Dopamine plays a key role in the regulation of motivation and reward seeking behavior. Sex differences in the dopaminergic system have been identified and implicated in the risk for and treatment of reward-related psychopathology. Here, in mice, we tested for sex differences in striatal expression of dopamine receptors implicated in the indirect pathway and reward-related behaviors. We observed novel sex differences in *Drd2* and *Drd3* expression that were associated with diminished effort in males. Using a lever-press progressive ratio task, females showed increased lever pressing to obtain a reward compared to their male counterparts. These findings highlight the importance of including female subjects in basic research and will inform future investigations of stress effects on reward-related pathology.

Tessa Palisoc

Poster: D11

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Zhou Zhu (MMI)

**Investigating Epigenetic Regulation of SHP-1 Suppression in Lung Fibrosis**

SHP-1 is a protein found in leukocytes and epithelial cells that is known to regulate inflammatory and immunological responses. Therefore, SHP-1 suppression is likely to exacerbate tissue damage due to inflammation. In inflammatory lung conditions such as fibrosis, SHP-1 is found in notably lower levels. This research investigates epigenetic regulation of the expression of SHP-1 and other proteins in fibrosis by observing the methylation status of their promoter regions. Methylation of these promoters is a possible contributor to suppression of these proteins in lung fibrosis. Lung epithelial cells and plasma samples are used in this research to determine promoter methylation status with and without fibrotic stimulation. This research may be applicable in early detection of lung fibrosis.

Wesley Parker

Poster: D12

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Louis Lapierre (Department of Molecular Biology, Cell Biology and Biochemistry)

**Effects of tissue-specific knockdown of autophagy and longevity associated proteins on lifespan in the *C. elegans* daf-2 mutant**

Autophagy is a crucial intracellular process that maintains cellular integrity by recycling cytoplasmic material into metabolic precursors (ref. 1). This multistep process is upregulated in many long-lived animal models and has been linked to longevity across phyla (ref. 2). In this UTRA we investigated the effects of tissue-specific knockdown of the autophagy supporting proteins HLH-30 and the LGG-1, as well as the longevity promoting transcription factor DAF-16, on *C. elegans* lifespan in the context of the long-lived *daf-2* mutant. Ultimately, we found that knockdown of HLH-30 and DAF-16 in the neurons alone, the intestines alone, and the whole body resulted in moderate to large reductions in lifespan in *daf-2* mutants; meanwhile, *daf-2* mutant lifespan was reduced by intestinal knockdown and neuronal knockdown of LGG-1 but moderately increased by whole body knockdown.

1. Choi, A.M.K., Ryter, S.W. & Levine, B. Autophagy in Human Health and Disease. *The New England Journal of Medicine* 368, 651-62 (2013).
2. Lapierre, L.R., Kumsta, C., Sandri, M., Ballabio, A. & Hansen, M. Transcriptional and epigenetic regulation of autophagy in aging. *Autophagy* 11, 867-80 (2015)

Crystal Parry

Poster: D13

Home Institution: University of Baltimore County

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)



Faculty Mentor: Alan Morrison (Department of Internal Medicine (Cardiovascular Medicine))

### **IL-1 $\beta$ -VEGF-A Signaling Axis in Atherosclerotic Calcification**

Coronary artery disease caused by atherosclerosis is characterized by lipid deposition in the wall of blood vessels along with inflammation and calcification. Previous research demonstrated that signal transducer RAC2 modulates pro-inflammatory cytokine IL-1 $\beta$ , resulting in increased calcification. It also suggested the promoter region of the gene encoding growth factor VEGF-A is activated by IL-1 $\beta$  signaling. The goal of this study is to assess the relationship between VEGF-A, IL-1 $\beta$ , and atherosclerotic calcification. Gene-deletion of IL-1 $\beta$  led to reduced VEGF-A expression and reduced calcification, supporting a causal relationship. These results were validated by comparing levels of IL-1 $\beta$ , VEGF-A, and calcification in human subjects. Future studies would demonstrate VEGF-A causes calcification, using macrophage-specific knockdown of VEGF-A expression in animal models.

Iris Peng

Poster: D14

Home Institution: Brown University

Summer Research Program: Department of Neuroscience, Undergraduate Research Assistant

Faculty Mentor: Stephanie Jones (Neuroscience)

### **Optimizing and Testing a Tactile Detection Device for Investigating Brain Dynamics in Somatosensory Perception**

Our lab investigates human brain dynamics and their underlying cortical mechanisms using electroencephalography (EEG) and computational neural modeling. This project uses a tactile detection task and transcranial magnetic stimulation (TMS) to investigate and modulate EEG correlates of somatosensory perception. In this task, a custom piezoelectric device delivers light taps to a subject's finger. The device's shape is important because it can affect EEG-measured brain responses to the taps, or evoked response potentials (ERPs). As an older model did not accurately reflect signals measured in prior studies, we designed a new 3D-printed device, performed pilot testing with EEG, and characterized the ERPs. This project will improve measures of tactile ERPs and therefore our understanding of the cortical mechanisms underlying tactile perception.

Barbara Pereira Vera

Poster: D15

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Lynae Brayboy (MCB and OB/GYN)

### **MDR-1 SNPs Potentially Disrupt Mitochondrial Function**

Multidrug Resistance Transporters (MDRs) use energy to efflux toxicants and foreign substances from the cell. They are infamous for their pathological role in evasion of chemotherapeutics and antibiotics. However, MDR-1 is normally expressed in the oocyte mitochondrial membrane—our previous work has demonstrated that its dysfunction leads to oxidative stress. Various single nucleotide polymorphisms (SNPs), or substitutions, have been reported in the MDR-1 gene—possibly altering its function. The central aim of this project is to study the effects of common

MDR-1 SNPs on mitochondrial function. MDR-1 dysfunction in oocyte mitochondria has been demonstrated to cause increased ovarian vulnerability to toxicants and decreased oocyte quality. An identification of SNPs that confer dysfunction could allow for increased genetic screening of reproductive-age women.

Marie Piatski

Poster: D16

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Amanda Jamieson (MMI)

**Genetic Sequencing, Characterization, and Effects of the Lung Microbiome**

The lung houses a unique community of microbes that live in harmony with its host, called the lung microbiome. Disease states in the lung have been associated with changes to the microbiome; however, the composition of the lung microbiome in both healthy and disease states is currently unknown. It is also unknown how the lung responds to these commensal microbes versus opportunistic pathogens which can bloom under favorable conditions. Lung macrophages are responsible for clearing pathogens while ignoring commensals, but how they do this is unknown. We created a library of bacteria isolated from murine lungs and studied the response of macrophages to these commensals compared to known lung pathogens to better understand this balance.

Alisa Pugacheva

Poster: D17

Home Institution: Brown University

Summer Research Program: Summer Research Assistantship in Biomedical Sciences

Faculty Mentor: David Berson (Neuroscience)

**Tiny but Fierce: Characterizing W3 cell projections in the FIGN mouse line**

Visual stimulus reaches higher areas of the brain through retinal ganglion cells (RGCs). W3 cells, an RGC type, are edge detectors, distinguishing small, high contrast object motion against a background, a critical protective measure against predators. Currently, researchers lack the ability to solely target W3 cells, therefore our understanding of their projections and circuitry remains incomplete. Preliminary data in FIGN mice shows labelling of small, bushy RGCs similar to W3s. Viral delivery of multiple cre-reporters, immunohistochemical labeling, and anterograde labelling of W3 projections into these areas, will allow us to further characterize the FIGN line and W3 cells, and will provide an invaluable tool for further RGC research.

Sarah Pugliese

Poster: E1

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Stephanie Jones (Neuroscience)

**Mathematical model of neocortex predicts that dendritic calcium spikes are visible in human EEG signals**

Computational modeling is a powerful tool for studying how the activity of cells in a neural network is read out into human electroencephalography (EEG) signals. Suzuki and Larkum (2017) found that calcium spikes in the dendrites of layer 5 neocortical pyramidal neurons (PN) are visible in recordings on the cortical surface of rats. We used our lab's model of neocortex to investigate and expand on this claim in relationship to human EEG. After adapting the model PNs to have more realistic electrophysiological properties, I found calcium spikes are indeed visible in the EEG. Furthermore, calcium spikes are visible in the absence of somatic spiking, and the polarity of the corresponding EEG indicates the direction of calcium flow in the dendrite.

Yael Quiles Ramirez

Poster: E2

Home Institution: University of Puerto Rico at Aguadilla

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Chyna Gray (Surgical Research), Alfred Ayala (Surgical Research)

### **Contribution of Negative Checkpoint Regulator, VISTA, to Inflammatory Response and Survival in Murine Sepsis**

Sepsis is a systemic immune response to infection where the immune system lacks the ability to balance inflammation and suppression. Sepsis research focuses on immune checkpoint proteins due to their role in regulating the inflammatory response. V-domain Immunoglobulin Suppressor of T-cell Activation, a checkpoint protein, inhibits T-cell proliferation and cytokine production following T-cell activation. We hypothesize that VISTA mediated immune suppression is protective by quelling bystander peripheral tissue damage in murine sepsis. We will identify changes in tissue histology and determine the abundance of proinflammatory markers in VISTA<sup>-/-</sup> mice. We have observed an increase in the abundance of thymic NFκB, NGAL, and serum cytokine levels in septic VISTA<sup>-/-</sup> mice indicating VISTA may protect tissue by suppressing an uncontrolled inflammatory response.

Maria Rodriguez

Poster: E3

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: David Sheinberg (Neuroscience)

### **Multiple Object Tracking: Rotation as an Object Feature**

In the real world, objects of interest are often in motion. The MOT task was developed to investigate our ability to track moving objects. Within the paradigm, 4-5 targets are signaled among similar distractors. Observers track the targets for a few seconds while all the objects translate around a display. Once the objects stop moving, observers report which objects they tracked. However, everyday targets and distractors are not identical. Previous research found that object feature differences between targets and distractors, such as color, facilitate tracking. My experiment is based on the fact that most moving objects are oriented in their direction of motion. I will compare the effect of two types of rotational motions on observer's ability to track objects.

Priyanka Roy

Poster: E4

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Neil Sarkar (Brown Center for Biomedical Informatics)

### **Using Phylogenetic Techniques to Study “Junk” DNA**

A significant portion of eukaryotic genomes consist of noncoding DNA, formerly known as “junk” DNA. Currently, phylogenies, which are trees that are used to model evolutionary history, are mostly based on coding regions. In this study, we are analyzing the noncoding region immediately preceding genes, which we refer to as “pre-genes.” We aim to examine possible patterns in evolutionary relationships of the pre-genes relative to genes across publicly available genomes. Our analyses will reveal relationships between pre-genes and their subsequent genes based on possible shared evolutionary history. Common patterns in evolutionary conservation of pre-gene and gene combinations may provide insights into the potential impact of pre-genes on gene-associated phenotypes.

Yasmin Roye

Poster: E5

Home Institution: University of Maryland Eastern Shore

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Craig Lefort (Division of Surgical Research), Brittany Neumann (Division of Surgical Research)

### **The Effects of ANP Ligand Binding on Neutrophil Transit through a Lung Capillary Constriction Device**

Activated neutrophils that are constantly retained in the narrow pulmonary capillary bed (PCB) can lead to a higher potential for pulmonary vascular damage. Activation due to pathogen/damage sensing includes cell stiffening. The aim of this study is to characterize how N-formylmethionine-leucyl-phenylalanine (f-MLP), and atrial natriuretic peptide (ANP) impact neutrophil stiffening and link it to the cytoskeletal biochemistry underlying it. Single cell transit times were followed through a microfluidic device that models the dimensions of the PCB. f-MLP stimulated neutrophils pass through the constriction slower than unactivated or cytochalasin D-treated cells. Vinculin has also been linked to transit times also. These preliminary data support that the stiffening response is due to the engagement of the cytoskeleton.

Alyssa Rust

Poster: E6

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Carlos Aizenman (Neuroscience)

### **The effect of Chlorpyrifos on the dendritic development in *X. laevis* tadpoles**

Several neurodevelopmental disorders, such as Autism Spectrum Disorder, could possibly be caused by exposure to toxic chemicals in the environment. It is believed that these chemicals may have adverse effects on nervous system development. Chlorpyrifos (CPF) is a widely used organophosphate pesticide used to control insect pests on a variety of mainstream food crops. Despite its approval by US and European food and drug administrations, several studies have found that CPF could potentially be a neurotoxin. Previous experiments have shown that early developmental exposure to CPF can cause anatomical and behavioral abnormalities in *Xenopus laevis* tadpoles. We aim to determine if early exposure to CPF will interfere with dendritic development, which could ultimately manifest as abnormal behavior.

Ian Sabula

Poster: E7

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Jill Kreiling (Molecular Biology, Cell Biology and Biochemistry)

**Investigating mir-465 family targeting of Kit ligand messenger RNA**

The Kit ligand (Kitl), also known as Stem Cell Factor, is a signaling protein that binds the c-Kit receptor. RNAseq analysis has demonstrated a decrease in Kitl mRNA with age in mouse liver, and the five members of the microRNA 465 family have been bioinformatically predicted to target 3 sites in its 3' untranslated region. Since miRNAs elicit cleavage or destabilization of targeted mRNAs, and the mir-465 family is upregulated with age, this could explain the decrease in Kitl mRNA in old mice. However, a causal relationship has yet to be experimentally corroborated. This project uses dual-luciferase assays, supplemented by targeted mutagenesis of miRNA sites, to begin this confirmation. Since changes in Kitl expression are associated with aging and cancer, data may clarify causes of these conditions in mice, and could inform similar investigations in humans.

Lori Sahakian

Poster: E8

Home Institution: Brown University

Summer Research Program: LINK Award

Faculty Mentors: Dioscaris Garcia (Weiss Center for Orthopaedic Trauma Research), Christopher Born (Weiss Center for Orthopaedic Trauma Research)

**Biofilm Platform for Development of Irrigation Agents**

Open fractures pose great risks of infection due to the accumulation of debris and bacteria, with infection rates as high as 30% (Darouiche 2004). Bacterial adhesion to orthopedic implants can result in biofilm formation. Due to their antibiotic resistance, prevention and eradication of biofilms is a challenge in orthopedics. Current methods utilize an isotonic saline solution irrigation technique or prophylactic administration of antibiotics. However, neither approach has proven to eradicate biofilms. This project is based on an in vitro model of biofilm development, growth, and quantification on two commonly utilized orthopedic implant materials: Titanium and Polyetheretherketone (PEEK). The project aims to identify the composition and dynamics of biofilm development on different implant materials using Confocal Laser Scanning Microscopy.

Destinee Semidey

Poster: E9

Home Institution: City University of New York Hunter College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP), BP-ENDURE

Faculty Mentors: Karla Kaun (Neuroscience), Natalie D'Silva (Neuroscience)

**The effects of alcohol deprivation on acute alcohol sensitivity in *Drosophila***

Alcohol is an abused substance that contributes to 10% of global deaths. Cravings that persist during abstinence may cause relapse due to aversive effects of withdrawal. The underlying mechanisms that regulate this response are essentially unknown. *Drosophila* is an effective model for basis of alcohol sensitivity and addiction. Utilizing this model, we investigated the correlation between alcohol abstinence and acute alcohol sensitivity. Using an enzyme-based ethanol absorbance method, we assessed how alcohol deprivation altered flies' ability to absorb alcohol following a chronic intermittent alcohol exposure paradigm. We found no significance with our deprivation time points. The study analysis is ongoing. This data will help understand behavior from repeated alcohol experiences for future addiction research.

Daniel Shleifer

Poster: E10

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Kevin Bath (CLPS)

**The sex selective effects of early life adversity on effort in mice**

Exposure to early life adversity (ELA) can significantly alter brain development and function. Here, we model early life adversity in mice by limiting a mother's access bedding and nesting during the perinatal period. This limited resource environment alters mom-pup interactions and elicits a stress response in pups. Previous work suggests ELA uniquely increases depressive-like behaviors in females. We hypothesized that ELA induces changes in the indirect pathway to alter effort and vigor in females. To explore this, we employed a lever pressing conditioning task with logarithmically increasing requirements for reward. We extract several metrics of effort, vigor, tenacity and habituation from the task to paint a broader picture of the behavioral impact of ELA on female mice.

Faith Simmonds

Poster: E11

Home Institution: Howard University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Daniel Spade (Department of Pathology and Laboratory Medicine)

**Mono-(2-ethylhexyl) Phthalate Toxicity on Cultured Fetal Mouse Ovary**

Phthalates, chemicals used to plasticize polyvinyl chloride products, are reproductive and

developmental toxicants present in our everyday lives. Di-(2-ethylhexyl) phthalate, DEHP, and its metabolite Mono-(2-ethylhexyl) phthalate, MEHP, is a potent male reproductive toxicant. However, less is known on the effects of DEHP exposure on the female reproductive system, especially on early ovarian and oocyte development. The goals of this study were to understand the short-term mechanisms of MEHP toxicity on cultured gestational day (GD) 14 fetal mouse ovaries through immunofluorescence staining for markers of germ cell and ovarian somatic cell development, and to optimize methods to study gene expression in the cultured fetal ovary.

Tali Sorets

Poster: E12

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Justin Fallon (Neuroscience)

### **Alternatively splicing muscle-specific kinase (MuSK) as a potential therapy for Alzheimer's Disease**

While it is established that adult hippocampal neurogenesis is important for learning and memory, the mechanism by which defective neurogenesis causes cognitive decline in Alzheimer's disease is currently unclear. Therefore, a deeper understanding of the neural stem cell cycle is critical for elucidating both normal brain function and disease. Bone Morphogenetic Proteins (BMPs) induce neural stem cell quiescence and can be modulated by targeting the MuSK-BMP pathway. Genetically engineered "D3 mice" that lack the binding domain required for high affinity MuSK-BMP binding generated twice the number of newborn neurons in the dentate gyrus and exhibited improved spatial memory compared to wild-type mice. In the upcoming months, the Fallon Lab will test if manipulating MuSK-BMP binding can enhance neurogenesis in an Alzheimer's Disease (AD) environment. If successful, targeting the MuSK-BMP pathway to promote adult hippocampal neurogenesis becomes a potential avenue for an AD therapy.

Maxwell Spurrell

Poster: E13

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Gary Wessel (MCB)

### **The Evolution and Regulation of Echinoderm Pigments**

Pigments are known to serve diverse biological functions such as camouflage and sexual selection. The purple sea urchin's (*Strongylocentrotus purpuratus*) embryos have pigmented mesenchyme cells which play a part in larval immune defense. Many genes, including those that synthesize the pigment Echinochrome A, are specifically expressed in this cell population. The purple sea urchin is relatively closely related to the bat star (*Patiria miniata*), whose embryos appear pigmentless. We have found that the larval bat star still expresses orthologs to pigment producing genes despite having no visible pigment. These genes are expressed in a similar cell population but are not regulated by the same transcription factors. Finally, the orthologous genes seem to be also involved in immunity.

Cassandra T-Pederson

Poster: E14

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Dima Amso (CLPS)

**More than fun and games: play as an index of developing executive functions**

Play is universal. It engages object manipulation, social interaction, language, etc. Yet, we don't know how play indexes other developing cognitive processes. We tested 4-9-year-old Western children (N=18) on 1) semi-structured play with mother and experimenter; 2) unstructured play; 3) several executive functions (EF) tasks. Preliminary results suggest children spontaneously show/tell more than ask questions about the toys. Children who engaged in show/tell with their mother more than the experimenter performed more poorly on EF tasks, controlling for age. Children whose mothers offered spontaneous positive reinforcement during semi-structured play also showed poorer EF performance. In contrast, independent interaction with objects during unstructured play correlated with higher EF. These data suggest that play based interactions reflect developing EF.

Jason Tsai

Poster: E15

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Anne Hart (Neuroscience)

**Evaluating common suppressor genes underlying neurodegeneration in overexpression and single-copy/knock-in models of SOD1 ALS in *C. elegans***

Amyotrophic lateral sclerosis (ALS) is an incurable disease that results from motor neuron degeneration, leading to loss of functions such as moving and breathing. Superoxide dismutase 1 (SOD1) gene mutations account for approximately 20% of familial ALS cases.

I have compared lab and literature lists of candidate suppressors and identified seven which might suppress ALS-associated defects in multiple laboratory models of ALS. I will cross these genes into the sod-1G85R knock-in *Caenorhabditis elegans* model and determine if neurodegeneration is suppressed.

If they suppress neurodegeneration, this suggests a common genetic basis between models of ALS. Because suppressors have been targets of treatment, we hope that identifying these genes is a step toward combating ALS.

Thomas Usherwood

Poster: E16

Home Institution: Brown University

Summer Research Program: None of the above; I am working at Brown for the summer without any official summer research program.

Faculty Mentor: Anubhav Tripathi (Biomedical Engineering)

**Prefilled Soda-Lime Glass Capillary Electrophoresis Platform For Lab-on-a-Chip**



## **Biomedical Applications**

We present a strategy for creating prefilled microfluidic chips for small-sample DNA separation applications. Based on the Agilent 2100 Bioanalyzer, this technique mitigates experimental errors from filling microchannels with sieving matrix (SM) for capillary electrophoresis, which is clumsy and inconsistent. Firstly, a poly(N,N-dimethylacrylamide)-based SM was developed. The mono- and divalent cations in soda-lime glass present problems as DNA dyes for light-induced fluorescence detection complex with these ions. To mitigate this and optimize detection by software, SM containing no dye was preloaded into the chip, and subsequently loaded SM dye concentration was varied. Palladium wire addition and gel concentration was tested to improve SM longevity and optimize retention time.

Kensley Villavasso

Poster: E17

Home Institution: Xavier University of Louisiana

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Sunthorn Pond-Tor (Pathology), Jonathan Kurtis (Pathology)

### **Expressing and Purifying Parasite Antigen pfGARP: Towards a Novel Vaccine for Plasmodium Falciparum**

Human malaria, caused by the parasite Plasmodium Falciparum, is a leading cause of mortality in developing countries. PfGARP has been identified as a parasite antigen that is distinguished by antibodies present in the plasma of children who are resistant, but not by children who are susceptible to Plasmodium Falciparum. PfGARP must be expressed and purified in order to be used in a vaccine. To express, we undergo transformation of the plasmid, fermentation, and confirmation using SDS-PAGE. For purification, the microfluidizer was used to filter and begin affinity chromatography (NiNTA, HIC, AEX, and strep-tactin). Bioassays and protein assays concluded the purification process. We were able to successfully complete this process, and the vaccine can be used in future animal trials.

Samer Wahood

Poster: F1

Home Institution: Brown University

Summer Research Program: Summer Research Assistantship in Biomedical Sciences, Hassenfeld Child Health Summer Scholars Program

Faculty Mentors: Eric Morrow (Molecular Biology, Cell Biology and Biochemistry (MCB) ), Brian Kavanaugh (Psychiatry and Human Behavior)

### **Designing an Epilepsy Questionnaire for Patients with Christianson Syndrome**

Christianson syndrome (CS) is an autism-related disorder due to changes in the SLC9A6 gene. The goal of this study is to develop a CS research registry of patients to advance the study of this condition. Given the concern about epilepsy in patients with CS, a questionnaire was developed to determine the quality of life of the patients and their caregivers, the types, frequency, and onset of seizures experienced by the patients, the medications taken by the patients, and other methods

utilized by patients to control seizures. This study is therefore important for families who learn that they have a child affected with a new syndrome often in advance of sufficient medical knowledge to understand the significance of the genetic diagnosis.

Anthony Walley

Poster: F2

Home Institution: Brown University

Summer Research Program: Presidential Scholars Program

Faculty Mentor: Karla Kaun (Neuroscience)

### **Octopamine's role in alcohol-induced activity responses**

Alcohol is a highly addictive drug of abuse. The mechanism by which alcohol takes advantage of the brain's reward circuitry is poorly understood. Octopamine is a neuromodulator in invertebrates that has been shown to be functionally analogous to mammalian norepinephrine. A subset of octopamine neurons hypothesized to innervate the mushroom body circuitry play a role in memory for the intoxicating properties of alcohol in *Drosophila melanogaster*. We activated these neurons using a temperature-sensitive cation channel (TrPA1) to explore their role in acute alcohol intoxication. Using the fly Group Activity Monitor (flyGrAM) we observed that exciting these neurons during alcohol exposure does not affect alcohol-induced alternations in group locomotor activity.

Christina Washington

Poster: F3

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: W. Curt LaFrance (Neurology and Psychiatry)

### **The Relationship between Psychogenic Non-epileptic Seizures and Traumatic Brain Injury in Veterans**

Psychogenic non-epileptic seizures (NES) are disabling seizures that mimic epilepsy, but are not caused by brain abnormalities. Given that traumatic brain injury (TBI) is often associated with seizure disorder comorbidities, many previous studies have proven that TBI is a risk factor for NES. A previous study done by Dr. LaFrance has also shown that TBI is associated with increased psychiatric diagnostic comorbidity, symptoms severity, and increased disability in patients with NES. However, no study has yet addressed the relationship between TBI and NES in veterans. Therefore, I hypothesize that veterans with NES and TBI will have poorer outcomes than veterans with NES. To prove this, I have collected and documented the diagnosis and treatment approaches of NES seen in patients at the Providence VA Medical Center. This data was then put into a database which totaled 100 patients. From there, I exported and conducted data analysis to compare the semiology of seizures, the psychiatric and psychosocial outcomes, and the measures of quality of life and functioning between patients with TBI and NES, and patients with NES. I hope that the data collected from this project will reveal the importance of studying the impact of TBI in patients with seizure disorders.

Hastings Williams

Poster: F4

Home Institution: Tougaloo College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Mark Johnson (Molecular and Cell Biology)

### **Crop Reproduction for our Changing Planet**

Climate change threatens our food supply because plant reproduction, which generates our crops, is temperature sensitive. The long-term goal of our work is to define how critical reproductive cells (pollen tubes), respond to high temperature and to define genetic variants that confer thermotolerance to plant reproduction. We are pursuing three molecular pathways that are known to control how cells respond to high temperature: 1) the heat shock transcriptional response, 2) the unfolded protein response, 3) production and metabolism of reactive oxygen species. Our poster will report on whether the pollen tube uses these mechanisms and whether the kinetics of their induction differ in varieties that successfully reproduce at high temperature.

Jordan Wise

Poster: F5

Home Institution: Xavier University of Louisiana

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Jeffrey Bailey (Pathology and Laboratory Medicine), Patrick Marsh (Pathology and Laboratory Medicine)

### **Effect of Cluster Randomized Trial Insecticide Treated Durable Wall Linings on Plasmodium falciparum Population in Liberia**

Plasmodium falciparum causes the deadliest form of human malaria. As the parasite is transmitted by way of the bite of a female Anopheles mosquito, those in a hot and humid climate are at a higher risk. One valuable method with proven effectiveness in combating the disease is insecticide-treated nets (ITNs), which protect users while sleeping. However, this prevention method is less than perfect. We hypothesize that implementing insecticide-impregnated durable wall linings (DLs) will reduce the transmission of the parasite and will be a more effective prevention method than ITNs alone. Our results can further suggest that large-scale implementation of DLs will be an effective long-term way of reducing the P. falciparum population and the burden of malaria in malaria-endemic regions.

Derek Xu

Poster: F6

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Mamiko Yajima (MCB)

### **Functional Contribution of DCLK1 in Embryonic Development**

Doublecortin like kinase1 (DCLK1) is a protein Ser/Thr kinase important for neuronal

development. More recently, it is reported to function in plasticity regulation of stem cells and cancer cells, but its functional mechanism is yet unclear. To reveal DCLK1's function in plasticity regulation, we here used the sea urchin embryo that undergoes highly regulative development. We found that DCLK1 protein is uniformly present during early embryogenesis but becomes restricted to mesenchymal cells after gastrula stage when major cell differentiation occurs in the embryo. The damage on the sea urchin larva induced ectopic DCLK1 expression in the ectoderm where the damage was most severe. These results suggest that DCLK1 may be involved in damage response and/or regeneration, contributing to embryonic plasticity.

Xinzhu (Tina) Yang

Poster: F7

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: David Berson (Neuroscience), Adam Mani (Neuroscience)

**Understanding Image Stabilization: Connectomics of the Mouse Medial Terminal Nucleus**

Retinal ganglion cells (RGCs) transmit all light information from the retina to the brain. The Accessory Optic System (AOS) is responsible for keeping an image stable on the retina via eye rotations and receives input from direction selective RGCs (DSGCs). Using electron microscopy data, tracer injections, and confocal imaging, we explore the connectomic relationships between different types of direction-selective RGCs that project to the medial terminal nucleus (MTN) of the AOS. Tracing in live slice preparations will elucidate the circuitry of postsynaptic cells in the MTN. This work will improve our knowledge of the constituents of the AOS and may open avenues for future treatment of pathological conditions of the AOS.

Zane Yu

Poster: F8

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Shuping Tong (Liver Research), Ji Su Li (Liver Research)

**The HBV Genome and its Evolutionary History**

The HBV genome is remarkably compact, and it codes for a plethora of different proteins by taking advantage of different open reading frames (ORFs). These quirks can be identified in both bat and fish hepadnaviruses (related to HBV), and point to evidence of how the HBV we know now may have come to be. Different deletions, additions, and other mutations accumulated over the centuries have tailored HBV to be able to dodge the human immune system and wreak an impressive amount of havoc on the liver through its efficient use of its tiny circular DNA.

Linda Zhang

Poster: F9

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Amitai Shenhav (Cognitive, Linguistics, and Psychological Sciences), Ji Su Li (Liver

Research)

**How hard do you want to work? The influence of positive and negative incentives on physical effort persistence**

Previous studies have examined how much effort people put into a task based on available incentives, but they have yet to fully capture how people choose whether to persist with their efforts and how those decisions are differently influenced by positive incentives (e.g., reward) versus negative incentives (e.g., avoiding loss). To address these questions, we developed a new task in which participants are given fixed time intervals to complete as many trials as they want of a physical effort task for monetary incentives. Across two studies, we varied the incentive amount (high/low) and/or type (positive/negative) across intervals. We found that participants chose to allocate more effort (e.g., completed more trials) when incentives were higher and when they were negative.

# HUMANITIES INDIVIDUAL PRESENTATIONS

Pablo Caban-Bonet

Poster: F10

Home Institution: Brown University

Summer Research Program: Mellon Mays Undergraduate Fellowship, Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Joseph Pucci (Medieval Studies)

## **Augustine's Self-Fashioning: Scripture in the Confessions**

Augustine was an extraordinary and dynamic thinker--yet, amongst all his qualities, I am most often astounded by his ready command of Scripture. What does this say about Augustine's thought? By coding complex happenings into Scripture, he allows the reader to understand the world in God's terms. For example, if he applies a particular Psalm to an experience or an emotion, then it implies that the quotation provides the truest expression of it. To Augustine, Scripture's authority overshadowed all other sources, for it was the Word of the living God: only through it could men and women know Christ and give themselves to Him. My research will explore how Scripture influences Augustine's thought in the Confessions.

Rosa Cordero-Cruz

Poster: F11

Home Institution: University of Puerto Rico- Rio Piedras

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Daniel Rodriguez (History)

## **Rape, Estupro, or Rapto: Colonization and Sexual Violence from Late Nineteenth to Early Twentieth Century Puerto Rico**

This paper analyses the evolution of rape in Puerto Rico's judicial system after the US took control of the island. Based on court cases and the Penal Codes, I examine how masculinity and femininity were represented. I also analyze when women were successful in their prosecution of the accused men in order to understand why some women received more protection from the state than others. Additionally, by researching debates regarding the new laws established and documents that indicate impressions of Puerto Rican sexuality, changes done to the legal system can be explained and linked to the political processes that occurred. Premised under the idea of progress, the transition highlights issues that go beyond sexual violence such as colonization and modernization.

Gabrielle DoVael

Poster: F12

Home Institution: University of Rhode Island

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Lindsey Jones (Education)

### **What's Missing? Race, Gender, and Prohibition in Early 20th Century Virginia**

Much history tends to become overlooked, forgotten and pushed to the side. In the early 20th century America, there were many impactful laws and historical moments taking place. One of them being prohibition beginning in 1920 and ending in 1933. Many states took part in prohibition as well as taking their own initiative to enforcing the laws regarding prohibition. Virginia, the second state to ratify prohibition, had plenty of organizations, laws and early motives to help encourage moderation or the abolishment of alcohol use. Between the years of 1916 and 1933 there were criminal records detailing individuals who committed a crime related to alcohol and what their sentencing was. This is a part of history that seems to be overlooked due to the possible injustice taking place during these trials. I alongside my mentor have looked more into the history of Virginia before and during the prohibition era as well as what can be concluded from these criminal records.

Katelynn Hester

Poster: F13

Home Institution: Southeastern Oklahoma State University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Linford Fisher (History)

### **Constructing Imaginary Natives: Visual Sovereignty and Native American Representation in Entertainment**

The aesthetics of Native existence have been distorted by non-Native entertainers throughout American history. This research aims to examine the use of Native aesthetics in popular entertainment as an expression of American sentiment toward Indigenous populations by aligning instances of Native representation with significant historical events involving the affairs of Native peoples. This paper argues that the representation of Native Americans in popular entertainment is reflective of the general sentiment held by non-Natives toward indigenous peoples throughout American history. This paper works to prove the thesis through the examination of theatrical productions, traveling medicine shows, Wild West shows, and silent/sound films. To provide further evidence for the thesis, the genre-typical stereotypes are juxtaposed with significant historical events impacting Native Americans.

Uriel Lopez-Serrano

Poster: F14

Home Institution: Bowdoin College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Patricia Ybarra (Theatre and Performance Studies)

### **Performing Sor Juana in the late-20th and early-21st Centuries: Latinx [Re]Imaginations of the Tenth Muse of Colonial Mexico**

Sor Juana Inés de la Cruz (c. 1648-1695) was a Mexican nun, poet, playwright, and scholar from the colonial era. In recent years she has become an icon for various global, social, and political movements, particularly movements advocating for Queer, Chicanx, and Latinx identities. Through the theatre, the [re]imagined Sor Juana is introduced to marginalized groups in the United States. I

argue that her presence within this space has made her into a quintessential figure of social progress, particularly for Chicana and Latina individuals. In theatre, a [re]imagination of her character becomes relevant and the embodied performance resonates with a contemporary audience. Specifically, I analyze Estela Portillo Trambley's (1936-1999) *Sor Juana* (1986); Alicia Gaspar de Alba's (1958-living) "Interview with Sor Juana Inés de la Cruz" (1998/2014); and Karen Zacarías's (1969-living) *The Sins of Sor Juana* (2001) so as to explore how they [re]imagine the narrative of Sor Juana. I trace how these three modern day representations of Sor Juana change the historical narrative and expand the way in which she is remembered. This [re]imagined narrative is significant because Sor Juana's transformation on stage allows others to see multiple ways in which some of her experiences during the colonial era are still pervasive in the world today. Thus, audiences find aspects of her story that resonate with their own lived experiences in contemporary America.

Gabriel Rivera

Poster: F15

Home Institution: University of Puerto Rico - Río Piedras

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Anthony Bagues (Africana Studies)

**From a History of Slavery to a History of the Enslaved in Puerto Rico: A Study of its Possibilities and Implications**

The traditional historiography of Puerto Rico quickly concluded that slavery was an "accident" in the Island's history. Although recent works have been able to debunk this myth by demonstrating the importance of slavery during Spanish control, they have centered on the study of the slave institution instead of the enslaved themselves. However, the problem of a history centered in the captives that were brought to Puerto Rico is not just one of silencing but of historical methodology and politics of erasure. By studying a slave conspiracy that took place in 1848 in the city of Ponce, Puerto Rico, my research will try to understand the political and methodological implications of such a work and find alternatives for its production.

Cecilia Slane

Poster: F16

Home Institution: DePauw University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Bathsheba Demuth (History)

**Valuing the Alaskan Wilderness: The 19th Century Writings of John Muir and W.H. Dall**

In the late 19th century, American conservation began to separate into two ideological approaches: scientific and spiritual. Two prominent naturalists, William Healey Dall and John Muir, who both expressed deep admiration for the land they explored during scientific expeditions and personal pilgrimages exemplify the origins of this division. In this project, I am researching how Dall and Muir experienced, valued, and described the Alaskan environment through public essays and personal journals. Using Muir and Dall as key figures, I am investigating how personal motivations inspired their valuing the land as a "wilderness," a pristine place antithetical to civilization.



Home Institution: Brown University

Summer Research Program: Research Assistant

Faculty Mentor: Barbara Stonestreet (Pediatrics, Women and Infants Hospital)

**The Role of Inter-Alpha Inhibitor Proteins in White Matter Growth During Prenatal Hypoxic-Ischemic Injury**

Hypoxic-ischemic (HI) brain injury in premature infants results in mortality and severe neurological deficit. The discovery of endogenous inter-alpha inhibitor proteins (IAIPs) in the brain during development may evince a possible remedy for this damage (Chen et al., 2016). Studies show that IAIP concentration decreases following HI brain injury, suggesting that they mediate normal cell growth in uninjured brain tissue (Disdier et al., 2018). The purpose of this project is to determine the extent to which endogenous IAIPs facilitate the growth of white matter. Cultured neonatal rat oligodendrocytes will be exposed to varying IAIP concentrations and oligodendrocyte growth tracked longitudinally using various staining and microscopy procedures. If IAIPs mediate white matter growth, then they may have a useful clinical application in the treatment of HI brain injury.

# SUMMER RESEARCH SYMPOSIUM POSTERS

Friday, August 2

Physical Sciences, Social Sciences, and Student Team Presentations

## PHYSICAL SCIENCES INDIVIDUAL PRESENTATIONS

Hameed Abdul

Poster: A1

Home Institution: University of Southern Mississippi

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP), CRA-W DREU

Faculty Mentor: David Ritchie (Computer Science)

### **Learning to Generalize 3D Motion Through Graph Neural Networks**

Complex 3D geometry comprises our daily existence. Such geometry is accompanied by ranges of motions and numerous ways to be manipulated. Generalizing 3D motion is a rather non-trivial Computer Vision task. State of the art approaches from the Vision community are fairly complex to train and are poor candidates for real-world applications. From the robotics community, off-the-shelf Vision approaches are used coupled with particle filtering or probabilistic graphical models. As the Vision and Robotics community continues to explore potential methods, certain challenges still remain. We propose using Graphical Neural Networks to map point cloud groupings to a comprehensive kinematic graph. This would represent motion attributes, orientation, and geometry for all objects/parts within the point cloud.

Michelle Adler

Poster: A2

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Ian Wong (Biomedical Engineering)

### **The Effects of Fibrillar Matrix Topography on Cancer Cell Migration**

Most in vitro cancer research models involve the use of single cell cultures in 2D environments which exclude a wide variety of factors potentially critical to cell migration. Cancer microenvironments are characterized by increased collagen density and restructuring of the fibrillar extracellular matrix. Using magnetic nanoparticle and Microtissue molds, cancer cell metastasis can be evaluated in a more robust, biologically relevant manner.

Dana Altoaimi

Poster: A3

Home Institution: Brown University

Summer Research Program: Funded by external, international scholarship program

Faculty Mentor: Alexandria Johnson (DEEPS)

### **Electrodynamic particle trapping for exoplanet atmospheric studies**

Hazes and cloud decks can limit the detection of vital information concerning the atmospheres of exoplanets. The Exoplanet Electrodynamic Balance (ExoEDB) helps eliminate this challenge by providing a lab-based platform to levitate, trap, and study the behavior of exoplanet cloud analogs under varying atmospheric conditions. The ExoEDB opens a window into investigating the different properties of the trapped particles, including nucleation, crystalline structural changes, surface interactions, and radiative properties. This work aims to characterize the ExoEDB system and proposes the optimal parameters required to stably trap exoplanet cloud analog particles. It then serves as a basis for future work in the field of exoplanet atmospheric studies in the lab as well as through observations and sophisticated modeling.

Teresa Amor

Poster: A4

Home Institution: Brown University

Summer Research Program: Summer Intern with Professor Silverman - Engineering

Faculty Mentor: Harvey Silverman (Engineering)

### **Improved Infant Cry Analysis System and LSTM Neural Network Classification**

Since 2011, in conjunction with Women and Infants Hospital, a cry-analysis system has been developed and improved. Last year basic work was done to expand the system to handle long, 12-hour recordings. Current work has made the system more robust and has used it to analyze new infant-cry datasets using LSTM neural networks. Infant syndromes investigated include opioid addiction, premature birth, and pain versus non-pain. Some of the problems in developing the system will be presented and results to date on classifying various hypotheses will be shown.

Charles Bares

Poster: A5

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Daniel Harris (Engineering)

### **Aerodynamic Design of an Underbody Diffuser**

Since the introduction of inverted wings in the 1960s for use in the Formula 1 circuit, aerodynamic downforce has played an increasingly important role in racing vehicle performance and success. Our current research sets the foundation for the development of an aerodynamics package for Brown Formula Racing's open-wheeled vehicle by first focusing on the design of an underbody diffuser. Computational Fluid Dynamics (CFD) studies were performed to optimize multiple geometric parameters with particular focus given to optimizing the shape of the rear diffuser section. Our simulations show good agreement with previously published experimental data and scale models were constructed for further experimental validation of the design in the University's wind tunnels.

Shoham Benmelech

Poster: A6

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Ian Wong (Biomedical Engineering)

**Investigating Silk Collagen Hydrogels for Mimicking the Dynamic Phenotypes of the Extracellular Matrix in Cancer Progression**

As cancer diagnoses increase steadily in developed countries, metastasis proves to be the leading cause of death. During metastasis (the migration of cancer cells from a primary to a secondary tumor) the extracellular matrix (a network of macromolecules that offer structure and support in the bioenvironment) changes drastically in response to cellular signals. We investigate the potential of recreating the dynamic topographies of the ECM during progressive stages of cancer metastasis using collagen (a protein naturally found in human ECM) to provide cell adhesion sites, and silk (a biocompatible protein derived from silkworms) to enable tunable matrix stiffness. Overall, we envision tunable in vitro platforms as a step toward personalized cancer treatment.

Julia Berkson

Poster: A7

Home Institution: Brown

Summer Research Program: Research assistant to Brown professor

Faculty Mentor: Chris Huber (Geology)

**Characterization of volatile content of lunar volcanic glasses using the Markov chain Monte Carlo method**

The presence of volatiles in primitive lunar basalts can provide insight into the formation and evolution of the moon and the composition of the lunar mantle. Diffusion curves of volatiles from erupted lunar glass beads, obtained by Saal et al. 2008, have been used to estimate indigenous water content of lunar magma. The water content estimates were unexpectedly high, since the moon is thought to have formed from a massive heating event. In this study, we use an optimization procedure to constrain the family of solutions that best fit the data and show that the water diffusion profiles can be fitted with a wide range of initial water content depending on the choice of clast cooling history.

Solana Buchanan

Poster: A8

Home Institution: Rice University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: James Russell (DEEPS), Timothy Herbert (DEEPS)

**West African Climate Changes Across the Plio-Pleistocene Boundary**

The Plio-Pleistocene Boundary is known for the onset of Northern Hemisphere glaciation approximately 2.7 Ma, that can be linked to an overall cooling of Africa over this period. By analyzing organic biomarkers from ODP Site 659, we reconstructed tropical sea surface temperature

(SST) and past terrestrial vegetation from 3.3-2.3 Ma. Analysis of the SST shows decreases through time which indicates links between Northern Hemisphere glaciation and tropical SST. Observations of the average n-alkane chain length imply relatively constant long-term vegetation trends but may display an inverse relationship with SST at orbital-time scales. Our data show links between West African tropical SST and North African vegetation trends which can help us form a more complete picture on past climate conditions.

Ye Won Byun

Poster: A9

Home Institution: Brown University

Summer Research Program: Conducted with faculty.

Faculty Mentor: Jia Li (Physics)

**Graphene/hBN Heterostructures with Two-Corbino Geometry and Quantum Point Contact**

Isolation of atomically thin crystals has driven intense research efforts into the physics of two-dimensional (2D) materials. These so-called van der Waals (vdW) materials are characterized by strong interatomic bonds within the 2D plane and weak vdW interactions between the layers, providing a great platform for the creation of heterostructures with a variety of properties. This project will develop a heterostructure consisting of alternating graphene, hexagonal boron nitride, and graphene monolayers, implementing Corbino geometry and Quantum Point Contact (QPC) structure which enables measurements such as longitudinal conductance and thermal flux. Ultimately, this research aims to advance our knowledge of quantum phenomena in low dimensional systems which leads to technological innovation towards future quantum computation.

Joseph Cavanagh

Poster: A10

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Lai-Sheng Wang (Chemistry)

**First Observation of a Transition Metal–Boron Triple Bond in ReB<sub>2</sub>O-**

Boron's electron deficiency causes it to bond readily with metals, forming many structures with unique properties. While boron's ability to form double bonds with metals is widely documented, the existence of a metal-boron triple bond has only been confirmed recently in the linear nanocluster BiB<sub>2</sub>O. Here we report the first experimental observation of a metal-boron triple bond in the nanocluster ReB<sub>2</sub>O using photoelectron spectroscopy and ab initio quantum chemical calculations. The relatively simple photoelectron spectrum taken suggests a highly symmetric structure. Furthermore, ab initio quantum chemical calculations suggest that this cluster has linear geometry and contains a Rh-B triple bond. This new observation may pave the road to future investigation into the nature of transition metal-boron nanoclusters.

Jungho (Daniel) Choi

Poster: A11

Home Institution: Brown University

Summer Research Program: Independent Researcher in research group at Brown  
Faculty Mentor: Brenda Rubenstein (Chemistry)

### **Using Symmetry to Mitigate the Sign Problem in Quantum Monte Carlo Simulations**

Quantum Monte Carlo (QMC) simulations are a suite of algorithms that numerically solve the Schrödinger Equation by sampling the equation with random numbers. In general, QMC algorithms scale nicely with system size while converging to an accurate solution. Unfortunately, due to the 'sign problem', QMC simulations of fermionic systems revert to solving the problem in exponential time, leading to extremely long computations. This project attempts to mitigate this problem by examining how physical symmetries impact the creation of Slater determinants in QMC that cancel each other's signs. The results will then be used to develop codes and theory that improve the sampling process in QMC.

Allie Coonin

Poster: A12

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Christian Huber (Earth, Environmental, and Planetary Sciences)

### **The Effect of Deglaciation on Subglacial Magma Chamber Dynamics and Eruption Cyclicality**

Correlations between glacial and volcanic records suggest volcanism is coupled with the removal of overlying ice. Ice unloading reduces pressure conditions inside the magma chamber at depth and affects conditions leading up to volcanic eruptions. This project utilizes numerical modeling of magma chamber dynamics to study the effect of the removal of a 1km ice sheet on eruption cyclicality. We expect volatile exsolution in the magma caused by ice unloading to shorten the system's longevity and increase the average volume erupted when the rate of unloading is fast compared to the rates of magma cooling and of crustal relaxation. Climate changes may perturb the eruption cycle of presently-glaciated volcanoes, further undermining the stability of ice sheets through various feedbacks.

Eashan Das

Poster: A13

Home Institution: Brown University

Summer Research Program: Space Grant/NASA

Faculty Mentor: John Mustard (Department of Earth, Environmental and Planetary Sciences)

### **Laboratory Testing of the Factor Analysis-Target Transform Method for Mineral Detections at Low Abundances from Hyperspectral Data**

Hyperspectral imaging spectroscopy has a proven capability to detect the presence of minerals on planetary surfaces remotely. Innovative new methods to detect target mineral presence and location at low abundances have been developed and applied to planetary data but with little validation. One such method is the Dynamic-Aperture Factor Analysis/Target Transform (DAFA/TT). While promising, this method has not been rigorously tested in laboratory settings. In this project we assess the DAFA/TT mineral detection method with laboratory hyperspectral imaging data. A suite of

target minerals, previously detected on Mars (serpentine, calcite, opal, selenite, montmorillonite, nontronite), are mixed in small proportions (1-10%) with a Mars soil simulant to create mixtures. We then rigorously test DAFA/TT's capabilities with laboratory hyperspectral imaging.

Evan Dastin-van Rijn

Poster: A14

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Nicole Provenza (Biomedical Engineering), David Borton (Biomedical Engineering)

### **Artifact removal from Local Field Potential recordings during Deep Brain Stimulation**

My project is part of an ongoing BRAIN Initiative-funded effort to design responsive algorithms to treat Obsessive Compulsive Disorder (OCD) using Deep Brain Stimulation (DBS). Currently, DBS systems are adjusted in an "open-loop" fashion, where parameters are tuned by a clinician during appointments spaced up to weeks or months apart. This "open-loop" paradigm is not ideal, as stimulation parameters may not be sufficient for treating severe symptoms. A "closed-loop" system may provide a solution by responsively varying stimulation parameters based on biomarkers indicating symptomatic behavioral states. Specifically, my research is focused on interpreting, processing, and removing the high amplitude, periodic artifacts contaminating local field potential recordings during DBS. This preprocessing step allows for subsequent analysis of OCD symptoms and identification of biomarkers using data from psychophysical tasks.

Ben Davidson

Poster: A15

Home Institution: Luther College

Summer Research Program: Incorporated Research Institutions for Seismology (IRIS)

Faculty Mentor: Colleen Dalton (Earth, Environmental and Planetary Sciences)

### **Rayleigh Wave Amplification in Alaska**

Alaska is located along the Alaskan-Aleutian subduction zone, where the Pacific plate subducts beneath the North American plate. This subduction zone creates surface features such as the Aleutian volcanic chain and the Wrangell volcanic field. Amplification can be used to understand how properties of the Earth and the Earth structure relate to the observable surface features. Rayleigh waves from far away earthquakes are recorded by the Earth Scope transportable array stations in Alaska. Amplification calculations from Rayleigh waves sampled at different periods are more sensitive at various depths within the Earth. These amplification measurements, combined with past phase velocity measurements, contribute to a build a model of the Earth's shear wave velocity structure in the study region.

Wylie De Groff

Poster: A16

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: James Russell (DEEPS)

### **Using Azorean Lake Sediment Records to Understand Environmental Effects of European Colonization**

European colonization of the Azores in the 1400s significantly changed the terrestrial ecosystems of the islands. To understand these environmental impacts over time, we used lake sediment records from the island of Flores. We used sterols and stanols to look for the presence of humans and herbivores and leaf waxes to look at changes in vegetation. We found that European settlement was recorded in the record of sterols and stanols, with increased sterol and stanol concentrations appearing more than a century before official settlement, indicating a possible earlier attempt at colonization of the island. Our leaf wax record shows a significant change in vegetation coinciding with colonization, indicating landscape transformation in the process of colonization.

Eric DuBois

Poster: A17

Home Institution: Brown University

Summer Research Program: DiMase Summer Internship

Faculty Mentor: Ian Wong (School of Engineering)

### **Customizable, Adherable Hydrogels for Investigating Cell Interaction and Drug Release**

Hydrogels are tunable polymer networks which can be used for drug delivery, filtration and tissue engineering. These networks can be easily 3D printed and molded into complex shapes for easy macro-level assembly and customized functionality. For this UTRA, I am developing hydrogel blocks that mimic cell microenvironments and can be robustly adhered together to investigate interactions across the interface. By using an ionic binding motif, we can develop a secondary interface and incorporate microfluidic systems to study drug release and diffusion.

Grace Fan

Poster: A18

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Ugur Cetintemel (Computer Science)

### **DeepSqueeze: Semantic Big Data Compression using Deep Learning Models**

Within the Big Data, there is a widespread issue of inefficient use and analysis of real-life datasets. So, we have decided to compress data into small representations that still preserve its content. This approach requires a thorough analysis of deep learning and data distribution models, as well as the effects they have on each other. By using autoencoders and neural networks to compress relational data tables and achieving the best compression ratio and runtimes, we can optimize time within database systems. This way, the minimal-loss compressional methods can also save a great amount of storage usage. Moving forward, future studies can take advantage of these results to better optimize model-based query processing, and improve efficiency in databases in general.

Batia Friedman-Shaw

Poster: A19



Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Brenda Rubenstein (Chemistry)

**Making Waves: Approximating Solutions to the Hubbard Model Using the Power Method**

Exact diagonalization may - in principle - be used to determine the wave functions and associated energy levels of any system whose Hamiltonian can be specified. As system sizes grow, however, the exact diagonalization becomes extremely time consuming, and efficient approximations are preferred over exact solutions. One such method of wave function approximation is the Power Method - about which I am currently learning. In this method, one forms a matrix propagator associated with the potential and kinetic energies of a system. This propagator is iteratively applied to a random initial wave function which, after a number of iterations, converges to a wave function describing the desired system. Studying the Power Method will help me better understand approximation methods for future research.

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Laila Gamaleldin

Poster: B1

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Elizabeth Chen (Brown Center for Biomedical Informatics)

**Automated Collection and Analysis of Suicide Risk Factors from Electronic Health Records**

Electronic health records contain an abundance of social and family history information. This information can help to better trace the social and behavioral factors (SBF) that correlate with a higher propensity for suicidal thoughts and behaviors. Using the portion of the Medical Mart for Intensive Care III (MIMIC-III) database focused on suicide-related admissions, we developed a program to automatically extract patient social and family history data from discharge notes. Essential Keywords surrounding patients' SBF were generated using MetaMap, a natural language processing tool for biomedical text. Gathered data was then analyzed for sequential patterns as well as association rules.

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Madelyn Gatchel

Poster: B2

Home Institution: Davidson College

Summer Research Program: DREU

Faculty Mentor: R. Iris Bahar (Computer science/engineering)

**Multi-SpoNN: A Lightweight Network for Multiple Object Detection**

Many autonomous robots rely on efficient neural networks. SpooNN is a lightweight convolutional neural network for object detection that is optimized for FPGA implementation. However, the network only supports single object detection without classification. In this project, we extend the network capability to detect and classify multiple objects and then evaluate network performance on various datasets appropriate for autonomous robots.

Miriam Gordin

Poster: B3

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Kavita Ramanan (Applied Mathematics)

**Approximations of Marginal Dynamics for Voter Models on (Possibly Random) Graphs**

Discrete-time stochastic interacting particle systems are high-dimensional Markov chains that describe the joint evolution of a large collection of particles, in which the evolution of each particle depends only on its neighbors within a specified underlying interaction graph. Such systems can be used to model the evolution of voting behavior and opinions in a group of people over time. We characterize the marginal dynamics for such models (for a typical person, or of a pair of neighbors) on different graphs (including the complete graph, cycle, and Erdos-Renyi random graphs). Since this is computationally intensive, we also study and compare the efficacy of classical mean field approximations and more recently established local equation approximations, for the marginal dynamics on such graphs.

Elizabeth Healy

Poster: B4

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Brian Sheldon (School of Engineering)

**The Impact of Oxide Content on Cycle Life and Stress Evolution in Silicon-based Composite Electrodes**

Silicon is a promising anode for the next generation of lithium ion batteries, but it undergoes extremely large volume changes during lithiation/delithiation. This leads to substantial stresses inside of particle-based electrodes, which are believed to cause poor cycling performance. Composite electrodes that also incorporate oxidized silicon are a cost-effective way to accommodate these stresses and extend cycle life. To obtain fundamental information about the chemomechanical phenomena in these composite structures, both silicon nanoparticles with oxide shells and silicon thin films with oxidized surface layers are investigated. By varying the oxide layer thickness in both schemes and analyzing the evolution of internal stresses in conjunction with electrochemical measurements, the trends between oxide content and stress evolution can be examined.

Kimberly Hernandez

Poster: B5

Home Institution: Wellesley College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Alexandria Johnson (DEEPS)

**ZnS and KCl clouds on exoplanets: GJ1214b**

Planets found outside of our solar system, or exoplanets, are ubiquitous, with unique properties compared to our solar system. In this work, we focus on the super-Earth exoplanet GJ 1214b that was discovered by the MEarth project in 2009. While clouds have been detected in its atmosphere,

the composition of the atmosphere below remains unclear.

We aim to obtain identifying scattering patterns for ZnS, KCl, and mixtures of ZnS and KCl (mineral and salt) particles in the lab, which have been theorized to compose clouds in the atmospheres of exoplanets like GJ 1214b. In order for us to understand these scattering phase functions, described by the intensity of the scattered light at different angles, I designed virtual instruments in LabVIEW that controlled our photomultiplier (PMT) detector (specifying the angle increments, number of steps and velocity). The light scattered by these particles was then measured with the PMT by sweeping it around an inflow of particles that have been illuminated with a green (532 nm) laser, which allows us to collect data on scattered light from  $\sim 20$  to 160 degrees from incident. Using these results in conjunction with planetary phase function observations and modeling, the broader exoplanet community will have a new tool by which to learn what lies below these clouds and further understand these unique environments. By characterizing the outer layer of an exoplanet's atmosphere, scientists can better understand an exoplanets' formation, intrinsic properties, and the possibility to sustain life, bringing scientists closer to discovering a habitable exoplanet.

Nola Iwasaki

Poster: B6

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Amit Basu (Chemistry)

### **Rotating Antibiotics: Modifying Antibacterial Diamides and Investigating their Conformational Isomerism**

Antibiotic resistance, one of the most severe global public health threats today, demands the rapid development of new, creative antibiotics. Several diamide compounds produced in the Basu Lab have shown antibacterial activity by inhibiting enzymes that recycle the bacterial cell wall during cell division. Understanding the conformations of these diamides can help elucidate how they interact with and inhibit the target enzymes. NMR studies suggest many of the diamides exist in multiple conformations resulting from restricted bond rotation. Techniques such as variable temperature NMR and hydrogen-deuterium exchange experiments can be used to understand what dictates these conformations. Diamides with two secondary amides are also being synthesized to expand the existing library of diamides containing both a secondary and tertiary amide.

Zev Izenberg

Poster: B7

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Karen Fischer (Earth, Environmental, and Planetary Sciences)

### **Visualizing Earthquake Fault Planes in Nicaragua**

I'm using a precision method to relocate earthquake data and determine fault planes in Lake Managua, Nicaragua. My visualizations of these data will illustrate the proximity of major fault lines

to population centers and contribute to our understanding of fore-arc sliver transport.

Zach Kapner

Poster: B8

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Amit Basu (Chemistry)

**Language in Biological Chemistry: A Key to Understanding The Complexities and Nuances of Modern Research**

From the first edition of Dr. Albert Lehninger's Principles of Biochemistry to the more modern For Dummies series on organic chemistry, the vast array of information, terms, and concepts comprising the intersection of chemistry and biology has been presented exactly as such: a vast array, designed to be studied and memorized, driving a lack of appreciation for the language of science and perpetuating misunderstanding of the modern language phenomena shaping the world of research today. By analyzing key patterns in language use- like the -ome and -omics evolution- and building language-based study resources for students, this project attempts to elucidate the role of language in science, for both those learning the basics and those advancing the frontier.

Gee Kim

Poster: B9

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Edward Hawrot (Biology), Tanya Sanders (Biology)

**Alpha-3 Nicotinic Acetylcholine Receptors in the Medial Habenulla**

My project will center on mapping areas of the mouse brain where we have discovered variability in the density of alpha-3 receptors for unknown reasons. I will be concentrating on the medial habenula due to our lack of exploration of this area of the brain despite surrounding areas in the periaqueductal gray have consistently high concentrations of alpha-3 receptors and the habenula is involved in pain processing. Articles on the exploration of the medial habenula are limited, so additional research into the relation of the medial habenula to alpha-3 nAChRs and the areas connecting to medial habenula will assist the Hawrot lab to understand the function of alpha-3 nAChRs.

Jeong Woo Kim

Poster: B10

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Elie Bienenstock (Applied Mathematics)

**Recurrent K-WTA Networks as a Model of Excitatory-Inhibitory Balanced Networks**

Excitatory-inhibitory balanced networks exhibit asynchronous activity, which is deemed essential for cortical computations. However, models of E-I balanced networks require a fine tuning of the ratio of E to I neurons as well as a period of adjustment to asynchronous activity. We propose K-WTA

recurrent networks as a fruitful tool for understanding the underlying dynamics of E-I balanced networks. Although the K-WTA dynamics is simple, it is highly non-linear and non-differentiable. Many alterations and versions of the K-WTA are explored. At its core, a neuron fires if it is one of the K winners with respect to a certain variable (i.e. membrane potential).

Solomon Klein

Poster: B11

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Reid Cooper (Geology)

### **Garnet Formation in Gore Mountain (NY) Amphibolite**

The Barton Garnet Mine in the Adirondack Mountains contains some of the worlds largest megacrystic garnets in a coarse-grained amphibolite. During the garnet-forming reaction, hornblende is also produced; this hornblende forms a rim surrounding the garnets, cutting off contact with the surrounding amphibole. As a result, fluids diffusing through the hornblende rim limit garnet formation. By using microprobe analyses of the hornblende rim, the elemental profile of the hornblende rim is captured and used to characterize diffusion, with the intent of describing garnet growth rates.

Nishanth Kumar

Poster: B12

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Stefanie Tellex (Computer Science)

### **Scoping within Object-Oriented Markov Decision Processes**

Artificial Intelligence agents can make use of object-oriented models of the world to plan and act. This is especially useful for real-world robots. However, these models are often large and contain much information that might be irrelevant to a particular task. As a classical example, a robot does not need to consider what the outside humidity is if it is attempting to find a particular person in the CIT. Our work attempts to answer the question of 'what is relevant?' for a particular goal and set of actions an agent might be able to perform. We introduce methods inspired by Classical AI Planning literature to attempt to answer this question and 'scope' the prototypical object-oriented representation: an Object-Oriented MDP. By using a combination of our method and Mixed-Reality technology, we hope to be able to provide robots with large, object-oriented world-models and have them quickly plan to accomplish complex tasks within them.

Eindra Kyi

Poster: B13

Home Institution: Smith College

Summer Research Program: REU

Faculty Mentor: Jeff Huang (Computer Science)

**Self-E**

A diary study of a semi-guided app self-experiment app for novices.

Luc Langlois

Poster: B14

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Anita Shukla (Biomedical Engineering )

### **Targeted Antifungal Liposomes for the Treatment of Systemic Fungal Infections**

In the last decade, there has been a sharp increase in antifungal drug resistance. To remedy this, we aim to encapsulate antifungals within liposomes, developing a novel antifungal delivery agent. Liposomes are phospholipid bilayer vesicles that can integrate therapeutics and be designed to deliver them to specifically targeted cells. To increase the attachment of our liposomes to *Candida albicans*, we are seeking to incorporate the peptide P113Q2.10 through the use of click chemistry. We hypothesize our antifungal liposomes incorporated with a targeting moiety will improve antifungal solubility, increase targeting of antifungals to *Candida* and extirpation of the fungus, and aid in preventing further antifungal resistance from developing.

Brendan Le

Poster: B15

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Jeff Huang (Computer Science)

### **Sketchy: Drawing Inspiration from the Crowd**

From in-person user studies, we observe designers relying on inspiration to assist their iterative design process while they sketch. However, inspiration is rarely supported in creativity support tools for sketching. To address this issue, we present Sketchy, a web-based drawing application that lets users join virtual rooms and gain inspiration from their peers in real-time. Data from user studies are used to develop the Peek model, an ExtremeGradient Boosting(XGBoost) classifier, that can predict whether a sketch is inspirational. Sketchy serves as a creativity support tool that empowers user's creativity when they peek to view another user's sketch, while simultaneously collecting training data from users votes in a naturalistic setting.

Bunlong Leang

Poster: B16

Home Institution: Brown University

Summer Research Program: Rubenstein Lab

Faculty Mentor: Brenda Rubenstein (Chemistry)

### **Molecular Dynamics of FUS Protein and Beta-Lactamase**

A major concern in pharmaceuticals is the adaptation of bacteria to become resistant to antibiotics. The gram-negative bacteria for example, harness the effects of the  $\beta$ -lactamase enzyme which helps them resist  $\beta$ -lactam antibiotics such as penicillin. My research focuses on the simulation of the molecular dynamics of various different mutated versions with the original (wild) type included for

comparison. These mutants include 93R\_S, 144G\_E, 163D\_Y, and double mutation 213A\_G/57L\_H. Different parts of the enzyme were analyzed for any movement over the course of five nanoseconds using a baseline intra-enzymatic displacement to account for significant movement. The mutated residues were observed along with the omega loop and a rather interesting chain consisting of residue 148-152. By better understanding  $\beta$ -lactamase and its potential mutations, pharmaceutical scientists may hopefully keep up with ever adapting antibiotic-resistant bacteria.

Andrea Llamas Sanchez

Poster: B17

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Kareen Coulombe (Engineering (Biomedical))

### **Alignment of Cardiomyocytes in Engineered Tissue Through Biophysical Growth Cues**

The focus of this project is to assess the alignment of intracellular proteins in heart muscle cells by processing engineered cardiac tissues, staining the tissue to identify the proteins of the muscle, and developing a new image analysis using MATLAB. In order to identify and quantify the presence and alignment of sarcomeres, I used microscope images of cells and wrote a code using MATLAB that analyzes the images for the defined geometric parameters and returns the desired data. The program accepts images and provides the total number of sarcomeres analyzed, their position and size in reference to the cell, and plot graphs that display the data. The automation of identifying and evaluating key components of cell structures in this new software tool will facilitate similar analyses in other experiments.

Xavier Loinaz

Poster: B18

Home Institution: Brown University

Summer Research Program: Paid research opportunity, but not UTRA

Faculty Mentor: Vicki Colvin (Chemistry/Biomedical Engineering/Molecular Pharmacology, Physiology, and Biotechnology)

### **Optimizing PAMPS-LA Polymer Chain Size for Gadolinium-Oxide Nanoparticle MRI Contrast Agents for Detecting Glioma**

Magnetic resonance imaging (MRI) produces medical images by applying a magnetic field on an organism's tissue and detecting the relaxation (change in spin) of the protons in water molecules. Making this relaxation easier is favorable for image contrast. Thus, for applications in detecting glioma, gadolinium-oxide nanoparticle contrast agents can be introduced into the body to improve proton relaxivity. These nanoparticles have surface coatings allowing them to be soluble in the bloodstream, and poly(2-acrylamido-2-methyl-1-propanesulfonic acid-lauryl acrylate), abbreviated as PAMPS-LA, is a polymer used for this purpose. From a prior study, its optimal chain size for the greatest yield in transfer into polar solvent is 6 to 10 kilodaltons, and in this project synthesis parameters were modified to achieve this chain size.

Edwina Lorient

Poster: B19

Home Institution: Central Connecticut State University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Christopher Bull (Engineering)

**‘The effect of different operating conditions on photovoltaic module performance’**

Solar panels are fundamental components in the photovoltaic (PV) power system, and these systems are used to convert solar energy to electrical power. The goal of PV systems is to extract the maximum power from installed modules under different lighting conditions. However, these systems may convert power less efficiently due to factors such as shading. This research investigates the equivalent circuit model and its characteristics under different partial shading conditions. Furthermore, this study looks at the relationship between output power lowering due to shading and the variation of power losses in association with the series. Using the equivalent circuit model, this paper illustrates the electrical power delivered by the module at different shading configurations according to the power-voltage and voltage-current curves. Included in the illustrations will demonstrate how the parameters of the PV module is a function of shading. This research will demonstrate how susceptible photovoltaic systems are to partial shading.

Jacqueline Luke

Poster: C1

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Allan Bower (Engineering)

**Implementation of Radio-Based Positioning System for Quadcopter Drones**

This project seeks to implement wireless a radio-based system to fly quadcopters using hardware developed by Bitcraze. This enables the quadcopters to fly autonomously via Python scripts as well as via real time user input more accurately with a greater range of motion than the image based positioning system used previously. Additionally, this implementation of this radio-based system allows multiple drones to fly simultaneously and can also fly drones synchronized as a swarm. The accuracy of this system was analyzed via MATLAB using the position and velocity data from the accelerometers of the quadcopters. This goal of this project is to further develop this system for future educational use, featuring position-velocity-acceleration data analysis as well as PID feedback control algorithms.

Luke MacHale

Poster: C2

Home Institution: Montana State University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Brenda Rubenstein (Department of Chemistry)

**Understanding the Thermodynamics of the 4-component Ugi Reaction Mechanism to**



### **Facilitate Molecular Data Storage**

With an unprecedented production of data worldwide, there rises an increasing global demand for smaller, more dense information storage media to keep pace. One fascinating alternative to conventional flash memory is molecular data storage: the storage of information in the trillions of molecules that we encounter on an everyday basis. In this work, we study how successfully information can be stored in one highly diverse class of molecules, known as Ugi molecules. The Ugi reaction employs a 4-component mechanism in which four separate reactant molecules combine to form a single, substituted product. This product is useful because a handful of reactant molecules can be used to produce a combinatorial large number of products, which can also be used for drug screening. We specifically use electronic structure theory to predict which Ugi reactants will most successfully yield their expected Ugi products. It's found that the energy change in free energies from reactants to final Ugi product with consideration of the intermediate imine is a strong predictor of whether the expected products will form. Our findings not only highlight which Ugi products will serve as the best candidates for information storage, but shed light on the mechanism underlying the Ugi reaction as well.

Andrea Malpica

Poster: C3

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Samiah Moustafa (Institute at Brown for Environment and Society)

### **Quantifying Ice Algae on the Greenland Ice Sheet using Satellite Imagery and Field-based Observations**

The Greenland ice sheet (GrIS) is losing ice at the fastest rate in 350 years and is an increasingly important contributor to global sea level rise. Currently, meltwater runoff is the primary source of GrIS total mass loss. Surface albedo, or ice sheet reflectivity, controls how much meltwater is generated on the ice sheet. Surface darkening coincides with a decrease in albedo. Biologically active impurities, 'bioalbedo', may play an important role in surface darkening. Expanding on the efforts made in Wang et al (2018) using Sentinel 3A satellite imagery and a spectral ratio index, this research will help to quantify the distribution and biomass abundance of ice algae from satellite imagery in a well-studied, coincident field survey and at three latitudinally-distributed drainage basins in west Greenland.

Willie McClinton

Poster: C4

Home Institution: University of South Florida

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: George Konidakis (Computer Science)

### **Meta-Learning with Multi-Level Hierarchies via Context Variables**

Sample efficiency has been one of the biggest problems for practical Deep Reinforcement Learning (DRL) because these algorithms tend to require large amounts of experience to learn an individual

task, which is not feasible with datasets generated from real-world experience. One possible avenue of remediation is Meta-Reinforcement Learning which enables agents to learn new tasks from small amounts of experience, by leveraging the data of past tasks and experiences. Specifically, Meta-Learning Context Variables have been shown to learn how to infer a hidden objective from state action transitions speeding up the sample efficiency of some Reinforcement Learning algorithms. Another approach, Hierarchical Reinforcement Learning, has shown that learning multi-level hierarchies can potentially accelerate learning in sparse reward tasks by dividing a problem into a set of short horizons subproblems and can also be used transfer knowledge transition dynamics between tasks. We believe that combining these approaches can lead to the benefits of both in one framework, further improving the sample efficiency over DRL tasks. Our approach reimagines context variables as task representations, leveraging information about the dynamics and reward structure of our task, of which we can use to generate a goal given the task. By adding this approach to the learning of multi-level hierarchies of policies, we can meta-learn a high-level goal representation concurrently with the lower-level multi-level hierarchical policies able to achieve that high-level goal. By decoupling the learning of multi-level hierarchies to achieve sub-goals during tasks and the meta-learning the context variables (tasks representations) to infer goals over different tasks we can hopefully improve the sample efficiency in both ways in parallel.

Samantha McGraw

Poster: C5

Home Institution: Brown

Summer Research Program: Space Grant/NASA, Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Jonathon Pober (Physics)

### **MWA Delay Spectrum Data Analysis**

I'm using a program called SimpleDS to do an analysis of data from the MWA, a telescope-style array that collects data with the goal of detecting the 21 centimeter line of neutral hydrogen from the Epoch of Reionization. The MWA initially had its 128 antennas positioned randomly before antennas were reconfigured into a highly regular hexagonal grid. These two patterns allowed for two types of data analysis, one of which has already been analyzed. I am using the other method, which is crucial because the different techniques have very different responses to systematic errors due to the other astrophysical emissions present in the data. Using this allows us to create future projects to research the early universe with more ease.

Lisette Melendez

Poster: C6

Home Institution: University of South Florida

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: John Mustard (Department of Earth, Environmental, and Planetary Sciences)

### **North Polar Layered Deposits on Mars: Investigating the Effect of Perennial Dust Deposits on Water-Ice Sublimation**

The north polar layered deposits of Mars are alternating layers of dust-rich and water ice-rich content that exist on the polar troughs of Mars, and through the study of the polar region, it is possible to extract information about martian paleoclimatic systems. The young mantling deposits are four low-albedo sediment deposits that exist around the Planum Boreum, creating a blanket-like feature over the north pole. The trough walls that it covers are riddled with protrusions, or layers that are more erosionally resistant and therefore extend further out from the wall. In this study, we aim to find a connection between the young mantling deposits and their effect on water-ice sublimation. We want to compare the difference between protrusion on and off the YMD. The amount of relative protrusion corresponds with the amount of erosion that the trough wall is undergoing. We created protrusion profiles for areas both on and off the YMD from the elevation data gathered in ArcGIS using MATLAB, where we created a smoothed line using a Savitzky-Golay filter and then subtracting our raw data from it. Our results indicate that layers are approximately 1.38 meters less protrusive on average underneath the YMD. This results will be useful in constraining the climatic forces that affect Mars during the Late Amazonian and help scientists develop accurate models of the martian surface.

Jacob Migneault

Poster: C7

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Richard Gaitskell (Physics)

### **Identifying Neutrinoless Double Beta Decay with Neural Networks**

Observing neutrinoless double beta decay would establish that the neutrino is its own antiparticle and give information about the mass scale of the neutrino. The Lux-Zeplin (LZ) dark matter detector uses a low background liquid xenon time projection chamber (TPC) which is able to observe double beta decay. Through physics simulations of signal and background events, this project evaluates the effectiveness of neural networks for pulse shape background discrimination on neutrinoless double beta decay.

Eric Mischell

Poster: C8

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Jung-Eun Lee (Geology)

### **Regional and Seasonal Responses of Tropical Precipitation to Past Climate Changes**

Climate models and proxy data indicate that the Intertropical Convergence Zone (ITCZ), a region of confluent equatorial winds characterized by persistent and intense precipitation, has shifted position over the past several thousand years due to climate changes. Currently, the annual mean ITCZ has idled in the Northern Hemisphere, but paleoclimate data indicates significant regional and seasonal variability. The discrepancy between models, which suggest a stable past ITCZ, and proxies, which show a broader latitude of migration due to seasons and continentality, demonstrates a failure of current climate models. By analyzing climatological data from models and proxies, I hope to better

understand the ITCZ, which is a key signifier of heat transport and is critical to understanding the global climate system.

Kitty Moy

Poster: C9

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Tayhas Palmore (School of Engineering)

**Innovations based on Conductive Polymers: Design, Synthesis, Characterization, and Testing of a Semi-Interpenetrating Polymer Network Based Actuator**

This project focuses on conductive polymers and their use in emerging technologies where lightweight, flexible, and conductive materials are needed but not yet available. Specifically, this project looks at understanding and developing a general protocol for the production of a semi-interpenetrating polymer network (s-IPN) based actuator. A poly(ethylene oxide)/polybutadiene s-IPN is synthesized from a free radical polymerization reaction and made conductive by the polymerization of 3,4-ethylenedioxythiophene within the IPN matrix. The resulting polymer will be characterized by H-NMR, SEM, XPS, and XRD in addition to electrochemical and mechanical testing.

Casey Nelson

Poster: C10

Home Institution: Brown University

Summer Research Program: NSF

Faculty Mentor: Iris Bahar (Computer Engineering)

**Modeling Applications to Create Realistic Workloads for NDP Architectures**

Previous studies of utilizing near data processing and NDP-aware implementations of concurrent data structures have shown both performance and energy efficiency improvements over the current, advanced implementations. However, the workloads used for these studies selected operations to perform randomly. Random sequences of operations do not well match real world applications which often exhibit patterns in data accesses. To better test the benefits of NDP usage, I have developed workloads which model the ordering and ratios of operations to match real-world applications. These new workloads also distribute data access in a way which creates hotspots, nodes with higher rates of accesses, in order to create a more realistic data access pattern.

Bonnee Nie

Poster: C11

Home Institution: Brown University

Summer Research Program: I am an undergraduate researcher in the Shukla Lab

Faculty Mentor: Anita Shukla (Biomedical Engineering)

**Investigating molecular interactions with a placental lipid bilayer**

Currently, in vitro techniques for investigating small molecule interactions with the maternal-fetal interface are limited. The placenta, which controls nutrient and waste transport during pregnancy, is

one of the least understood human organs. A technique for forming supported lipid bilayer models of the placenta via quartz crystal microbalance with dissipation monitoring (QCM-D) has been developed in our lab. QCM-D monitors frequency and dissipation changes, which allows us to understand mass and rigidity changes. Using this method, we have monitored molecular interactions between small molecules (including phthalates and antifungal therapeutics) and these placental bilayers in order to investigate their interaction at the maternal-fetal interface. We seek to use the results of this experiment to reinforce standards for maternal safety.

Katie O'Leary

Poster: C12

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Yongsong Huang (Department of Earth, Environmental, and Planetary Sciences)

**Were They There Yet? Human Settlement and Environmental Impacts on the Azores in the Middle Ages**

The Azores Archipelago is a volcanic island chain in the mid-North Atlantic Ocean that was historically settled by the Portuguese in 1427 AD, however, palynological studies place human settlement at an earlier date. To pinpoint the timing of human settlement on Corvo island and ecological changes overtime, we are using biomarkers from lake sediment cores. Fecal sterols and stanols are used as indicators for humans and livestock, and leaf wax n-alkanes (C27-C35) track terrestrial vegetation changes. Our preliminary results show fecal sterols for humans and cattle increasing about 1500 AD, followed by a dramatic decrease in the average n-alkane values. This does not support an earlier human settlement date in Corvo, but suggests that after 1500 AD humans had significant impacts on the environment.

Carlos Olivares Reboredo

Poster: C13

Home Institution: University of Chicago

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Jung-Eun Lee (IBES)

**Mountains and Precipitation**

Biogeophysical feedback mechanisms contribute to significant changes in the global climate system, such as the aridification of the Sahara. Previous studies demonstrate that earth's orography influences major precipitative systems. Here we investigate the potential for orography to alter global vegetation using a general circulation model coupled with dynamic vegetation. We examine the implications of this feedback on climate and biome establishment in different continents.

Andrew Park

Poster: C14

Home Institution: Grinnell College

Summer Research Program: Research Experience for Undergraduates (REU)

Faculty Mentor: Jeff Huang (Computer Science )

### **Self-E: Helping Users Learn the Impact of Lifestyle Changes**

Our project from the Brown HCI Lab is developing an app called Self-E that allows users to self-track and experiment how health traits, such as meditation, may impact their life. As an effort to allow people to test any health traits, I'm developing an integral aspect of Self-E that helps users to come up and create their own experiments through a series of steps.

Ben Peeples

Poster: C15

Home Institution: Washington and Lee University

Summer Research Program: Allen Student Research Grant

Faculty Mentor: Jerome Robinson (Chemistry)

### **Investigation of Conjugation Strategies for a Multi-functional Zwitterionic Chelate**

This project has focused on optimizing and discovering conjugation strategies for the multi-functional DO3A chelate, focusing on using thiol-ene and diels alder chemistry. The generation of the DO3A has already been optimized; however, this research sought to take this system further by attempting to functionalize the DO3A ligand in such a way that will be useful as a MRI contrast agent and radiotherapy agent.

Samantha Pennino

Poster: C16

Home Institution: University of South Florida

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Meredith Hastings (DEEPs and IBES)

### **Stormwater and Rain: Sources of Nutrients to Upper Narragansett Bay?**

Excess nitrogen in waterbodies contributes to poor water quality, making it important to identify nitrogen sources. Stormwater leads to excess nitrogen in Narragansett Bay. In this study, nutrient concentrations in stormwater and precipitation were measured from 2 different locations, which is effective for determining the amount and form of nitrogen (ammonium, nitrate, and nitrite). The isotopic composition ( $d_{15}N$ ,  $d_{18}O$ , and  $d_{17}O$ ) was also measured of nitrate which identifies nitrogen sources. Results show that the sources of nitrate in the storm drains at both sites are primarily atmospheric deposition with some septic waste; however, the outfalls are from septic alone. There may be leaking sewer pipes, infiltrating ground water, or overflowed septic systems adding N to the Bay at these locations.

Zoe Phillips

Poster: C17

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Jerome Robinson (Chemistry)

### **Sustainable Carbohydrate-Based Polymers From CO<sub>2</sub> and Epoxides**

My research involves the synthesis and characterization of novel environmentally sustainable polymers with tunable thermodynamic and degradation properties. Made out of carbohydrates

(sugars) and carbon dioxide, these polymers are cost-efficient and biodegradable with non-toxic by-products. Carbohydrate-based polymers, or polycarbonates, have many industrial and biomedical applications, including the delivery and controlled release of drugs used to treat liver cancer. In my research this summer, I investigated the optimal synthesis, material properties, and degradation profiles of polycarbonates with the questions: 1) How can we efficiently create polymers from glucose, galactose, and carbon dioxide? 2) How can we change the functionality and degradation rate of these polymers upon exposure to relevant environmental responses like enzyme-catalyzed breakdown?

Jesse Remeis

Poster: C18

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Daniel Harris (Engineering)

### **Rapid-Prototyping of Microfluidic Channels with Application to Taylor Dispersion**

Understanding micron-scale fluid flows is critical to advancing microfluidic technologies, which have been used for drug delivery, diagnostic testing, and chemical preparation. For pressure-driven flows in such channels, dissolved solutes spread rapidly and become diluted due to the combined mechanisms of fluid advection (flow) and molecular diffusion in an effect known as “Taylor Dispersion.”

The Harris Lab at Brown has recently developed a rapid and inexpensive microchannel manufacturing technique, which we utilize to quantify the role of channel aspect ratio on the rate of solute spreading. Our experimental measurements compare favorably to known theoretical solutions. Ongoing work includes expanding the manufacturing technique to fabricate channel geometries that include recessed micro-features along their walls, with the aim of quantifying dispersion reduction via superhydrophobic channel walls.

Jolie Ren

Poster: D1

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Li-Qiong Wang (Chemistry), Giovanna Roz (Computing Information Services)

### **Innovation in Freshman Chemistry Teaching: Creating Interactive Online Pre-laboratory Videos for General Chemistry Laboratory**

The use of online learning is becoming ubiquitous, and students agree that the implementation of an online visual is long needed and is becoming more of a necessity. To better prepare students for their laboratory experiments, we are creating short online videos for general chemistry laboratory with built-in interactive components that supplement existing lab manuals. A result of the collaboration between the Chemistry Department and Computing Information Services, this project will include interactive software that allows students to engage with the virtual experiments. Several topics include safety, device setup and operation, and laboratory procedure. These short online laboratory videos is in very high demand and will impact student learning for years to come.

Jennifer Riggin

Poster: D2

Home Institution: Tulane University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Steven Clemens (Earth, Environmental and Planetary Sciences ), Joe Orchardo (Earth, Environmental and Planetary Sciences )

### **The Isotope Dilution Method: A New Approach to Measuring the Isotopic Composition of Individual Foraminifera**

Foraminifera are highly abundant microfossils commonly used as climate proxies. While foraminifera are often analyzed in bulk, the analysis of individual foraminifera can provide evidence of the seasonality of past climates. However, the analysis of individual foraminifera is restricted by the inability of current mass spectrometers to produce a sufficient signal from the small volume of gas produced by an individual foraminifera. Here, we present a new approach to measuring the isotopic composition of small samples by using the isotope dilution method.

Elizabeth Rogan

Poster: D3

Home Institution: Brown

Summer Research Program: Robinson Lab

Faculty Mentor: Jerome Robinson (Chemistry)

### **Polymers from CO<sub>2</sub> - Synthesis of Polyurea from CO<sub>2</sub> and Silylamine**

Polyurea derivatives are used in many fields of science including pharmaceuticals, polymer science, biology, among others. Despite their many uses, the current synthesis paths that exist in the literature for these derivatives are done at high pressures or by using high toxicity catalysts. Our research this summer proposes a synthesis route using carbon dioxide as a carbonyl source and silylamine.

Austen Royer

Poster: D4

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Harvey Silverman (Engineering), Ken Silverman (Engineering)

### **Infrared Laser Pointer and Applications for a True 3D Display**

Over the past few years, a true three-dimensional display has been developed at LEMS in Engineering. One issue has been that off-the-shelf input devices to this display are inadequate. This summer, a project was started to develop and demonstrate a more suitable device for user input. The current approach is to use an infrared laser as a pointer which does not interfere with the RGB display. A two-camera system, suitably filtered for the infrared frequency, can pick up linear images of the display and coordinate them to define a point in 3D space. The development of this display and an application will be the subject of this presentation.



Jorge Ruiz Gonzalez

Poster: D5

Home Institution: Sonoma State University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Stephen Parman (Department of Earth Environmental and Planetary Sciences )

### **Predicting noble gas solubility in silicates**

Noble gases cycle in and out of the Earth's mantle through various geological processes. How noble gases are incorporated into rock-forming silicates at the site of these processes is not well understood. Silicates that bear 6-member rings structures have orders of magnitude higher solubility of noble gases than those that do not have such rings. This correlation may be a result of the sites inducing polarization of noble gas atoms.

To quantify the relative polarization of noble gas atoms in different ring-bearing minerals, a simple model was constructed of the electrostatic field at the ring sites. The goal is to construct a model that can predict noble gas solubility based upon the shape of the local electrostatic field.

Esteban Safranchik

Poster: D6

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Stephen Bach (Computer Science)

### **Named Entity Recognition Using Weakly Supervised Learning**

Large sequences of text are often times fundamental to research conducted in many disciplines. For example, Doctors may find it useful to obtain a list of all experimental drugs to treat Alzheimer's and their side effects, recorded in a collection of plain text medical documents. However, in most fields, there is only a limited amount of data available to train machine learning models and extract these kinds of entities.

Following the previous example, most natural language processing models are correctly able to identify "Donepezil" and "headache" as nouns. However, being able to label such words as "drug" and "side-effect" given their relative structure in a sentence or paragraph is more valuable to researchers who wish to perform a statistical analysis on the documents.

Formally, our research focuses on weakly supervised machine learning models, a subfield of machine learning that relies on a limited amount of previously labeled training data indicating the ground truth. Weakly supervised models learn to generalize predictive rules derived mostly from the input data itself with little human intervention. Contrastingly, fully supervised learning models carry out these tasks with plentiful access to training data.

We present Wiser, a semi-supervised learning model that generalizes beyond noisy, probabilistic labels expressing uncertainty about the ground truth. We begin with a subject matter expert (SME)

writing so called labelling functions, that express beliefs about the dataset. These heuristics functions have different accuracies and overlappings, and are used as input for a generative conditional random field (CRF) that learns how to weight them based on their voting patterns. The conditional random field outputs probabilistic labels, which are then fed into a BI-LSTM that generalizes even further by optimizing a noise-aware loss function.

Andrea Salazar

Poster: D7

Home Institution: University of Chicago

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Timothy Herbert (Department of Earth, Environmental, and Planetary Sciences), Colleen Dalton (Department of Earth, Environmental, and Planetary Sciences)

### **Modeling the Role of Volcanism in the Last 20 Million Years of Global Cooling**

The Miocene Climatic Optimum occurred 15 million years ago and saw temperatures up to 6 degrees celsius warmer than today. Following the MCO was a longterm cooling trend that culminated in today's climate. On million year timescales, the carbon-silicate cycle is a major regulator of Earth's climate. Perturbations in the cycle can lead to dramatic climate changes. Previous works have shown that the plate spreading rate at mid-ocean ridges is variable, which would directly impact the rate of CO<sub>2</sub> emission into the atmosphere. In this work, we construct a box model that couples atmospheric inputs and weathering to the oceanic calcium carbonate cycle to show that volcanism is the forcing mechanism behind this global cooling trend.

Jamila Smith

Poster: D8

Home Institution: SUNY Fredonia

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Sloane Garelick (DEEPS), James Russell (DEEPS)

### **What the lake says: Assessing temperature and precipitation changes in Eastern Africa since the LGM using sediment cores from Lake Mahoma, Rwenzori Mountains, Uganda.**

Global climate change threatens the natural climate patterns of the tropical Rwenzori Mountains of eastern Africa. We need to better understand how climate will change in this region in order to protect the fragile environments of this region. The period between the Last Glacial Maximum (LGM; 22 kyr) and present can help us infer future climate changes because it was the last period of time that saw extreme global climate change and thus, is analogous to the future. By using organic compounds taken from the lake sediment core of Lake Mahoma (~ 2990 m) in the Rwenzori Mountains, we can reconstruct past temperature and precipitation changes respectively. This will allow us to infer future climate changes in this region.

Vida Steiro

Poster: D9

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Jonathan Ryan (IBES), Sarah Cooley (IBES)

### **A community-based approach for mapping shorefast ice breakup in Uummannaq Fjord, West Greenland**

Arctic communities depend on shorefast sea ice for transportation, hunting, and fishing. However, residents local to the Arctic have reported that it is now thinner and breaking up earlier than it did in the 1990s. My project investigates controls on shorefast ice breakup in five communities in Uummannaq Fjord, Greenland. I analyze changes in snow, water and ice extents between 2016 and 2019 using high-resolution Sentinel-2 imagery. The results are compared with meteorological data from local weather stations to investigate how climate warming impacts shorefast ice breakup. I also produce a website for displaying the results of my work including near real-time monitoring of shorefast ice. This product may be useful for planning travel between villages within the fjord.

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Brandon Stubbs

Poster: D10

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: James Russell (Earth, Environmental, and Planetary Sciences)

### **Life in 3 Million BCE: The Link Between Environmental Change and Human Evolution**

The primary goal of my project is to gain a deeper understanding of climate and environmental change in equatorial East Africa over the Pliocene-Pleistocene boundary (about three million years ago) and how it impacted the evolution of our species in that region. Using leaf wax biomarkers preserved in a sediment core from Kenya, the research assesses the effects of long-term climate change, particularly the glaciation of the northern hemisphere, and short-term climate change, associated with episodic changes in Earth's orbit, on patterns in East African rainfall and vegetation. Additionally, these environmental changes are compared to important human evolutionary events to determine the relationship between the environment and human evolution.

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Adam Tropper

Poster: D11

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Jiji Fan (Physics)

### **Can Random Matrix Models Explain Hierarchies in Particle Physics?**

The world we live in is constructed from a few dozen types of so-called elementary particles – particles which cannot be broken down into smaller pieces. One particularly fascinating property of elementary particles is their mass. This property is interesting because even though elementary particles have common mass origins, the masses of different species vary exponentially. Thus, the masses of elementary particles are arranged in a hierarchy of sorts. I explain this hierarchy using random matrix models in Quantum Field Theory. I have shown that a particular model of scalar fields interacting through mass-mixing on a lattice is characterized by eigenvectors that are

exponentially localized and have shown how to derive such a model from a more UV suitable theory.

Malik Walker

Poster: D12

Home Institution: Princeton University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Alexander J. Evans (Department of Earth, Environmental, and Planetary Sciences)

### **Geophysical Investigation of Lunar Impact Craters with Anomalous Gravitational Signatures**

Gravity data returned by the dual Gravity Recovery and Interior Laboratory (GRAIL) spacecraft has shown that lunar craters between 20–140 km in diameter generally exhibit a linear trend between gravity and crater diameter. Through our analyses of gravity and topography data returned by GRAIL and the Lunar Reconnaissance Orbiter (LRO), respectively, we identify a subset of anomalous craters that have gravitational signatures that significantly deviate from expected values. Based on the observed deviation in the gravitational signatures, we evaluate a range of plausible pre-impact near-surface structures that could have conceivably produced these anomalies and thereby further constrain the near-surface compositional and magmatic evolution of the Moon.

Sophie Weiss

Poster: D13

Home Institution: Cottey College

Summer Research Program: Undergraduate Research Assistant Delaney Lab

Faculty Mentor: Sarah Delaney (Chemistry)

### **The effect of histone tail deletion on base excision repair initiation**

The simplest component of a chromosome is the nucleosome core particle (NCP). An NCP contains duplex DNA wrapped 1.7 times around an 8 protein histone core. When DNA is in an NCP, the accessibility of DNA to repair enzymes is heavily restricted due to DNA's close proximity to the histone core and adjacent histone tails. In multiple organisms, histones have been found with clipped or removed tails. One idea in this emerging field is that the clipping of histone tails opens the DNA to more repair and transcription activities. In our study we focus on the H3 tail. We express histones without this tail and determine the effect on the base excision repair pathway.

Angela White

Poster: D14

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Ian Dell'Antonio (Physics)

### **Simulating New Cosmic Shear Cancellation Techniques for Applications in Deep Field Gravitational Lensing**

Gravitational lensing techniques are limited by the amount of error incurred by present methods of

measurement. Lensed galaxies are sheared: like a funhouse mirror, the dark matter surrounding observable galaxies distorts its shape and skews our measurements. Eric Huff, a scientist at NASA's JPL, has derived a method of measurement that corrects for the distortions. Professor Dell Antonio hopes, through my project, to provide those theoretical calculations with practical support, rendering the field of weak lensing ten times more accurate. Therefore, the goal of my summer research project will be to determine that Huff's algorithm holds for complex rotating systems, and then to study the change in the accuracy of the measured lensing as we reduce the amount of information on galaxy velocities to a realistic degree.

Holly Zheng

Poster: D15

Home Institution: Brown University

Summer Research Program: Working independently with professor

Faculty Mentor: Ellie Pavlick (Computer Science)

### **Examining Restrictive Modifiers Through Wikipedia Edit History**

Editing a sentence by inserting additional words is linguistically meaningful for natural language understanding. For example, adding the phrase "in the United States" after "New York City" reinforces information already implied by the original phrase, but adding the same phrase after the word "physicians" modifies the word. Differentiating modifiers is challenging for machines because the task often requires common sense knowledge. In this work, we use a corpus of 13 million edit instances from Wikipedia to investigate modifiers that are restrictive. The database consists of Wikipedia edits where an editor inserts a new phrase into an existing sentence. Judgments from human annotators and computer models on these modifiers allow us to examine different motivations of insertion.

## SOCIAL SCIENCES INDIVIDUAL PRESENTATIONS

Ella Brett-Turner

Poster: D16

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Margot Jackson (Sociology)

### **Public Investments and Class Gaps in Parents' Educational Expenditures**

There is an established link between family socio-economic status and children's well-being, as well as class gaps in parental investment related to children's growth and development. High socio-economic status families are able to provide private investment of money and time in their children in ways that low-income families may not be able to. Public investments in low-income families could allow parents to reallocate resources towards their children's education. The Earned Income Tax Credit (EITC) is a national and state-level supplemental income for low-income families. Using data sourced from the Consumer Expenditure Survey, we examine the effects of EITC spending on class (income and education) gaps in parental educational expenditures on children.

Shiloah Coley

Poster: D17

Home Institution: University of Wisconsin-Madison

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Rebecca Carter (Anthropology and Urban Studies)

### **Beyond the Walls: How Black Youth in Graffiti Crews in Toronto Perceive Their Roles in Society and Community Spaces**

Graffiti art blossomed throughout North America in the 1970s as an avenue for marginalized youth to make their voices heard in the face of oppression and to create a sense of place for themselves and their communities. While there is extensive literature on graffiti art, there is minimal research on the relationship between the individual and the graffiti crew, a group of associated graffiti artists that often work with and learn from each other. Although graffiti was initially embraced by marginalized youth in urban areas, their voices and contributions remain absent in scholarly work. This research explores how black youth participation in graffiti crews in Toronto impacts how black graffiti artists perceive their roles in society and other community spaces.

Elizabeth Cruz

Poster: D18

Home Institution: DePaul University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Paul Testa (Political Science), Juliet Hooker (Political Science)

### **Contemporary attitudes towards confederate monuments in the millennial generation**

In 2017 an article published in The Washington Post entitled “A new survey shows white millennials think a lot more like whites than millennials.” The author was dismayed to find that political opinion surveys of millennials seemed to contradict the widely held expectation that younger people are more liberal and less racist than prior generations. What can this kind of data tell us about public opinion on controversial racial issues? Most recently there has been contention surrounding what should be done about the Confederate monuments in the United States. This has sparked protests throughout the South and on college campuses. In this presentation using a poll from GenForward Survey (polling millennials ages 18-34) that focuses on the Perceptions of Race and Racism, I examine two important questions: 1) why do millennials support or oppose confederate monuments being taken down from public spaces? And 2) have attitudes among young people toward the use of race in public policy changed? To further examine this, I analyze millennials’ sentiments on how they believe racial progress can be achieved and what they see as the biggest threat to Americans today. Factors that will be examined for statistical relevance in relation to support for the removal of confederate monuments and use of race in public policy are gender, location, income, and ideology.

Christiana Faucher

Poster: E1

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Mascha van't Wout Frank (Department of Psychiatry and Human Behavior)

**The effects of anodal tDCS stimulation of the vmPFC and risk taking on avoidance-based fear learning**

One commonly used treatment for anxiety and PTSD is exposure therapy, during which patients are repeatedly exposed to doses of a triggering stimulus without a bad outcome, resulting in a gradual decrease in fear reaction. Unfortunately, many anxiety and PTSD patients continue to experience symptoms despite treatment, and relapse is common. Using a 4 stage avoidance-based reversal learning task, I tested in a healthy population whether applying anodal transcranial Direct Current Stimulation, a form of subthreshold non-invasive brain stimulation, to the vmPFC (an area implicated in extinction learning and flexibility) can improve reversal learning, or help prevent fear relapse. Additionally, I tested whether pre-existing factors, such as one’s willingness to take risks impact reversal learning and tDCS efficacy.

Patricia Fernandez

Poster: E2

Home Institution: Temple University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Elizabeth Fussell (Sociology)

**Migration in the Caribbean: Does migration make countries more resilient to tropical storms and hurricanes?**

Small island developing states (SIDS) in the Caribbean are vulnerable to climate change, particularing in facing a higher intensity of hurricanes and tropical storms. While out-migration is

typically an option of last resort for hurricane recovery, the concept of migration as an adaptation to the effects of climate change is widely discussed by researchers in the field of migration and climate change. Our research investigates whether migration is making Caribbean SIDS more or less resilient to hurricanes, in terms of retaining population size after a disaster. We look at Puerto Rico and Hurricane Maria as a case study that motivates our research question as to how migration and hurricane recovery functions in other Caribbean SIDS.

Daneris Fuentes

Poster: E3

Home Institution: University of Puerto Rico-Rio Piedras Campus

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Sara Becker (Center for Alcohol and Addictions Studies)

### **The Influence of Opioid Treatment Provider Attitudes on Skill and Knowledge after Contingency Management Training**

Contingency Management (CM) is one of the most effective treatments for opioid use disorder, yet it's hardly used in community treatment centers. This study looks at how providers' attitude towards CM affects their skill and knowledge after training. X leaders and X providers from 8 clinics were asked to complete a survey previous to attending a CM workshop to determine their attitude towards CM. Once they completed the workshop, participants were asked to submit a role-play tape and complete the CM Knowledge Test. The tests were individually scored out of 20. The role-play tapes were rated by using the CM Competence Scale by coders independently blind to attitude scores. For the results, we will be using regression analysis to examine if there's an association between attitudes and overall performance. The results of this research will be use to design future CM workshops and provide better trainings.

Galen Hu

Poster: E4

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Megan Ranney (Emergency Medicine), John Patena (Emergency Medicine)

### **Relationship and Risk Factors of Comorbid Symptoms of Adolescent Violence Exposure**

The prevalence of violence exposure is as high as ever. In adolescents specifically, this represents an acutely pressing issue, as teenagers have been shown to manifest deleterious symptoms from violence exposure. This study examines this relationship between adolescent violence exposure and its comorbid effects (i.e. poor school performance, depression, substance-use, etc.). Moreover, this study aims to better understand the pathology of violence exposure in adolescents by identifying specific risk factors or protective factors that exacerbate or alleviate already proven comorbid effects. The population in this study consists of teenagers (13-17 years old) who present at Hasbro Children's Hospital. Our findings may ultimately impact clinical practice by offering significant insight towards further intervention design.



Eric Ingram

Poster: E5

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Oriel FeldmanHall (CLPS Department)

### **Mechanisms of Learning Under Social Uncertainty**

The dynamics of social and nonsocial learning are very different, and we investigate differences between the two environmental contexts. Our study tracks how sensitivity to uncertainty in participants can be investigated through the decisions they make in a trust game (social context) and a slot machine game (nonsocial context) where participants choose to give money to a partner or a slot machine. We aim to see if participants adapt to uncertainty faster in a game involving a human, or a machine. On another level, we investigate the differences between clinically healthy individuals, individuals with OCD, and those with general anxiety disorders (GAD). Eye tracking data is used to measure changes in dopaminergic signals associated with social and nonsocial learning.

Kelsie Lopez

Poster: E6

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Roman Feiman (CLPS)

### **How children learn that "some" means "not all", but "dax" doesn't**

How do children come to interpret abstract words, like "some" and "all"? These words do not map to anything one could point to; instead, their meanings are abstract, picking out proportions of the nouns they combine with. One way to understand what someone means to say when using these words is to pay attention to the difference between similar sentences, such as, "I ate all of the cookies," versus "I ate some of the cookies." If children know what "all" means, they could infer that someone saying they ate some of the cookies did not eat "all" of them (if they had eaten all, they should have said so). We test children's ability to make these inferences in two experiments.

Emely Medina

Poster: E7

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: David Rangel (Education)

### **The Complex Logics of Parenting in the United States: The Case of Mexican Immigrant Families**

Numerous studies have pointed to social class as the main driver of parents' educational practices (Lareau 2003; Calarco 2018). However, this large focus on social class may delimit our understanding of contextual influences on parenting. Drawing on interview data with working-class and poor Mexican-immigrant parents with elementary-aged children in San Antonio, Texas and Phoenix, Arizona, this paper examines the relative salience of social class on parenting practices and beliefs. Our interview data highlight the ways in which contextual factors such as legal status, language (in)accessibility, and hostile social contexts shape parents' interactions with schools,

teachers, and their children, above and beyond other factors such as social class.

Isabelle Moseley

Poster: E8

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Judson Brewer (Public Health)

**Measuring the anticipated and actual reward value of food over the course of a novel mindful eating intervention**

Although traditional “forced restraint” approaches to dieting are ineffective in long-term weight loss maintenance, they remain the clinical standard. We propose a new approach to overcoming unhealthy eating habits, which utilizes mindful eating to change the reward value of unhealthy food. We hypothesize that if people pay attention to how unhealthy food makes them feel in their bodies, their and desire to eat it will decrease. To test this hypothesis, we will pilot a mindful eating intervention based on smartphone technology with two novel elements: (i) a mental simulation exercise asking participants to imagine eating the unhealthy food and feeling into their bodies before eating; (ii) multiple check-ins that encourage participants to feel into their bodies after eating.

Emily Rehmet

Poster: E9

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Theresa Shireman (School of Public Health)

**Pharmaceutical Evergreening Practices Applied to Antipsychotics Increase Medicaid Expenditures**

In the last decade, several second-generation antipsychotic patents have expired, paving the way for lower-cost generic antipsychotic drugs in the Medicaid program. Medicaid is United States insurance for low-income individuals, disproportionately providing coverage for people with serious mental illness. A study based on 2011 data forecasted that generic antipsychotics would reduce Medicaid expenditures to \$1,882 million. We examined this forecast using the CMS Medicaid Drug Spending Dashboard. In contrast to the projection, we found that antipsychotic expenditures increased 134% or \$736 million to \$4,412 million. Their projection was off because of the emergence of new branded products and patent protection efforts by the brand name pharmaceutical firms. These evergreening practices have substantial implications for public expenditures of antipsychotics.

James Sylvester-Costello

Poster: E10

Home Institution: CUNY Brooklyn College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentor: Scott Frickel (Institute at Brown for Environment and Society (IBES))

**Are Industrial Sites and Green Spaces Spatially Related?**

Are today’s parks and playgrounds sitting atop what were once industrial sites? Most studies of

urban parks has been conducted on the history of specific parcels of land, but less is known about general trends in urban land use. Urban land use patterns, especially when analyzed in conjunction with changes in demographics, can reveal the histories of our cities.

Our research utilizes historic records for Providence, Rhode Island collected from almanacs and city directories to establish yearly counts and locations of industrial sites. Contemporary park locations are then overlaid atop all historic industrial sites in ArcGIS. We predict that spatial analyses will show a significant positive relationship between historic industrial sites and contemporary parks.

## STUDENT TEAMS

Abdullah Ahmed, James Fife, Fatemeh Radaei

Poster: E11

Home Institution: Brown University

Summer Research Program: Independent Research Project

Faculty Mentor: Carsten Eickhoff (Biomedical Informatics)

### **Predicting delirium phenotypes and early motor recovery in stroke patients using generative machine learning models.**

Delirium is frequent after acute stroke, and likely hinders recovery and increases future disability. However, delirium is commonly under-diagnosed using standard medical screening practices. We aim to tackle this challenge by developing generative machine learning models of sensor-based activity measurements that will be able to diagnose and categorize delirium phenotypes (hyperactive, hypoactive, or mixed), then correlate and predict early motor recovery and long-term functional outcomes after stroke. A prospective study will be conducted on 40 acute hemorrhagic stroke patients with unilateral weakness who are admitted to Rhode Island Hospital over 12 months period. Daily delirium assessment will be conducted by expert clinicians using a standard protocol. Data from these assessments will be compared and correlated to data obtained from wearable sensors, called wrist actigraphs, that will be worn continuously on patients' affected and unaffected limbs.

David Baek, Shi-Yo Chen

Poster: E12

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Debasree Banerjee (Pulmonology and Critical Care)

### **The Effects of Ramelteon on Sleep and Delirium in ICU Patients**

We will conduct a randomized double-blind controlled trial, comparing the effects of an FDA-approved melatonin receptor agonist, Ramelteon, versus a placebo on sleep quality and incidence of delirium in ICU patients using Richards-Campbell Sleep Questionnaire (RCSQ), Actigraphy, and Confusion Assessment Method.

Caitlin Barrett, Gillian Melikain

Poster: E13

Home Institution: Brown

Summer Research Program: LINK

Faculty Mentor: Dioscaris Garcia (Molecular pharmacology, physiology & biotechnology)

### **Determining Endotoxin Content and Bacterial Colonization using a Rapid Visualization Assay**

Yearly 2 million fracture fixation devices are implemented during orthopaedic procedures. The infection rates for these devices can range from 2% for closed fractures up to 30% for open fractures (Trampuz 2006). Such infections can extend hospital stays, increase costs and decrease

quality of life. Many of these infections are complicated further by endotoxin virulence factors released after the death and lysis of gram-negative bacterial cells (Pier 2007). This study validates a rapid visualization assay which utilizes fluorescently conjugated antibodies, and Confocal Laser Scanning Microscopy (CLSM) to detect bacterial presence and allow for determination of endotoxin content and bacterial colonization on surgical explants, tissue, and synovial fluid in 30 minutes.

Haley Barthel, Alexander Zhao

Poster: E14

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Jamila Siamwala (Molecular Pharmacology, Physiology, and Biotechnology)

### **Sleeping Beauty to the rescue Pulmonary Arterial Hypertension**

Pulmonary arterial hypertension (PAH) is a cardiovascular condition resulting in high blood pressure in the pulmonary arteries and is associated with right ventricular remodeling due to increased pressure and lack of capillaries. In injury, capillarization and angiogenesis are important for improvement. The goal of this project is to use the SB gene transfer system to overexpress the macrophage mediated VEGFA production and to increase angiogenesis with the ultimate aim of improving capillarization the failing RV of PAH patients. We hypothesize that overexpression of macrophage derived VEGFA will increase endothelial cell migration and tube formation and restore RV function in PAH.

Matthew Berg, Rebecca Mathew, Deniz Bayazit, Ariel Rotter-Aboyoun

Poster: E15

Home Institution: Brown

Summer Research Program: CS Undergraduate Researcher

Faculty Mentor: Stefanie Tellex (Computer Science)

### **Grounding language to landmarks: improved drone instruction following in outdoor environments**

Outdoor environments present unsolved challenges for translating the ambiguity of colloquial language to commands the robot can understand. Existing approaches to this problem are limited because they require training a language model for the landmarks of a particular environment before the robot can understand commands referring to those landmarks. To improve such understanding, we present a framework that parses references to landmarks, then uses cosine similarity to ground landmark phrases in natural language commands to landmarks in a predefined semantic model of the world. We intend to test our framework both in simulation and with the Skydio R1 drone, aiming to demonstrate our approach enables untrained users to control a robot in large outdoor environments with unconstrained natural language.

Aliosha Bielenberg, Charlie Steinman

Poster: E16

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Michele Hayeur Smith (Haffenreffer Museum of Anthropology), Soumen Mallick (Earth, Environmental, and Planetary Sciences)

**Archaeological Investigations of the Eastern North Atlantic Trade and Globalizing Economic Systems**

We undertake a comparative examination of archaeological textiles as evidence of women's labor in the Norse colonies of the North Atlantic and extend these investigations into the eastern North Atlantic's urban settings where North Atlantic textiles were traded and consumed, and from which European cloth reached the North Atlantic islands. Our research methods focus on isotopic signatures of wool from both North Atlantic locations as well as textiles samples from Northern European urban contexts, which we examine using laboratory methods to determine where sheep were grazed as they absorbed strontium isotopes into their bones, teeth and wool.

Jenna Ellington, Siddhi Deshpande

Poster: E17

Home Institution: St. Francis College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program (SR-EIP)

Faculty Mentors: Euy-Myoung Jeong (Cardiology), Olin Liang (Cardiology)

**Cloning of RUNX1 and SOX17 CRISPR-Knockout Lentivirus Vector and Virus Protein Expression in Mammalian Cells**

Pulmonary Hypertension (PH) is an incurable disease characterized by increased vascular resistance in the lungs. Previous studies indicate that dysfunctional endothelial to hematopoietic transition contributes to its pathogenesis. The CRISPR knockout oligomers were selected from Exon 1 region of Runx1 and Sox17, using online tools CHOPCHOP and E-CRISP. The oligomers were then prepared for insertion by PNK phosphorylation and CRISPR knockout cloning of Runx1 and Sox17 with a lentiCRISPR V2 plasmid vector. The LentiCRISPR-V2 vector was prepared through BSMBI vector digestion, gel purification and elution. Cloning will be verified through gene sequencing. We hypothesized a greater expression of endothelial mammalian cells by the pluripotent bone marrow cells after knock-out of the Runx1 gene with CRISPR knockout and overexpression of Sox17.

Kimberlyn Ellis, David Garcia

Poster: E18

Home Institution: Brown University

Summer Research Program: NIH-PREP

Faculty Mentors: Abigail Peterson (Molecular Biology, Cell Biology, and Biochemistry), Phyllis Dennery (Molecular Biology, Cell Biology, and Biochemistry)

**Persistent Effects of a Short Hyperoxic Exposure in Neonatal Mice**

Underdeveloped lungs account for a significant contribution to the morbidity of prematurity. Preterm infants often require supplemental O<sub>2</sub> (Hyperoxia) as an important life-saving modality of respiratory support. One unfortunate consequence of supplemental O<sub>2</sub> therapy, however, relates to its adverse effects on lung development, often manifested as bronchopulmonary dysplasia (BPD)

and various wheezing disorders. Our previous examinations in cultured mouse lung epithelia cells (MLE-12) have shown that hyperoxic exposure leads to long term functional and morphological abnormalities even after a short (4 hour) exposure. We seek to create a comparable in vivo model so as to evaluate whether there are persistent changes in the respiratory epithelial cells post-hyperoxic exposure. This will provide translational insights into the pathophysiology of BPD.

Jessica Eskander, Elaine Tran

Poster: F1

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Paul Greenberg (Ophthalmology)

### **Prevalence of Preoperative Medical Consultations in Cataract Surgery Patients**

Despite the low risk of cataract surgery, it is associated with high use of preoperative consultations (office visits to non-ophthalmologists prior to surgery). In this retrospective study, I investigated the rate of preoperative consultations for cataract surgery patients at the Providence VA Medical Center (2014-2018). As veterans have a significantly higher disease burden than other U.S. patient populations, we hypothesized that the prevalence of preoperative consultations would be greater than the rate of 52% reported in previous studies using Medicare claims data. However, this study found that only 4.22% of cataract surgery patients received preoperative consultations, excluding anesthesia. Our results underscore the need for further study (examining charts) to confirm the rates of preoperative consultation reported using Medicare claims data.

Andrea Gilmore, Ryan Bain

Poster: F2

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Dioscaris Garcia (Department of Physiology, Biotechnology, and Molecular Pharmacology), Christopher Brown (University of Orthopedics)

### **An Analysis of the Antimicrobial Effects of a Silver Carboxylate Coating on Multi Drug Resistant *Serratia marcescens* on Orthopedic Biomaterials**

A rising contributor of hospital acquired infections is opportunistic pathogen *Serratia marcescens*, a gram-negative bacterium commonly associated with orthopedic wounds, specifically in the spine. The use of silver as an antimicrobial agent has received attention for its ability to combat biofilm formation through its long lasting release and low incidence of antibiotic resistance (Rabin, N. 2015). This project will test the antibiotic-resistance capabilities of *Serratia marcescens* through the use of an antimicrobial silver carboxylate coating.

Three spinal implant biomaterials, Polyetheretherketone titanium, and stainless steel are coated with various concentrations of a titanium dioxide–polydimethylsiloxane coating with increasing amount of ionic silver neodecanoate. Implants are inoculated onto orthopedic biomaterials with a 10<sup>7</sup> CFU/ml concentration of *S. Marcescens* and analyzed for colonization.

Claire Hawkins, Natalie Rugg, Lexie Ekstrom

Poster: F3

Home Institution: Brown University

Summer Research Program: Space Grant/NASA, Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Ian Dell'Antonio (Physics)

### **Dark Matter Interactions in Galaxy Clusters**

The presence of dark matter within a galaxy cluster distorts the observed shape of elliptical galaxies behind the cluster in an effect called weak gravitational lensing. We are measuring this shape distortion of elliptical galaxies behind a series of nearby galaxy clusters to investigate the distribution of dark matter in these galaxy clusters. Our goals are to contribute to the ongoing project of measuring and mapping dark matter and to compare the distribution maps of dark matter, galaxies, and x-ray emitting gas in these galaxy clusters to learn more about the extent to which dark matter is self-interacting.

Jacquelin Ho, Lizmaylin Ramos

Poster: F4

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Carlos Aizenman (Neuroscience)

### **Identifying the physiological basis for abnormal behavior arising in *X. laevis* tadpoles reared in deprived environments**

Natural experience results in congruent information from different sensory modalities arriving in the brain, and natural statistics shape how individual cells in the brain are tuned to different combinations of multisensory stimuli. I manipulated rearing environments so that this congruency between sensory modalities is altered. I then tested various processes that rely on effective multisensory integration (MSI) to see if they are altered. Previous behavioral assays to determine whether rearing environment affects multisensory integration in the *Xenopus laevis* tadpole model saw significant differences in schooling behavior. This project seeks to understand how changes on the neuronal network or subcellular level can lead to these observed behavioral changes and explain this neurodevelopmental phenomenon.

Jessie Jing, Catherine Liao

Poster: F5

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Jin Li (Education Department)

### **European American and Chinese Immigrant Children's Learning Beliefs and Related Socialization at Home**

This three-year longitudinal study has four goals: what learning beliefs European and Chinese immigrant children have and how they are socialized at home, how they come to hold their learning beliefs, how Chinese immigrant children adapt to home and mainstream socialization, and how children's beliefs influence their learning and achievement.



Three groups were followed in the study, each consisting of 100 individuals: middle-class European Americans (non-immigrants), middle-class Chinese immigrants, and low-income Chinese immigrants. The study followed these children starting at the age of 4 for three consecutive years using ten different methods of data collection. These methods included parent interviews, mother-child conversations, story completion, children's achievement tests, mother-teaching child, mother diary, mother survey, and teacher ratings of children's learning and social adjustment.

Maria Kloiber, Nedyana Daskalova

Poster: F6

Home Institution: St. Olaf College

Summer Research Program: HCI REU

Faculty Mentor: Jeff Huang (Computer Science)

### **Using an Automated Self-Experimentation System to Encourage Health Behavior Changes**

Mobile applications for sleep tracking have become popular, less-invasive alternatives to traditional sleep studies (Behar et al., 2013). However, most existing applications display summary statistics without guiding users to pursue their health goals, and are often not validated for use by those with diagnosed sleep disorders (Choi et al., 2018). We use the diary study methodology to examine the experience of veterans—a population with high rates of sleep disorder diagnoses and barriers to accessing traditional healthcare—using an app that directs users through self-experiments to identify behavior changes that can improve their sleep (Mysliwiec et al., 2013; Misra-Hebert et al., 2015). We also conducted non-directed interviews to investigate methods of visualizing self-experiment data to maximize the results' motivational effects. Overall, our study provides insight to how automated health tracking systems can be made more effective for a wider variety of users.

Halle Purdom, Livia Belman-Wells, Christian Landis, Prince Ncube, Axel Weber Poster: F7,F8,F9

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Angus Kingon (Engineering), Theodore Morse (Engineering)

### **Optical Engineering and Characterization of Novel Scintillating Detectors for X-Ray Medical Imaging**

The two imperatives for medical X-ray imaging are higher resolution and reduced exposure time. Commonly, medical x-rays have a resolution of 75-100 microns due to the lateral spread of x-rays in the scintillation material used to convert the high energy light to detectable visible light. To increase resolution, we are developing a new optically engineered scintillator. We coated the inner walls of borosilicate glass capillary arrays with silver, then filled the capillaries with a scintillating material. Silver's low index of refraction creates total internal reflection inside the pores, eliminating lateral spread and increasing resolution to approximately 5 micrometers. To address exposure time, we infiltrated three scintillators; triphenylbismuth, cesium iodide and perovskites (CsPbBr<sub>3</sub> and Cs<sub>4</sub>PbBr<sub>6</sub>), into the capillaries and measured the quantum efficiency.

John Rush, Wills Andersen, Kameron Medine

Poster: F10

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Matthew Zimmt (Chemistry)

**Constructing Ultra-High Resolution 2D Templates via Self-Assembly of Multicomponent Monolayers**

The goal of this TEAM UTRA project is to prepare three unique, yet complementary molecules that will self-assemble into complex molecule patterns when they adsorb on a surface. Side chains with complementary shapes stabilize pattern assembly as they minimize chain energy when packing at the solution – graphite interface. Wills Andersen, Kameron Medine, and John Rush have been synthesizing three TPE molecules cores comprised of a combination of six side chains. These side chains ensure the three TPE cores assemble a highly organized packing pattern. In addition to the packing chains, two smaller templating chains can be placed on the center of each TPE which can have a number of different substituents including biologics such as amino acids/sugars, or nanoparticles.

Violet Sackett, Bria Metzger, Paige Torres, Terren Nunes

Poster: F11

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: Andrea Simmons (CLPS), Ruth Colwill (CLPS)

**CLPS 1195 - Life Underwater in the Anthropocene**

This summer, we are developing a laboratory course entitled “Life under water in the Anthropocene”. The Anthropocene refers to Earth’s current geological era and is defined by human impact on the planet’s geology and ecosystems. It is imperative that we promote a widespread understanding of our impact on the environment, and freshwater ecosystems are some of the most biodiverse, valuable, and vulnerable on the planet. The course will utilize two aquatic model species, zebrafish and African clawed frogs. This summer is dedicated to developing protocols to investigate the impacts of human-sourced stressors like artificial noise and light, herbicides, and acidification; these experiments will provide a foundation for students to pursue their own authentic research projects in the fall.

Stephen Sun, Jay-Young Cho

Poster: F12

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Rick Fleeter (School of Engineering)

**Development of a robotic arm for nano-spacecraft**

Brown Space Engineering plans to build and launch a second CubeSat named PictoSat following the success of EQUiSat, Brown University’s first satellite launched in May 2018. The primary payload of PictoSat will be a robot arm. The arm provides the capability for various engineering and outreach

missions, such as capturing and transmitting pictures and videos with a camera on the end of the arm, and both manually and semi-autonomously controlling the arm from the ground. This summer UTRA project aims to lay the groundwork for PictoSat's primary payload by designing a prototype robot arm and accompanying control and safety software that can be adapted for use on PictoSat.

Berke Turkey, Addie Harrison, Gil Parnon, Gisela Hoxha, Madison Russell Poster: F13

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Bjorn Sandstede (Applied Mathematics)

### **How do skin patterns develop on zebrafish fins?**

Zebrafish (*Danio rerio*) are fish that live in freshwater and have black stripes and yellow interstripes. Many of the mechanisms involved in determining skin patterns in zebrafish are still not well understood, but the increase in empirical research on zebrafish patterns provides us with ways to model zebrafish skin patterns more accurately. Studying the development of skin patterns in zebrafish has significant implications in developmental biology, cancer and genetic diseases. This is an interdisciplinary research project that puts together knowledge from biology, chemistry and mathematics and has implications outside of mathematics and in technologies that could improve people's lives.

Victoria Vafae, Vivian Ling, Emily Papiez Poster: F14

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentors: David Borton (Engineering), Vicki Colvin (Chemistry)

### **Antioxidant Nanoparticle Films for Improving Deep Brain Recording**

Brain recording electrodes have wide applications in clinical practice – these electrical sensors have been used to treat Parkinson's disease as well as movement disorders. However, the brain recognizes these chronically implanted electrodes as foreign bodies, stimulating an immune response involving reactive oxygen species (ROS) that leads to the development of scar tissue and the death of neurons. Ceria nanoparticles have been shown to stop scar formation by shutting down the ROS generation process. By testing antioxidant capacity, toxicity, and localized drug delivery, we characterized both ceria itself and ceria in film.

Homer Walke, Sebastien Jean-Pierre Poster: F15

Home Institution: Brown

Summer Research Program: National Science Foundation

Faculty Mentor: Michael Littman (Computer Science)

### **Learning Trigger-Action Programs**

Smart devices for the home are increasing in popularity. Many devices allow users to control their behavior using trigger-action programming (TAP) or "if this then that" rules. However, TAP rules

written by users sometimes contain bugs that lead to undesired outcomes. We propose two techniques to learn TAP rules from the history of a user's interactions with their devices. First, we show that decision trees can predict a user's action based on conditions in the home and we provide a method to convert a decision tree into TAP rules. Then, we show how to convert the data generated by a user into a Markov decision process that can be solved to generate TAP rules.

Corinne Williams, Grace Fan

Poster: F16

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Ugur Centintemel (Computer Science)

### **Twitter Data Analysis to Track the Spread of Ideas**

Our work has focused on the spread of ideas related to instructional practice and content (such as sharing ideas and resources on how to teach math) and the spread of populist ideas about education standards as a vehicle for federal government control of local public schools. Our analysis has focused on tweets from 2012-2018, using basic text analysis and sentiment analysis to assess the systematic differences between tweets referencing the Common Core (i.e. the Common Core State Standards Initiative in education) and those referencing college and career readiness standards. We have been examining how the former term has become a target and vehicle for populist antipathy and the latter term has become a vehicle for sharing information on.

Julia Windham, Nam Do

Poster: F17

Home Institution: Brown

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Ellie Pavlick (Computer Science)

### **Diagnosing mental well-being from language use on social media**

This project aims to synthesize current medical research with data-driven techniques to: understand the relationship between teenage mental health and social media; classify mental disorders using social media text and image data; and distinguish between self-diagnoses of disorders and colloquial uses of mental health keywords online.

Yiheng Xie, Cintia Barbosa DeCastilho

Poster: F18

Home Institution: Brown University

Summer Research Program: Undergraduate Teaching and Research Awards (UTRA)

Faculty Mentor: Robert Hurt (Engineering)

### **Inter-layer adhesion energies of 2D nanomaterials**

Emerging nanomaterial including graphene oxide, molybdenum disulfide, molybdenum diselenide and manganese dioxide have potential applications in the semiconductor industry, filtration and wearable technologies. However, these materials' inter-layer bonding energies have rarely been studied. Our research focuses on measuring the inter-layer adhesion energies of these materials and

subsequently improve their mechanical performance by introducing a variety of chemical additives. Samples are prepared by mechanical exfoliation and the adhesion energies are measured through lap-shear test. These results will lend insight into the durability of these materials in industry applications.

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