BROWN

2018
Summer Research Symposium

Presented by The Office of the Dean of the College

Sayles Hall 11:00am - 1:00pm

Thursday, August 2
Life Sciences and Humanities Individual Presentations, Team Presentations

Friday, August 3
Physical and Social Sciences Individual Presentations, Team Presentations

Summer Research Symposium

Sayles Hall

Thursday, August 2

Life Sciences, Humanities, 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

Jill Pipher, Vice President for Research and Elisha Benjamin Andrews Professor of Mathematics

11:00 - 1:00 Research Poster Presentations

Friday, August 3

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 - 11:20 Brief Remarks, Presentation of Mentoring Award

Rashid Zia, Dean of the College

11:00 - 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

Ruth Foster
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 Friday, August 17th.

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*
	B17*	C17*		E17*	F17*

[ENTRANCE]

[LOBBY]

* = Thursday Only

Thursday, August 2 Index

Project titles and full abstract text are available on the following pages.

Friday, August 3 Index

Project titles and full abstract text are available on the following pages.

Summer Research Symposium Posters

Friday, August 2

Life Sciences, Humanities, and Team Presentations

Humanities Individual and Team Presentations

Amyre Brandom Poster: A1

Home Institution: Xavier University of Louisiana

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Jennifer Betts (Brown University Archives)

Sisterhood: Ethel Robinson's Legacy

My research project examines Ethel Robinson's experience at Brown University and her role in founding the first African American sorority. Together with Elizabeth Cook, Robinson assisted in establishing Alpha Kappa Alpha Sorority Inc. Ethel Maria Tremaine Robinson is a Brown University alumna from the class of 1905. After completing her own degree in Philosophy at Brown, Robinson proceeded to an instrumental role in numerous African American females' lives as an English professor at Howard University. Through an examination of Ethel Robinson's experience, the present project explores the role of African American sisterhood in empowerment of black women. The words of one African American woman inspired students to break through glass ceilings.

Katerina Ramos-Jordan Poster: A2

Home Institution: University of Puerto Rico Río Piedras

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Leticia Alvarado (American Studies)

Hungry to Belong: Rethinking the Puerto Rican Body Within the Streets of El Barrio

This project analyzes the representation of the Puerto Rican body in the context of the urban space in East Harlem, also known as, Spanish Harlem, or El Barrio. Both the body and the urban space share oppression, deterioration, and a fluid connection between New York City and the island of Puerto Rico. In order to determine the transnational movement of culture in relation to a pursuit of belonging in El Barrio, I will look at different works of diasporic Puerto Rican literature. To convey this, I will distinguish the relationships between the body, urban space, and language by analyzing When the Spirits Dance Mambo, by Marta Moreno Vega, Piri Thomas Down These Means Streets, and Bodega Dreams by Ernesto Quiñonez. In addition to these primary texts, poetry by Rosario Morales and Sandra Maria Esteves will augment the close readings and frame the themes of these main texts. I will critically discuss the historical significance of crucial moments in Puerto Rican migration. This includes the post-World War II migration wave (1940s-1950s), the revolutionary era of the 60s, and its outcome in the 80s. Through this analysis, I will explore the ways in which the literary production of Puerto Rican diaspora has reflected the complex transnational dialogue between the island, the Puerto Rican body, and El Barrio.

Kayla Smith Poster: A3

Home Institution: Spelman College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Jennifer Betts (Brown University Archives)

Black Revolutionary Theatre

Where there is a Black power movement, there is a Black arts movement. Black art movements shape the course of the diasporic narrative and reclaim the vitality and dignity of blackness by critiquing colonial and racist ideologies that distort African history and identity. Born out of the global Black Arts Movement and student protests at Brown University, Rites and Reason theatre was founded in the fall of 1970 by professor, and playwright, George H. Bass. This work highlights Rites and Reason theatre as a movement grounded in political and intellectual bursts of energy that has been able to influence, sustain and dismantle ideologies and change the campus culture of Brown University.

Hang Tran Poster: A4

Home Institution: Brown University

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

Faculty Mentor: Michael Stewart (English)

Mermaids & Metaphores

This project thought about mermaids and monsters. It collected archival materials, narratives, historical accounts, fiction, poetry, theory to complicate questions such as: How does the mermaid relate to gender and sexuality? How do monsters reveal society's anxieties, abjections, phantasies? Weaving together critical-race and queer theory, Emily Dickinson, sequins, and queer modifiers, I produced an intertextual narrative that fixates on language and images and sensibility (senses/sensible/nonsense) to activate spaces unsensed.

Aliosha Bielenberg, Brandon Stubbs, Kelley Tackett, Halle Krieger, Justin Han, Remy Poisson Poster:A5

Home Institution: Brown University

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

Faculty Mentor: Yannis Hamilakis (Joukowsky Institute for Archaeology and the Ancient World)

Koutroulou Magoula Archaeology and Archaeological Ethnography Project

The Koutroulou Magoula project -- a collaboration between Brown, University College London (UCL), and the Greek Archaeological Service -- centers on a multi-period archaeological site in central Greece with the main period of occupation in the Middle Neolithic (around 6000 BCE). It is a finds-rich tell, with buildings surviving to more than 1 m in height, pottery, lithics, animal bones, and an impressive corpus of more than 350 clay figurines. Through the UTRA program six Brown students engaged with the site as artists, ethnographers, and scientists. This involved training in archaeological field

techniques and independent research that linked to our individual disciplinary backgrounds.

Life Sciences Individual and Team Presentations

Willie Tobias — Poster: A6

Home Institution: Tougaloo College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Brian Leblanc (Immunology)

The Role Of Extracellular Matrix Proteins On Neutrophil Aggregation In Response To Fungal β-glucan.

Candida albicans fungal infection makes elongated hyphae that are resistant to phagocytic elimination. These tissue based fungal initiates neutrophilic clustering and NETosis, which requires contact with ECM (Fibronectin). The functions are mediated by B2 integrin, Complement receptor 3. Our lab compares various matrices, such as fibrinogen, vitronectin, laminin and collagen(I, IV) in order to understand if these responses are matrix-specific. These are ECMs that are possibly doors into the different functionalities of the neutrophil. Fungal infections are problematic in the ICU and detrimental to a patient's recovery time. This research will hopefully lead to alternative therapies to combat fungal infections, improve recovery time of patients and help us better understand how integrins and membrane receptors interact with ECM.

Victoria Tran — Poster: A7

Home Institution: Brown University

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

Faculty Mentor: Gilad Barnea (Neuroscience)

Transsynaptic mapping and manipulation of the postmating switch circuit in *D. melanogaster*

The postmating switch is a hardwired neural circuit underlying the change in receptivity and egg laying behaviors that occurs in female flies after copulation. The novel genetic tool, trans-Tango, will grant access to these highly specific neural circuits by using an exogenous receptor-ligand pair. Expressing the receptor pan-neuronally while genetically limiting the expression of the ligand tethered to the presynaptic terminal membrane will selectively target the expression of the reporter gene to postsynaptic neurons. The reporter gene can be genetically controlled and can range from fluorescent labeling proteins to ion channels that induce tonic activation or repression of the neurons in order to map and manipulate neurons within circuits such as the postmating switch circuit.

Andrew Verdesca — Poster: A8

Home Institution: Brown University

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

Faculty Mentor: John Sedivy (Department of Molecular Biology, Cell Biology and Biochemistry)

Elucidating the Relationship between IGF-1, MYC, Longevity, and Osteoporosis

Mice heterozygous for the transcription factor Myc live 20% longer and have decreased rates of age-related morbidities, including osteoporosis. Myc+/- mice also have lower serum levels of the protein IGF-1, which is associated with increased lifespan but also with increased risk of osteoporosis. We hypothesize that bone-specific increases in IGF-1 expression compensate for the decreased serum IGF-1 in a sex-specific manner. Consistent with this hypothesis, we have found that bone IGF-1 RNA and protein are increased in Myc+/- females, but decreased in Myc+/- males compared to WT. To mechanistically address how these changes correlate to the osteoporosis phenotype, we have assessed and found significant changes in markers of differentiation and function in primary osteoclasts and osteoblasts isolated from Myc heterozygotes.

Brian Vuong Poster: A9

Home Institution: Brown University

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

Faculty Mentor: Bahar Bilgen (Orthopaedics)

The Effects of Doxycycline on Chondrocyte Viability, Biochemical and Biomechanical Properties of Cartilage in Osteochondral Allografts

The antibiotic doxycycline has been shown to disrupt chondrocyte differentiation and inhibit cartilage matrix degradation. We hypothesized that doxycycline would improve chondrocyte viability, attenuate glycosaminoglycan (GAG) content loss, and better maintain the biomechanical properties of cartilage for osteochondral allografts. In this study, calf cartilage plugs were cultured at 37 C in the absence and presence of doxycycline (1 ug/mL, 10 ug/mL) for 9 weeks. LIVE/DEAD Viability/Cytotoxicity assays demonstrated that 1 ug/mL of doxycycline yielded the highest chondrocyte viability at biweekly time points. On d28, GAG levels were significantly higher in the 1 ug/mL doxycycline treatment group. However, the equilibrium modulus of plugs in the 10 ug/mL doxycycline treatment group on d42 were significantly higher than that of the other treatment groups.

Rachel Walker Poster: A10

Home Institution: Brown University

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

Faculty Mentor: Qian Chen (Department of Orthopaedics)

Impact of Tumor Necrosis Factor Receptor Pathways in Osteoarthritis Stem Cells

Osteoarthritis is a chronic disease which affects millions of people by causing pain, inflammation, and ultimately the degradation of the cartilage and bone primarily associated with joints. My research focused on influencing the TNF receptor pathway in human osteoarthritis stem cells and determining potential treatment targets. Cell cultures were used to evaluate the gene target(s) before treating the cells with small interference RNA (siRNA) to silence either TNF receptor 1 or 2. The cells were tested for gene expression of the targeted mRNA using real-time reverse transcription PCR to verify the inhibition. Inflammatory genes were tested as well to determine the impact of each receptor.

Hastings Williams, Daniel Solis Poster: A11

Home Institution: Tougaloo College

Summer Research Program: Summer Research Assistantship in Biomedical Sciences

Faculty Mentor: Mark Johnson (Molecular and Cell Biology)

The Hunt for bZIP60 Splicing

Sequencing data suggests that Arabidopsis thaliana changes its genetic expression in response to temperature stress via an unfolded protein response, where the ER located, membrane-spanning protein IRE-1 and its domains act as a “thermometer” of sorts, measuring the levels of unfolded protein in a cell as it increases with temperature. At some unfolded protein concentration, IRE-1 splices mRNA that would otherwise be expressed in the ER, into a form that is expressed in the nucleus, thus changing genetic expression. Commonalities in the genomes of Arabidopsis and tomato suggest that tomato also undergoes this response, and thus our project for the summer was to set out and find evidence of the splicing event that is characteristic of the unfolded protein response.

Raquema Williams Poster: A12

Home Institution: Tougaloo College

Summer Research Program: EPScOR REU

Faculty Mentor: Nitin Padture (Materials Science)

Towards Lead-Free Oxide Perovskites for Solar Cells

Solar power represents the largest form of sustainable clean energy. Among the technologies available to convert solar energy to electricity, hybrid organic-inorganic perovskites (HOIPs) have quickly emerged as a potentially low-cost, high-efficiency solar cell material. However, current HOIP materials have challenges with long term stability and lead toxicity. Here, we experimentally explore a class of lead-free oxide double perovskites. Prior theoretical research has simulated the electronic and optical properties of these materials, and suggested that Ba2SbV.75Ta.25O6 is the best suited target lead-free oxide perovskite material for solar cells. In this project we synthesized Ba2SbV0.75Ta0.25O6 perovskite from pure oxide powders. The pure oxide powders were mixed and calcined at different temperatures and durations in air. The resulting powders were characterized using X-ray diffraction and optical absorption spectroscopy. The results from these experiments are presented, together with a discussion of the possible use of this materials in future perovskites solar cells.

Olivia Woodford-Berry Poster: A13

Home Institution: Brown University

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

Faculty Mentor: Eric Darling (Biomedical Engineering)

Antibody Internalization in Mammalian Cells

Tissue engineering is a growing field that relies on the ability to distinguish between cell populations,

especially with regard to the regenerative capacities of stem cells. While antibodies are broadly used for cell sorting, tagging cells with animal-derived antibodies affects their clinical utility, and the lifespan of antibodies on the cell surface is not well understood. This study develops a technique to determine the internalization time of antibodies bound to mammalian cells, using A375 cells, a human melanoma line, as the model cell type. This method could potentially be used to determine the internalization time of antibodies tagging stem cells, which would allow researchers to enrich stem cell populations for clinical applications or the development of novel sorting techniques.

Phillip Yang, Claire Chung Poster: A14

Home Institution: Brown University

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

Faculty Mentor: Yang Zhou (Department of Molecular Microbiology and Immunology)

Elucidating the Roles of PLSCR1 in a House Dust Mite Murine Asthma Model

Phospholipid scramblase 1 (PLSCR1) regulates phospholipid translocation across the lipid bilayer and is believed to contribute to the innate immune response. This project investigated the role of PLSCR1 in a house dust mite (HDM) murine asthma model. Four wild type (WT) C57/B6 mice and four PLSCR1 knockout mice were given 25 μL intranasal administrations of HDM powder in PBS (1 mg/mL), three times a week for three weeks and sacrificed. One WT and one PLSCR1 knockout mice were given intranasal PBS as controls. The mice were then sacrificed and blood serum, bronchoalveolar lavage fluid (BALF), and lung tissues were collected for further analysis. Our results demonstrate that the PLSCR1 knockout mice had higher levels of inflammation than the WT mice, contributing to a more severe asthma phenotype. Thus, PLSCR1 appears to play a significant role in modulating the innate immune response and warrants further investigation into for the development of future asthma treatments.

Eric Zhong Poster: A15

Home Institution: Brown

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

Faculty Mentor: Wayne Bowen (Molecular Pharmacology, Physiology, and Biotechnology (MPPB))

Characterizing the Effects of MAM03055A, a Novel Bivalent Sigma-2 Receptor Agonist in Hepatocellular Carcinoma Cells

Hepatocellular carcinoma (HCC) is the third leading cause of cancer mortality in the world. Sigma-2 receptor agonists can induce cell death in HCC cells, leaving normal cells unharmed. This study aims to confirm the efficacy of a novel bivalent sigma-2 receptor agonist, MAM03055A by measuring cytotoxicity with the MTT assay and studying the biochemical pathway of apoptosis. I will confirm cytotoxicity of the compounds with the MTT assay using the yellow tetrazolium MTT dye. To determine the mechanism of apoptosis I will use Western blot to monitor the expression of apoptotic proteins, caspase 3, PARP, and BID. If MAM03055A is efficacious, it can be used in future HCC treatments or in conjunction with existing therapies to drastically improve survival rates.

Angela Zhu Poster: A16

Home Institution: Brown University

Summer Research Program: Summer Research Assistantship in Biomedical Sciences

Faculty Mentor: Albert Woo (Pediatric Plastic Surgery)

Classifying Nasal Septal Deviations by Examining Degree of Deviation Against Nasal Cavity Volume

Nasal septal deviations are among the most common physical deformities. However, there is no standardized classification system for physicians to diagnose and treat patients. A retrospective study was conducted at Rhode Island Hospital to develop such a system. In this study, quantitative measures of the nasal septum—tortuosity, deviation area, and root mean square—were compared against the ratio of the deviated side's volume to the total nasal cavity volume. DICOM file–formatted data were obtained and analyzed using MATLAB, OsiriX, and 3D Slicer. Participants were selected by a convenience sample of the most recent CT scans of the nasal cavity available from May to July 2018 in Rhode Island Hospital's database. The study ultimately hopes to identify a direct relationship between degree of septal deviation and corresponding decrease in the ratio of the deviated side's volume to the total nasal cavity volume. Future study directions may include relating nasal cavity volume to airflow.

Kenya Alfaro Poster: B1

Home Institution: California State University, Long Beach

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Qian Chen (Department of Orthopedics)

Sonic Hedgehog Regulates Cartilage-resident Mesenchymal Stem Cells in Osteoarthritis Patients

The concentration of this laboratory is the use of cell therapy on degenerative diseases specifically osteoarthritis(OA). The regulation properties of osteoarthritic derived mesenchymal stem cells (OA-MSCs) are analyzed due to the large presence of mesenchymal stem cells in OA cartilage. Duties include performing qRT-PCR and Southern Blotting to determine the mRNA expression levels of different markers in OA-MSCs.

Abigail Atkinson Poster: B2

Home Institution: Brown University

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

Faculty Mentors: Walter Atwood (Molecular Biology, Cell Biology & Biochemistry)

Use of fluorescent protein-tagged 5-HT2 receptors in elucidating JC polyomavirus infection in glial cells

JC Polyomavirus (JCPyV) is a human pathogen which in immunocompromised individuals causes progressive multifocal leukoencephalopathy (PML), a fatal central nervous system disease. All three variants of serotonin subtype 2 receptors (5-HT2Rs) are important for JCPyV infection of glial cells, but little is known about how the receptors and virus interact. I generated inducible lentiviral vectors expressing proteins 5-HT2aR-BFP, 5-HT2bR-mCherry and 5HT2cR-EGFP to explore whether JCPyV

interacts with monomers or homo/heterodimers of 5-HT2Rs during entry into host cells. I will generate glial cell lines stably expressing the fluorescent receptors and use confocal microscopy to visualize potential interactions. Elucidating the role of 5-HT2Rs in JCPyV infection may lead to the development of drug targets and therapies to treat or prevent PML.

David Baek, Jill Chen Poster: B3

Home Institution: Brown University

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

Faculty Mentor: Debasree Banerjee (Instructor in Medicine)

Effect of Chi3l1 on Macrophage Function in Septic Condition

Sepsis, the overwhelming systemic inflammatory response to bacterial infection, is one of the leading causes of death among critical patients in the developed world. It has been reported that Chi3l1 is significantly dysregulated in patients with sepsis, though its role as a biomarker or its function in injury repair in sepsis have not been elucidated. In this project, we look for how Chi3l1 regulates macrophage function via alteration of mitochondrial oxidative metabolism, meaning production of Chi3l1 results in reduced bacterial clearance (phagocytosis) and increased oxidative stress leading to heightened inflammatory and injury responses in the pathogenesis of sepsis.

Katherine Barry Poster: B4

Home Institution: Brown University

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

Faculty Mentor: Edward Walsh (Departments of Neuroscience, Diagnostic Imaging and Institute for Brain Science)

Magnetic Resonance Mapping of Tissue Conductivity and Permittivity

Magnetic resonance imaging continues to expand into new diagnostic areas as a result of improvements in scanner hardware, image data acquisition development, and implementation of new image reconstruction techniques. Using a rearrangement of Maxwell's equations, it is possible to produce maps of permittivity (ability of a material to be polarized) and conductivity using a clinical MRI scanner. Using a custom pulse sequence, maps of conductivity and permittivity are shown for a set of calibrated saline solutions. This technique will find use in tumor diagnosis and characterization, as well as for mapping of tissue electrical properties for source localization in simultaneous MRI/EEG studies.

Myles Bartholomew Poster: B5

Home Institution: Xavier University of Louisiana

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Alfred Ayala (Division of Surgical Research)

The Contribution of SHP-1 Signaling to Sepsis-Induced Changes In Not Only Immune Cell Function, but Overall Survival

We recently reported heightened expression of PD-1 and PD-L1 in septic background control mice with dysfunctional immune response. We hypothesize that in response to increased expression of PD-1 caused by sepsis, SHP-1 is activated. To examine this hypothesis, we provide data on the relative change in activated SHP-1 (phospho-SHP-1): unactivated SHP-1 levels in the endotoxin (LPS)-stimulated J774 mouse macrophage cell line over time, as well as in peritoneal macrophages derived from mice. Additionally, we explore the effects of tyrosine phosphatase inhibitor 1 (TPI-1) on survival. This study will elucidate not only if SHP-1 is activated in excess by sepsis, but also if it might be a novel target for increasing resistance to experimental septic mortality.

Gabriela Batista Poster: B6

Home Institution: Brown University

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

Faculty Mentor: Theresa Desrochers (Neuroscience)

Investigating how motor sequences facilitate abstract task sequence execution

We complete sequences of tasks daily, e.g. making coffee, that include both simple motor movements (grind beans) and abstract planning (prepare coffee) to accomplish a goal. While preliminary data showed that imbedded motor sequences facilitate the execution of abstract sequences, whether these sequences form integrated or parallel representations remains unknown. We examined how the addition or removal of motor sequences from learned abstract sequences changed performance. Participants practiced abstract sequences that either contained an underlying motor sequence, or did not. During a second session, motor components were removed or added to learned sequences. Preliminary results replicate that practice and imbedded motor sequences facilitate abstract task performance. Ongoing data collection seeks to elucidate how motor learning interacts with abstract sequential control.

Ryan Bronson Poster: B7

Home Institution: Brown

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

Faculty Mentor: Daniel Weinreich (Ecology and Evolutionary Biology)

Predicting effects of differential drug dosing schedules on the evolution of pyrimethamine resistance in *P. falciparum* infection.

We examine sixteen genotypes that increase *P. falciparum* fitness in the presence of pyrimethamine and a model for growth rate as a function of temporally changing drug concentration. We apply a range of clinically realistic and comparable drug dosing regimes to this model. Using our MATLAB simulation of evolution of drug resistance, we observe patterns given different temporal drug regimens. We account for changing environment due to human metabolism, mutational bias observed in P. falciparum, and various other applications of the model. We extend this work to a more general study of evolution in changing environment. We examine the possibility of an optimal drug regime for minimizing drug resistance and provide a framework for future population genetics studies.

Karisma Chhabria Poster: B8

Home Institution: Brown University

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

Faculty Mentor: Amanda Jamieson (Molecular Microbiology and Immunology)

The Role of Chemotaxis in Leukocyte Recruitment and Immune Prioritization

When the body is compromised by multiple insults, such as pneumonia and surgical wounding as a common clinical example, the immune system must adjust its response to these competing inflammatory sites. Our earlier findings show that infection in the lungs causes delayed dermal wound healing and decreased recruitment of innate immune cells to the wound. We hypothesize that cell trafficking patterns manifest differently when faced with the dual insult, especially related to chemokine-mediated chemotaxis. We have performed in vitro and in vivo experiments to address the functional significance of altered chemokine receptor expression on leukocyte migration in this model. Our findings suggest that cell trafficking is a point of control in apparent immune prioritization of multiple inflammatory sites.

Alyssa Clayton Poster: B9

Home Institution: University of California, San Diego

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Elizabeth Harrington (Graduate and Post-Doctoral Studies in the Division of Biology and Medicine)

Effects of Rab11 Wild-Type Overexpression on Pulmonary Endothelial Cell Function

Our lab has shown that the endosomal protein, p18 and Rab family GTPase proteins, Rab-4 and Rab-9, were protective against Acute Respiratory Distress Syndrome (ARDS) via endocytic trafficking and the recycling of vascular endothelial-cadherin to the endothelial cell surface, thereby promoting barrier function. We hypothesized that late endosomal protein Rab11 wild-type (WT) would be protective against bovine pulmonary endothelial cell (BPAEC) damage. Rab11 cDNA was transfected into the BPAECs so as to create an overexpression model and examine its effect on BPAEC migration, tube formation, and permeability. Data is still being collected, however, we speculate that understanding the role of Rab11 WT in endothelial cell function may reveal innovative treatment approaches to repair the vasculature in settings of ARDS.

Ryan Cohen Poster: B10

Home Institution: Brown University

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

Faculty Mentor: Karla Kaun (Neuroscience)

Investigating ethanol as a potential modulator of Notch endocytosis

Alcohol affects the brain's reward pathways, resulting in cravings that fuel addiction. We have

previously shown that the Notch signaling pathway is upregulated upon exposure to behaviorally relevant doses of alcohol. This signaling pathway involves the dual cleavage of the intermembrane receptor Notch, after which the Notch intracellular domain translocates to the nucleus and interacts with transcription factors to impact gene expression. Endocytosis plays a role in Notch signaling and trafficking within cells. Rab proteins, GTPases that regulate endocytic trafficking, support the study of endocytosis by serving as markers of endosomal elements. This project aims to investigate the dose-dependent effect of ethanol on Notch endocytosis by studying Notch and Rab5 in cultured Drosophila S2 cells.

Samantha Cohen Poster: B11

Home Institution: Brown University

Summer Research Program: American Physiological Society (APS) Undergraduate Summer Research Fellowship (UGSRF)

Faculty Mentor: Carlos Aizenman (Neuroscience)

A Computational Model of the Emergence of Multisensory Integration in Xenopus Laevis Tadpoles

Researchers in the Aizenman lab have hypothesized that the multisensory phenomenon of inverse effectiveness may arise from the supralinear summation of individual tectal neuron responses resulting from active dendritic properties. Furthermore, NMDA receptors may mediate this non-linear summation. In this study, we attempt to answer the following questions: are such dendritic properties necessary or sufficient for multisensory integration, and how many NMDA receptors must be recruited in this process? Using the NEURON simulation environment (Hines and Carnevale, 1997), we will be building a computational model of multisensory neurons that incorporates visual and hindbrain (auditory, mechanosensory) input. Data obtained from the model will be paired with morphological data, building off of previous Aizenman lab studies on tectal cell morphology. This software will allow us to manipulate several key parameters, including active dendritic properties and dendritic morphology, as well as the location and density of NMDA receptors. We hope that proper adjustment of these parameters will help generate a testable hypothesis that could then be addressed experimentally in the live optic tectum.

Vanetta Walley Poster: B12

Home Institution: Tougaloo College

Summer Research Program: Brown-Tougaloo Partnership

Faculty Mentor: Alison DeLong (Molecular Biology, Cellular Biology and BioChemistry)

PP2A Regulatory Subunit Mutations That Increase Organ Size in Arabidopsis thaliana

Reversible phosphorylation of proteins modulates cellular metabolism and activities in response to external stimuli, and is controlled by protein phosphatases. Protein Phosphatase 2A (PP2A), a Ser/Thr phosphatase that includes three subunits (A, B, and C), regulates diverse cellular processes. The B subunits of PP2A are regulatory subunits, encoded by three gene families, conserved in plants and animals: B55, B56, and B72 (Booker and DeLong 2017). The DeLong lab has demonstrated PP2A regulation of ethylene synthesis in Arabidopsis, but has not yet identified which B subunits are involved. We are using a genetic approach to test the hypothesis that B72 family members (B12 through B17) are involved in regulating synthesis of ethylene. An evolutionarily duplication event produced the

closely linked B16/B17 gene pair. We used CRISPR-mediated mutagenesis to mutate B16 and B17 simultaneously and isolated a frameshift mutation that ablates important C-terminal regions of both B16 and B17 proteins. To address possible functional overlap with B13, another seedling-expressed B72, we also constructed a mutant line carrying a b13 knock-out mutation in combination with b16b17+1. Mutations of the B72 subunits confer increased seedling organ lengths as well as increased leaf dimensions. The b16b17 mutants showed reduced sensitivity to an inhibitor of the metabolic enzyme, hydroxymethylglutaryl-CoA reductase (HMGR). Our data suggest that B72 subunits are important regulators of growth and metabolism in plants.

Sophia Collis Poster: B13

Home Institution: Brown University

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

Faculty Mentors: Beatrice Lechner (Pediatrics)

Development of an RNA Knockdown Model to Evaluate the Role of Biglycan in Fetal Membrane Cell Rupture

Preterm birth is linked to deficiencies in the biglycan (BGN) glycoprotein. Mice entirely deficient of BGN deliver prematurely and have abnormal fetal membranes (FM), but do not yield a high FM cell count. Therefore, we must design a BGN knockdown model with RNA Silencing. FMs were harvested 16.5 days after gestation; cells were cultured until 90% confluence was reached; siRNA-transfection reagent cocktails were prepared and added to cells. Western blot analysis showed a successful BGN knockdown with a higher concentration of siRNA relative to the transfection reagent. However, further experimentation will be needed to refine these values. Once this is achieved, we may look more in depth into the role that BGN plays in FM cell rupture.

Beatriz de Arruda Poster: B14

Home Institution: Brown University

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

Faculty Mentor: David Borton (School of Engineering)

Development of a wireless implantable electromyography system for recording muscle activity in freely-moving animals

This project aims to develop a prototype signal processing implant for collecting chronic electromyography (EMG) data from untethered animals. Such a system is useful for neuroscience research because data acquired from freely-moving animals better depict the functions of the animal's motor system in a naturalistic setting. I extended an existing commercial wireless neural transmitter (Blackrock Microsystems, Utah) to acquire EMG signals in addition to brain activity data. I developed a circuit board which attenuates the EMG signals before routing them to the commercial transmitter. Additionally, I designed the circuit encapsulation for chronic percutaneous implantation on the skull of non-human primates. Benchtop tests and validation in anesthetized mice were performed and the results are reported here.

Gabriela de Queiroz Campos Poster: B15

Home Institution: Brown University

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

Faculty Mentor: Jared Saletin (Psychiatry and Human Behavior at Alpert Medical School of Brown University)

Quantifying individual sleep patterns and symptom severity in childhood ADHD

Studies suggest that attention-deficit hyperactivity disorder (ADHD) may in part result from disordered sleep. This project aimed to further elucidate the interplay between sleep stability and pediatric ADHD symptomology. We monitored sleep-wake patterns of thirteen middle-school students (ages 10-13; with and without ADHD) over twelve weeks using wrist-worn actigraphy. This data was used to estimate bedtimes, sleep duration, and sleep regularity in their daily lives. Participants also underwent standardized neuropsychological assessment of ADHD (e.g., Conners-3). We mapped sleep measures onto ADHD symptom severity in order to assess whether children with increased inattentiveness and hyperactivity showed more irregular sleep. Our next analyses will examine how these associations dovetail with functional brain networks implicated in ADHD, as measured by fMRI.

Rodrigo Delatorre Poster: B16

Home Institution: New York University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Anne Hart (Neuroscience)

C. elegans Knock-in Models ALS: Characterizing Pathology and Creating Higher Throughput Assays

Amyotrophic lateral sclerosis (ALS) is a late-onset fatal neurodegenerative disease of the upper and lower motor neurons. Mutations in superoxide dismutase (SOD1) account for 20% of the patients with a familial history of ALS. These mutations may sensitize neurons to additional stressors or genetic mutations that may impair the cellular proteostasis machinery. Previous results in our lab showed improper phenotypic expression of rol-6 gene in transgenic C. elegans carrying the knock-in ALS-associated sod-1 mutation, G85R, and the GFP-expressing transgene, vtIs1. Here, we propose a novel genetic screen to identify suppressors of ALS SOD1 toxicity in animals with improper rol-6 expression. We further explored the impact of ALS associated mutations on C. elegans behavior in two other genetic ALS models.

Jared Sanchez Poster: B17

Home Institution: Brown University

Summer Research Program: Program in Liberal Medical Education Summer Research Opportunity

Faculty Mentor: Jennifer Saunders (Rhode Island Hospital Department of Pediatric Endocrinology)

Unveiling the Hepatoprotective Mechanism Behind Ischemic Preconditioning in Pre-Injury Rat Model

Ischemia-reperfusion injury is a serious complication of liver transplantation which may irreversibly damage the transplanted organ. After a period of nutrient deprivation (ischemia), reestablishing blood flow (reperfusion) can lead to tissue injury via hypoxic, apoptotic, and necrotic cellular response pathways. Surgeons have had success combating oxidative and inflammatory insult using ischemic preconditioning; although, the mechanisms behind the hepatoprotective action of ischemic preconditioning remains unclear. Western Blot analysis reveals that various MAPks (Mitogen-Activated Protein kinases) might be involved in both the hepatocellular damage after prolonged ischemia and hepatocellular protection following short ischemic preconditioning.

Breanna Demestichas Poster: C1

Home Institution: Binghamton University

Summer Research Program: Undergraduate Research Assistant in Kaun Lab

Faculty Mentor: Karla Kaun (Neuroscience)

Characterizing Drosophila melanogaster as a model organism for fentanyl abuse

Opioids are a class of substances known for their analgesic and euphoric effects. The highly addictive traits of synthetic opioids, including fentanyl, have led to an opioid epidemic worldwide. Due to its versatile set of genetic tools and striking similarity in reward circuitry to the mammalian brain, Drosophila melanogaster is an excellent model for investigating the molecular basis of addiction. While fentanyl activates the mu-opioid receptor in mammals, the mechanisms through which it affects Drosophila are unknown. We investigated acute and self-administration behavior of Drosophila following fentanyl exposure and further predicted binding sites for fentanyl on the Drosophila mu-opioid receptor homolog.

Laura Diaz Poster: C2

Home Institution: University of Puerto Rico, Rio Piedras Campus

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Thomas Bartnikas (Pathobiology)

Identifying Mouse Tissues that Express the Manganese Transporter Slc30a10 and Analyzing Glycogen and Lipid Levels in Slc30a10 Deficient Organs in Mice

Miners exhibit manganese accumulation which can lead to a Parkinson-like syndrome known as manganism. In 2012, the first case of inherited manganese excess was identified in a small group of patients carrying homozygous mutations in SLC30A10. In a study about homozygous mutations in Slc30a10 in mice, the most prevalent accumulation of manganese was in the liver and the central nervous system. Since Slc30a10 deficiency leads to manganese accumulation in the liver, then Slc30a10 will be found in the liver and liver pathologies induced by manganese toxicity will be identified in Slc30a10 deficient mice. We identified the localization of Slc30a10 using fluorescent imaging on Slc30a10-GFP mouse tissues. We also identified liver pathologies in mice who suffered loss of function of Slc30a10.

Edward Dickerson Poster: C3

Home Institution: North Carolina Agricultural and Technical State University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentors: Gregory Jay (Emergency Medicine)

Restoration of Joint Motion by rhPRG4 in Mutant Mice that Recapitulate Camptodactyly Arthropathy Coxa-Vara Pericarditis (CACP) Syndrome in Humans

The CACP syndrome is a rare autosomal recessive condition caused by mutations in the PRG4 gene, which encodes a lubricating glycoprotein present in the synovial fluid as well as the surface of articular cartilage. The skeletal component of the CACP disease begins at birth or early adolescence and it worsens with age. Lubricin is a surface active glycoprotein that plays a key role in preventing cartilage damage in healthy synovial joints. The purpose of this study is to investigate the effect of lubricin once injected into the synovial cavity. Current work in the lab is determined to seek if lubricin will increase the joint functionality percentages of the mice as well as eliminating any foreseen discomfort and hardship related towards gait. A machine called DigiGait was used to show the control mice's gait parameters. Areas of focus range from changes in stride length to paw angel percentiles. Before receiving the injection, two species of mice were placed on the treadmill. The same mice were injected with lubricin in both of their knee joints and placed back on the DigiGait. This procedure was repeated every 96 hours to study exactly how long the lubricin is effectively benefiting the mice's gait. Each possible treatment data phase was analyzed via calculated percentiles, always comparing new gait activity to the control's gait activity. After 16 days of experimentation, the results of the collected gait parameters after the lubricin injection are outstanding. There has been an increase and a decrease in some of the parameters, with the mice showing better strength, control, and authority of their hind synovial joints. This study has significant implications into understanding the development of CACP, as well as, articulating a movement dedicated towards increasing the healthfulness of the joints of those affected by CACP syndrome.

Tania Dominguez Poster: C4

Home Institution: University of Puerto Rico-Rio Piedras Campus

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Robbert Creton (Molecular Biology, Cell Biology And Biochemistry)

Imaging Behavior of Zebrafish Larvae Exposed to Diazepam (Valium) Using a 96-Well Plate Assay

Anxiety and chronic pain can be very crippling to humans. That is why some are treated with Benzodiazepines. In this study, we developed a high throughput assay to screen behavior of Valium sedation using zebrafish larvae as a model. We used a 96-well plate in order produce Valium sedation: 5 days post-fertilization (dpf) larvae zebrafish had 0% larval activity with 80uM Valium. Also testing Flumazenil as an antidote, showed partial rescue from the sedation even though we used up to 60uM Flumazenil. This allows us to screen many more pharmaceuticals and/or antidotes in a small period of time. Also, we can show the scientific community how the behavior of larvae zebrafish can be studied to treat neurological disorders.

Bailey Driscoll Poster: C5

Home Institution: Brown University

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

Faculty Mentor: Katie Sharkey (Psychiatry & Human Behavior)

Sleep in the Children of Women with Perinatal Mood Disorders

This project investigates if mothers' sleep patterns during pregnancy predict sleep their young children. We measure sleep in children >18 months old using one week of actigraphy with wristwatch-like devices that record activity levels, light exposure, and skin temperature. We use an algorithm to estimate the child's time asleep and light exposure during the first two hours of wake. Using data from previous studies of the mothers' sleep, we compare bedtimes, wake-times, and sleep quality. We then use blood samples from the children to analyze genome-wide DNA methylation. We hypothesize that sleep will be correlated between mothers and children and that we will detect epigenetic differences between "better" and "worse" sleepers that may be linked to differences in maternal sleep.

Alexandra Ertman Poster: C6

Home Institution: Brown University

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

Faculty Mentors: Andrea Simmons (CLPS)

How do big brown bats (*Eptesicus fuscus*) adjust their biosonar calls when exposed to virtual noise?

Big brown bats (*Eptesicus fuscus*) perceive their environment using echolocation, by which they emit ultrasonic calls and receive echoes to identify and classify objects. Echolocation is highly efficient and allows bats to navigate densely cluttered environments and avoid weakly-reflective obstacles. My goal is to understand how bats adjust their emitted calls in response to various noise conditions so that they maintain navigational accuracy. This will be explored through two experiments: (1) exposing a flying bat to pre-recorded echoes, to simulate encountering an unanticipated obstacle, and (2) training bats to locate virtual echoes, created by digitally manipulating their real-time calls, while being exposed to sounds similar to those heard while flying and foraging within a swarm of conspecifics.

Zihang Feng Poster: C7

Home Institution: Brown University

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

Faculty Mentors: Hongwei Yao (Molecular Biology, Cell Biology & Biochemistry)

Hyperoxic exposure causes endothelial-to-mesenchymal transition, implications for the pathogenesis of pulmonary hypertension

Rationale: Hyperoxic exposure in neonates causes lung injury including arrested vascularization and simplified alveolarization, which are the characteristics of bronchopulmonary dysplasia (BPD). Although most BPD survivors eventually can be weaned from supplemental oxygen, there can be residual pulmonary dysfunction and cardiovascular sequelae in adolescence and adulthood including pulmonary hypertension. One important contribution to pulmonary hypertension is the endothelial-to-mesenchymal transition (EndoMT), a biological process where endothelial cells (ECs) progressively

lose their specific markers and gain mesenchymal phenotype. We hypothesized that hyperoxic exposure diminishes the EC specific cell markers and lead to an increase in mesenchymal cell specific markers. Methods: Mouse fetal lung endothelial cell line (MFLM-91U) were exposed to hyperoxia (95% O2/5% CO2) for 24 h. Some cultures were placed in air for 24 h post exposure (air recovery). Protein extraction and BCA protein assay were performed to prepare Western blots for determination of mesenchymal cell markers: vimentin, α-SMA, CD44, Snail; and EC markers: VE-cadherin and PECAM-1. Western blot membranes were imaged using the ChemiScan, calculated by ImageJ program, and analyzed by GraphPad Prism software. Results: MFLM-91U cells exposed to hyperoxia and hyperoxia followed by 24 h air recovery showed increased levels of CD44, vimentin, and snail. The levels of α-SMA were not significantly altered among air, hyperoxic exposure and air recovery followed hyperoxia groups. The levels of VE-cadherin were reduced after hyperoxic exposure in MFLM-91U cells. Conclusions: Hyperoxic exposure causes endothelial-to-mesenchymal transition, which may be one of the mechanisms for pulmonary hypertension in BPD patients.

David Ferranti Poster: C8

Home Institution: Brown

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

Faculty Mentor: David Rand (Ecology and Evolutionary Biology)

Understanding the link between genetic and phenotypic variation in a highly heterogeneous environment

We examined genetic and phenotypic variation of the northern acorn barnacle, Semibalanus balanoides, across rocky intertidal habitats in order to assess the strength of natural selection in a heterogeneous environment. Previous work on the nuclear genome of S. balanoides has revealed a signature of selection along the tidal gradient. I analyzed the mitochondrial DNA of S. balanoides individuals living in four differentially-stressed microhabitats from the Damariscotta River in Maine. My results show no evidence of selection in the mitochondrial genome. Further work will involve characterizing the operculum of the barnacle to test for functionally significant phenotypic differences between high-tide and low-tide barnacles. This phenotypic data will be combined with the genetic dataset to perform a genome-wide association study (GWAS).

Sophie Fisher Poster: C9

Home Institution: Brown University

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

Faculty Mentor: Alexander Jaworski (Neuroscience)

Regulation of motor neuron wiring by the cell adhesion molecule TAG-1

Neuronal migration and axon guidance are essential for nervous system wiring. Using genetic inactivation in mice, we uncovered multiple functions for the neuronal cell surface protein Transient Axonal Glycoprotein-1 (TAG-1) in motor neuron wiring; primarily regulation of motor neuron cell body positioning and axon guidance. To determine if TAG-1 functions cell autonomously, we used a conditional knockout approach. After validating efficient motor neuron specific deletion of TAG-1, we confirmed cell-autonomous function. Now, we are using other genetic mouse models to understand the molecular mechanisms of TAG-1 function.

Celina Fonseca Poster: C10

Home Institution: University of Massachusetts Amherst

Summer Research Program: Summer Research Assistantship in Biomedical Sciences

Faculty Mentors: Christopher Born (Orthopaedics)

Platform for the Visualization of Bacterial Biofilms on Orthopaedic Implants

Surgical site infections in orthopedics pose a great problem for both physicians and patients. In spinal surgery there is a 0.5% to 18.8% surgical site infection rate, and a heightened risk for a chronic infection. Once a bacteria has adhered to a bone or implant, it forms a biofilm which is almost impossible to treat without removing the entire implant. This study focuses on a clinically-relevant experimental model to understand the development of biofilms, and research possible ways of removing them. Via Confocal Laser Scanning Microscopy and Scanning Electron Microscopy, we assess the biofilm formation Staphylococcus epidermidis on Polyetherether Ketone over the course of 24 hours.

Annaliese Fries Poster: C11

Home Institution: Brown University

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

Faculty Mentor: Mamiko Yajima (MCB)

Inducing Asymmetric Cell Division in the Sea Urchin Embryo Using Optogenetics

During the 8-16 cell stage of sea urchin embryonic development, asymmetric cell division at the vegetal pole produces smaller cells called micromeres that function as major organizers in the embryo. Micromere formation requires precise control of spindle orientation and positioning, as well as recruitment of cell fate factors, yet the molecular mechanisms that control this event are not well understood. Activator of G-protein Signaling (AGS) is a protein that localizes to the vegetal cortex and has been implicated in control of micromere formation. To test how AGS controls asymmetric cell division and micromere specification, we manipulated localization and activity of AGS with spatio-temporal control using optogenetics to induce asymmetric cell division.

Sydney Gang Poster: C12

Home Institution: Brown University

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

Faculty Mentors: Karla Kaun (Neuroscience)

Utilizing TRIC in Understanding the Neuronal Mechanisms of Alcohol Addiction

Alcohol addiction is a persistent global issue, yet the neural mechanisms underlying this addiction are not well elucidated. My project uses a transcriptional reporter of intracellular calcium (TRIC) to observe how ethanol affects neuronal activity in Drosophila dopamine neurons. Specifically, we are looking at the activation of dopaminergic PAM neurons, which have been found to be important in memory

formation. Dopamine is known to play a critical role in the rewarding properties of alcohol across species, from flies to humans. By analyzing the calcium activity of the dopaminergic PAM neurons, we can gain a better understanding of how the neuronal circuitry is affected by ethanol at the molecular level and how this may contribute to alcohol addiction.

Zachary Gardell Poster: C13

Home Institution: Brown University

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

Faculty Mentor: Ashley Webb (Molecular Biology, Cell Biology & Biochemistry)

Elucidating the role of FOXO3 in glioma stem cell reversible cell cycle exit

With a median five-year survival rate of less than 5%, Glioblastoma multiforme (GBM) is among the most lethal of human cancers. Current therapies fail to target a population of stem-like cells in the tumor niche termed Glioma Stem Cells (GSCs). Recent studies suggest GSCs arise from dysregulation of adult neural stem cells (NSCs). Data from our lab show the pro-longevity transcription factor, FOXO3, regulates the quiescent NSC pool. Using patient-derived GSCs, we are testing the hypothesis that FOXO3 may act similarly to promote and maintain cell cycle arrest in GSCs. We may thus uncover a new mechanism responsible for GSC reversible cell cycle arrest, thereby providing insight into strategies to develop targeted and more effective GBM therapies in the future.

Synphane Gibbs Poster: C14

Home Institution: North Carolina A&T State University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Michelle Dawson (Molecular Pharmacology, Physiology, and Biotechnology

Enhancing Therapeutic Efficacy of Platinum Based Drugs by Pharmacologically Inhibiting PARP in Ovarian Cancer

Ovarian cancer is the 5th leading cause of cancer mortality in women. The standard treatment includes platinum-based therapeutics which rely on inducing DNA damage-mediated apoptosis. Unfortunately, ovarian cancer cells overexpress a class of DNA damage repair molecules called PARPs. PARPs are hypothesized to reduce and delay effects of chemotherapies that induce DNA damage in cancer treatment. In this study, we tested the hypothesis that inhibiting PARP activity would increase efficacy of platinum-based chemotherapeutics. We tested this by evaluating the effect of Carboplatin in combination with the PARP inhibitor Niraparib Tosylate. The effects were analyzed by measuring toxicity, DNA damage and cell death. Our data suggest a synergetic effect of Carboplatin and Niraparib Tosylate by enhancing toxicity to cancer cells.

Andrea Gilmore Poster: C15

Home Institution: Brown University

Summer Research Program: Weiss Sipprelle

Faculty Mentors: Dio Garcia (Orthopaedics)

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

Serratia marcescens is a gram-negative bacterium commonly associated with chronic orthopedic wounds, specifically in the spine. Surgical Site Infections (SSIs) caused by opportunistic pathogens such as S. marcescens, often require longer hospital stays and additional surgeries. Serratia marcescens lacks much understanding and scientific consensus. Therefore, has been dismissed as a significant pathogen in need of clinical attention. To address this challenge, the antimicrobial effects of a Silver Carboxylate Complex coating were tested on three medical implant materials: peak, stainless steel, and titanium. The pathogen in study was inoculated onto orthopedic implant materials, and scanned via scanning electron microscopy in order to assess bacterial colonization. The significance of this project is to limit infections involving surgical devices regardless of antibiotic resistance.

William Hackett Poster: C16

Home Institution: Brown University

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

Faculty Mentors: Joo-Hyun Song (CLPS)

Automatic Adjustment of Saccade Planning

Participants were presented with either one diamond or one odd-colored diamond among distractors and instructed to make a saccade to fixate the target shape. They initiated eye movements to a single target faster than the odd-color target when the trial types were presented in separate blocks, suggesting different states of visuomotor readiness for the easy task versus the harder task. However, when the trial types were randomly mixed within a block, the initiation latencies homogenized, so that saccades were initiated more slowly for the single-target trials and more quickly for the odd-colored-target trials. When trial types were predictably alternated, there was still homogenization of initiation latencies, revealing that explicit knowledge of upcoming trial types is not driving this effect.

Andrea Malpica, Lola Loening Poster: C17

Home Institution: Brown University

Summer Research Program: IBES

Faculty Mentors: Jeanne Loewenstein (IBES)

Fish Habitat Enhancement and Broodstock Assessment in RI Waters

Our overall project objectives have been to obtain finfish population data in Providence River, quantify the effects of oyster reef restoration in Rhode Island coastal salt ponds on juvenile finfish populations, and identify areas that are substrate-limited and construct reefs to enhance broodstock in Narrow River and Green Hill Pond. The Coastal Restoration Team has been focusing on three projects this summer: Fish Habitat Enhancement (FHE) in Providence and Seekonk Rivers. Oyster Reef Assessment in Quonochontaug and Ninigret Ponds. Oyster Broodstock Enhancement in Narrow River and Green Hill Pond. Thus far, we have collected hundreds of oyster shells for spat collections in Green Hill Pond.

Sierra Harken Poster: D1

Home Institution: Brown University

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

Faculty Mentors: David Rand (EEB)

Characterizing mitochondrial physiology in Drosophila introgression lines

Metabolic disorders affect approximately one third of US adults. While mitochondrial function is known to affect these conditions, their precise effects are made difficult to discern due to to the interaction of their own genome (mtDNA), and the nuclear genome. To address this, we utilized Drosophila introgression lines to investigate how these two genomes function together (mito-nuclear interactions). Expanding upon previous data which demonstrated variable effects in response to metabolic stress across introgression genotypes, we assayed the mitochondrial activity in the Drosophila fat body with confocal microscopy. This is an important preliminary step in characterizing how mito-nuclear interactions affect metabolic activity.

Meghan Hershkowitz Poster: D2

Home Institution: Brown University

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

Faculty Mentor: Theresa Desrochers (Neuroscience)

Responses to Timing Patterns Using fMRI in Monkeys

Extracting sequential information from sensory environments is integral for everyday cognitive processes. To understand sequential processing, we are using functional magnetic resonance imaging (fMRI) in awake monkeys to examine neural activity as they passively view visual sequences. To isolate visual and temporal sequence characteristics, we are analyzing two additional visual tasks that both present visual stimuli in random order: one with no consistent timing, and one with temporally grouped stimuli. Based on previous findings (Marchant et al., 2013), we expect increased activity for the isolated timing patterns in the monkey striatum and insula. These results would suggest that the specific timing of stimuli is an essential component of sequence representation in the brain.

Jacquelin Ho Poster: D3

Home Institution: Brown

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

Faculty Mentor: Carlos Aizenman (Neuroscience)

Multisensory Integration and Schooling in Xenopus laevis tadpoles

The nervous system integrates information from multiple senses to allow an organism to interact with its environment. An open question is whether multisensory integration is genetically determined by brain development, or whether it arises with early sensory experiences. This project seeks to

answer whether normal sensory input is required for the development of typical schooling behavior in Xenopus laevis tadpoles. Schooling behavior depends on the integration of multisensory input; through manipulating the environment in which tadpoles are raised, we can discover whether sensory deprivation during early growth stages leads to difficulty with multisensory integration. From this, we will determine whether schooling behavior is learned or hardwired into the neural system.

Jeffrey Hsu Poster: D4

Home Institution: Brown University

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

Faculty Mentor: Michelle Dawson (Department of Molecular Pharmacology, Physiology and Biotechnology)

Characterizing Putative Epithelial-to-Mesenchymal Transition Phenotype of Ovarian Cancer Spheroids in Three-Dimensional Hydrogel Scaffolds

Ovarian cancer is the most lethal gynecological cancer largely due to its late detection after metastasis has occurred. Stromal cells (SCs) promote cancer cell growth by secreting growth factors and extracellular matrix proteins to remodel the microenvironment. Interestingly, when SCs develop senescence, these effects are amplified resulting in severe inflammation. Unfortunately, the exact role senescent stromal cells (SSCs) play in ovarian cancer metastasis remains unclear. Here, ovarian cancer cells are encapsulated in alginate microspheres in order to study phenotypic changes in response to SSC-conditioned media. Morphological characterization, qRT-PCR, and flow cytometry, are then used to elucidate whether SSC-secreted soluble factors promote an epithelial-to-mesenchymal transition (EMT), a process often associated with increased malignancy and invasion across multiple cancer types.

Reem Ibrahim Poster: D5

Home Institution: Smith College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentors: Ruhul Abid (Cardiovascular Research Center (CVRC), Cardiothoracic Surgery Division at Rhode Island Hospital,

Proteomic Analysis of Extracellular Vesicles from Human Bone Marrow-derived Mesenchymal Stem Cells

Our objective for this project was to determine if the protein contents of extracellular vesicles (EV's) released from human mesenchymal stem cells (hMSC's) grown in a non-stressed environment differs from EV's grown in a stressed environment, and if they are, what advantages and disadvantages they may have in regards to further applications regarding improving cardiac function. Using proteomic analysis, we determined that stressed EV's were shown to have certain upregulated proteins that may prove to be more helpful with inducing angiogenesis and assisting with overall recovery after a myocardial infarction. Our results raise the possibility that using stressed EV's for treatment may be more viable than non-stressed EV's for increasing blood circulation in patients suffering from chronic myocardial ischemia.

Carmilya Jackson Poster: D6

Home Institution: Tougaloo College

Summer Research Program: Burwell Laboratory

Faculty Mentors: Rebecca Burwell (Cognitive, Linguistic and Psychological Sciences)

Optogenetic Modulation of the Medial Prefrontal Cortex Regulates Novelty Exploration

Linked to the PER, necessary for object recognition, is the secondary motor cortex (MOs) and the infralimbic cortex (IL). The MOs aids in processing information about novelty whereas the IL aids in decision making. Our lab has shown that optical stimulation of PER at specific frequencies can alter recognition memory (Ho et al., 2015) but we predict that PER-MOs-IL interaction is crucial for novelty driven memory. To test this theory we're performing a 2D spontaneous object recognition task. Optical fibers are implanted into the MOs or IL of rats, which are stimulated at 30hz and 11hz. We hypothesize that stimulation at 30hz will increase exploration of a familiar object and stimulation at 11hz will decrease exploration of a novel object.

Carleen Jeffers Poster: D7

Home Institution: Brown University

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

Faculty Mentor: Thomas Serre (CLPS)

Automating Pathology with Deep Learning

Computer vision algorithms and deep neural networks have been exploited for the detection and diagnosis of cancer, as well as the prediction of patient survival and selection of optimal treatment path. However, the absence of a sufficiently large publicly available dataset of tissue images indicates that there exists an incredible untapped potential in training deep neural networks to identify pathology that can be unlocked by amassing a dataset of such images that meets current computer vision standards. As such, we aim to first create a dataset of pathology images specifically designed for training deep neural networks, and then systematically explore the effectiveness of deep neural networks trained on this dataset in reading tissue images. In particular, we hope to use this dataset to establish deep neural networks as a viable solution for automating diagnosis and accurately predicting patient survival from histopathological slides. It is the expectation that once we have been able to establish that deep neural networks are able to achieve levels of accuracy and reliability matching those of human practitioners, these algorithms can then be immediately incorporated into clinical settings to act as a second read on tissue slides, reducing human error. In addition, these networks have the potential to outperform human practitioners on these assessment tasks; as such, their implementation can lead to more reliable predictions. Ultimately, this work will lay the foundation for future research in the relationship between computer vision and pathology.

Soham Kale Poster: D8

Home Institution: Brown University

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

Faculty Mentor: Nicolas Fawzi (Molecular Pharmacology, Physiology and Biotechnology)

Automation of NMR Spectroscopy Protein Assignment

My project's purpose is to automate the process of NMR spectroscopy protein assignment in order to analyze the structure of FTO and other proteins. NMR spectroscopy is used to elucidate the structure and interactions of proteins. It provides information about each residue's connectivity and spatial location. However, it does not directly provide information about a residue's identity. The data need to be assembled into a model in order to reveal each residue's identity. Only then can meaningful biology be accomplished. Depending on the quality of data, this process can be cumbersome or impossible. My project uses a Monte Carlo Markov chain algorithm to sample through possible models to identify the best one.

Ye Eun Lee Poster: D9

Home Institution: Brown University

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

Faculty Mentor: Peter Belenky (Molecular Microbiology and Immunology)

Impacts of genotoxic agents on rates of ribosomal mutations in the 30S ribosomal rspE gene.

The RspE gene is responsible for encoding a portion of the 30S ribosomal subunit in B. subtilis. Single nucleotide mutations in the RspE gene provide protection from the effects of the ribosome targeting antibiotic spectinomycin. The goal of the project is to study the impacts of genotoxic agents on the mutations in the RspE gene. We will define whether specific treatments result in different mutation rates or a preference for specific nucleotide changes. Sequencing a library of these mutants using the Illumina next generation sequencing platform will allow to characterize the mutations and observe how various genotoxic agents impact mutation types and rates.

Raadhika Kher Poster: D10

Home Institution: Brown

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

Faculty Mentor: Sarah Delaney (Chemistry)

Epigenetic Erasure by TET Oxidation in the Nucleosome

DNA methylation is an important epigenetic marker with roles in gene silencing and imprinting. The most common form of DNA methylation occurs as 5-methylcytosine (5mC) and is often followed by a guanine residue in what is known as a CpG site. While DNA methylation can have beneficial roles, it may also be detrimental in a biological system, leading to disease such as cancer. Full oxidation of 5mC by TET enzymes yields 5-carboxycytosine, which can be recognized by TDG and excised as part of the base excision repair pathway. I am interested in observing the effect of TET oxidation of 5mC in a CpG site when the DNA is associated with histone proteins in a nucleosome.

Jay Khurana Poster: D11

Home Institution: Brown University

Summer Research Program: Summer Research Assistantship in Biomedical Sciences

Faculty Mentor: Alexander Brodsky (Pathology, RIH)

Pan-Cancer Analysis of Collagen Variants Shows Significant Associations with Patient Outcomes

The tumor microenvironment (TME) is a critical driver of tumor progression and response to therapy. Collagens are major components of the TME that control disease progression and mediate therapeutic response. Historically, overexpression of collagens has been associated with stiffening of the tumor stroma, malignancy and therapeutic resistance. However, the role of somatic mutations in collagens has not been addressed, and collagens are not included in currently available cancer targeted sequencing panels. Our preliminary results indicate that loss-of-function collagen missense and nonsense mutations are associated with altered survival and progression times across several tumor types. This work establishes collagen mutants as potential biomarker candidates of survival in several cancers and opens the pathway for additional functional research.

Sarah Kim Poster: D12

Home Institution: Brown

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

Faculty Mentors: Anne Hart (Neuroscience)

Developing new strategies to analyze exercise-induced fatigue in C. elegans

Amyotrophic lateral sclerosis (ALS), is a fatal neurodegenerative disease. Mutations in the human FUS protein cause some cases of familial ALS, and our work investigates this gene's C. elegans ortholog, fust-1. To see if there is a defect in behavior in worms with a patient allele fust-1 mutation we ran swimming assays. In this, we investigated the connection between sleep frequency and duration in these mutants. Understanding more about the genetic and molecular basis of ALS facilitates finding therapies for this disease and further understanding of why neurons die.

Hannah Kim Poster: D13

Home Institution: Brown

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

Faculty Mentors: Alexander Jaworski (Neuroscience)

Examining the Signaling Properties of Robo3 in Axon Guidance

During nervous system development, axons reach their targets in response to attractive and repulsive guidance cues, sensed by receptors in the axonal growth cone. Robo3 is a divergent member of the Robo family of guidance receptors. Robo3 differs from Robo1 and Robo2 in its intracellular domain

(ICD) and fulfills specialized functions during axon guidance, suggesting that Robo3's ICD contributes to its unique activity. We designed different versions of Robo3 with specific ICD deletions to study the function of individual intracellular motifs in Robo3's function. Additionally, we aim to identify proteins that mediate Robo3 signaling, and we established immunoprecipitation approaches to discover Robo3's intracellular binding partners. Our initial results lay the groundwork to gain deep mechanistic insights into Robo3-mediated axon guidance.

Justin Kim Poster: D14
Home Institution: Brown University

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

Faculty Mentor: Jun Feng (Surgery)

The therapeutic implications of protein kinase C inhibition in endothelial dysfunction induced by cardioplegic-ischemia/reperfusion injury

Cardioplegic-ischemia/reperfusion (C-I/R) injury, a condition that arises in cardiac surgery patients, triggers endothelial dysfunction, which can cause life-threatening cardiac conditions post-surgery. Unfortunately, the risk of C-l/R-injury-induced-morbidity and mortality is elevated for type-2 diabetes mellitus patients. Dramatic increase in intracellular Reactive Oxygen Species (ROS), which prompt endothelial apoptosis, plays a leading role in C-l/R-injury-induced endothelial dysfunction. The proposed project hypothesizes that inhibition of protein kinase C (PKC), a known regulator of ROS-producing pathways, will provide endothelial protection against C-I/R injury by reducing oxidative stress and apoptosis. Non-diabetic and diabetic Human Coronary Artery Endothelial Cells will be subjected to a simulated in vitro C-I/R injury with and without chelerythrine, a PKC inhibitor, pretreatment.

Jane Kruskop Poster: D15

Home Institution: Brown University

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

Faculty Mentor: Anne Hart (Neuroscience)

Suppressor gene loss of function ameliorates defects in C. elegans model of SOD1 ALS

We currently do not understand why motor neurons are dying in patients with amyotrophic lateral sclerosis (ALS), a neurodegenerative disorder. Identifying and characterizing genes with mutations that suppress neuron degeneration can deepen our understanding of the mechanisms behind ALS. We have identified a specific suppressor gene, referred to as goi-1 herein, whose loss of function ameliorates the glutamatergic neuron degeneration observed in our C. elegans model of ALS, caused by the G85R mutation of SOD1. To test if this gene suppresses other defects observed in our model, I used a swimming assay to determine if goi-1 loss of function suppresses locomotor defects in SOD-1G85R animals. I also examined if goi-1 loss suppresses cholinergic motor neuron degeneration in the sod-1G93A model.

Rushil Kumbhani Poster: D16

Home Institution: Brown University

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

Faculty Mentor: Richard Bennett (Department of Molecular Microbiology and Immunology)

A Mechanistic Study of Phenotypic Switching in the Human Fungal Pathogen Candida albicans

Candida albicans is the most prevalent type of fungal pathogen that commonly resides in the human gastrointestinal tract, and is able to cause mucosal and systemic infections in humans. C. albicans is able to epigenetically switch between two stable cell types, the “white” and “opaque” phenotypes, each with distinct cellular and colony morphologies, mating behaviors, and metabolic activity. These two phenotypes are regulated by a transcriptional circuit with interlocking feedback loops, with Efg1 and Wor1 being the master regulators of the switch between the two states. However, recent work has shown that knocking out the Efg1 gene still allows bistable switching, suggesting that there are as yet unknown factors regulating bistable switching.

Krishna Mallem Poster: E1

Home Institution: Brown University

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

Faculty Mentor: Gaurav Choudhary (Medicine)

Elucidating the effect of GPX4 inhibition on cardiolipin oxidation and subsequent downstream effects in the mitochondrial electron transport chain

In this project I worked to elucidate the role of GPX4 in skeletal muscle. GPX4 is a phospholipid hydroperoxidase that is responsible for degradation of lipid soluble reactive oxygen species (ROS). There are two types of ROS, which are water soluble or lipid soluble, and prior research has shown that an increase in ROS results in increased oxidation of cardiolipin. Cardiolipin is an important component of the inner mitochondrial membrane and its oxidation has been implicated to have a role in the mitochondrial electron transport chain. I studied downstream effects of GPX4 inhibition on the mitochondrial electron transport chain by observing changes in cellular respiration, mitochondrial structure, and cell viability. By determining the effects that GPX4 inhibition has on mitochondrial energy production, structure, and cell viability, a long term application would be to determine corresponding phenotypes in rats that relate to increased or decreased GPX4 activity.

Jena Lee Poster: E2

Home Institution: Brown

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

Faculty Mentor: Alison DeLong (MCB)

CRISPR-mediated mutagenesis facilitates genetic analysis of Arabidopsis PP2A genes

Protein phosphatases regulate plant life cycles through their regulation of signaling and metabolic pathways. One protein phosphatase affecting numerous aspects of plant growth is protein phosphatase 2A (PP2A), a heterotrimeric protein complex consisting of scaffolding (A), regulatory (B), and catalytic

(C) subunits. Although insertional mutagenesis has allowed the genetic analysis of many genes in the Arabidopsis thaliana model system, important members of the three B-subunit gene families are not represented in existing mutant collections by knock-out alleles. We are using paired gene-specific guide RNAs in combination with an egg-expressed Cas9 nuclease to rapidly generate large coding sequence deletions in two genes that encode members of the B56 gene family. We have also initiated characterization of the resulting mutants.

Troy Li Poster: E3

Home Institution: Brown University

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

Faculty Mentors: Dioscaris Garcia (Orthopaedics)

Silver Carboxylate Complex-Eluding Dressing Eliminates Methicillin-resistant Staphylococcus aureus and Propionibacterium acnes Colonization

Methicillin-resistant Staphylococcus aureus (MRSA) and Propionibacterium acnes (P. acnes) are major causes of Orthopedic Surgical Site Infections (SSIs) and once acquired, SSIs can be life-threatening and often require revision surgeries. Common surgical preps such as Chloraprep, Duraprep, or Betadine have been shown to be ineffective at eradicating bacteria prior to surgery. This project evaluated the therapeutic concentration of a Silver Carboxylate Dressing against MRSA and P. acnes. Post-operative surgical site infections have been on the rise due to the increasing prevalence of antibiotic-resistant pathogens and ineffective sterilization techniques. Our results indicate that MRSA and P. acnes are susceptible to the Silver Carboxylate Dressing upon wet application and also to the residual dry coating left behind for up to 72 Hours.

Mark Liang Poster: E4

Home Institution: Brown University

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

Faculty Mentor: Nicholas Fawzi (Bio MPPB)

ALS Associated Mutations in FUS Impact Protein Dynamics and Phase Separation

Fused in Sarcoma (FUS) is an RNA-binding protein implicated in the progression of neurodegenerative diseases such as ALS. FUS contains an intrinsically disordered prion-like domain capable of creating both dynamic assemblies and irreversible protein aggregates -- mutations in this region have been linked to familial forms of ALS, although the exact mechanisms of disease progression remain unknown. Here we show that pathogenic mutations in the low complexity region of FUS disrupt normal transient behavior of the protein, affecting native phase separation behavior. Using microscopy and NMR, we examine the protein in-vitro and confirm changes in the chemical environment of FUS, namely increased interactions and negatively impacted dynamics.

Ian Light Poster: E5

Home Institution: Brown

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

Faculty Mentor: David Rand (Ecology and Evolutionary Biology)

Phenotypic differences between High and Low elevation populations of Drosophila in response to Hypoxia

The research I conducted was a slightly different direction than the proposal. I looked at the phenotypic difference in hypoxia responses between two populations of wild Drosophila. One population is from high elevation from Fiche, Ethiopia. The other was an ancestral strain from lowland Zimbabwe. I measured the diameter of the dorsal trachea between the two populations as it has been observed that evolution under low oxygen levels can modify the diameter of this structure as it adjusts to oxygen needs. I also ran a development time assay where I compared the time taken for the different populations to develop to adulthood under low oxygen versus normal oxygen. The resistance to hypoxia of adults from both populations was also assessed.

Shirley Lin Poster: E6

Home Institution: Brown University

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

Faculty Mentor: Kevin Bath (CLPS)

The Effects of Early Life Stress on the Development of Cholinergic Neurons and p75NTR Expression in the Basal Forebrain Complex

Alzheimer's disease, a progressive disease that causes neuron death, affects more than five million people in the US and millions more around the world. My hypothesis for this investigation is that early life stress alters the development and maintenance of basal forebrain cholinergic cells, ultimately leading to reductions in basal forebrain cholinergic cell complexity and number. Furthermore, I hypothesize that early life stress impacts basal forebrain cholinergic cell development through its effects on the p75NTR signaling pathway. The p75NTR pathway has also been recently targeted as a potential treatment for Alzheimer's disease, so a better understanding of its mechanism and the factors that alter this pathway may lead to a not only potential for treatment for Alzheimer's, but also other neurodegenerative diseases.

Irmaris Lopez-Lopez Poster: E7

Home Institution: University of Puerto Rico

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

Faculty Mentors: Dioscaris Garcia (Department of Orthopaedics)

Rapid Visual Quantitative Diagnostic for the Detection of Bacterial Bioburden

On average, 5% of over two million fracture fixation devices implanted annually become infected, and more than 26,000 prosthetic joint infections are diagnosed annually. In open fractures, the rate of infection may be as high as 30%. These infections prolong recovery time, and result in additional hospital costs of up to $17,000.
Typically, orthopedic infections are identified using traditional methods such as culturing and

Polymerase Chain Reaction (PCR), but these procedures may take up to 14 days and are unreliable. The assay successfully identified bacteria in on synovial fluid and explants in approximately 30 minutes. The surface coverage of 43 synovial samples was analyzed using a threshold of <10% which is hypothesized to translate to a clinical infection.

Fahim Mahmud Poster: E8

Home Institution: Brown University

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

Faculty Mentor: Karla Kaun (Neuroscience)

Characterizing Drosophila melanogaster motivation and behavior in an ethanol self-administration apparatus

Globally, alcohol use disorders are among the leading risk factors for premature death. Despite the need for more effective treatment methods, much of the neuro-molecular mechanisms underlying alcohol-seeking behaviors remain unknown. In this study, we present a novel operant runway model for ethanol self-administration to characterize the motivational response and intoxicated behavior of Drosophila melanogaster. Drosophila exhibit long-term memory for the appetitive qualities of alcohol intoxication. We use this high-content behavioral assay, in conjunction with computer vision for fly-tracking and machine learning for quantifying behaviors, to analyze various behavioral metrics. We aim to identify key features associated with development of alcohol-seeking behavior. In the future, we will use this assay to characterize the reward-related neural circuits implicated in addiction.

Madhu Nori Poster: E9

Home Institution: Brown University

Summer Research Program: Summer Research Assistantship in Biomedical Sciences

Faculty Mentor: Carlos Aizenman (Neuroscience)

Current Source Density Analysis of Multisensory Circuitry Development in the X. laevis Tectum

Our multiple senses are constantly receiving parallel streams of information about our surroundings. We have observed neurons that are capable of integrating input from multiple sensory modalities, but many details about multisensory integration are still not understood. However, we know that several neurodevelopmental disorders, including Autism Spectrum Disorder (ASD), exhibit abnormal multisensory integration. There is evidence that early sensory experience shapes multisensory circuitry in the optic tectum of tadpoles, an ideal model for the study of multisensory integration. I aim to carry out Current Source Density Analysis (CSD) on electrophysiological recordings of local field potentials (LFPs) in the tadpole tectum to first, compare how the tectal network encodes unisensory versus multisensory stimuli, and second, investigate how different rearing environments sculpt the subcellular spatial pattern of visual and mechanosensory inputs onto tectal multisensory neurons.

Cate Marchetti Poster: E10

Home Institution: Brown University

Summer Research Program: Hassenfeld Child Health Summer Scholars

Faculty Mentors: Elissa Jelalian (Pediatrics)

Associations of Eating Meals Away from Home with the Home Food Environment and Body Mass Index in Elementary School Children.

The purpose of the present study was to test for a relationship between the frequency of meals purchased out of the home and the household food environment, and the correlation of both factors with body mass index (BMI) in children.This study is a cross-sectional evaluation of 82 children from low-income families living in three Rhode Island communities.

Nathan McDermott Poster: E11

Home Institution: Brown

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

Faculty Mentors: Jason Sello (Chemistry)

Chemical Inhibition of the Nitrosative Stress Response in Mycobacteria

Pupylation, a novel post-translational modification in bacteria wherein proteins are tagged with Pup (prokaryotic ubiquitin-like protein) for degradation, is critical for Mycobacterium tuberculosis undergoing nitrosative stress during infection. We hypothesize that pupylation can be inhibited by targeting Dop (deamidase of Pup), which activates Pup via hydrolysis of a key glutamine residue to glutamate, using 6-diazo-5-oxo-L-norleucine (DON), a covalent inhibitor of glutamine-utilizing enzymes. We have determined using resazurin and plate-based assays that DON analogues can render Mycobacterium smegmatis (a non-pathogenic M. tuberculosis surrogate) susceptible to nitrosative stress. Using copper-catalyzed Click reactions on alkyne-functionalized DON analogues, we found several proteins bound to the compounds. On-going biochemical experiments will determine if the DON analogues are targeting Dop, rendering the bacterium susceptible to nitrosative stress.

Sacha McElligott Poster: E12

Home Institution: New York University

Summer Research Program: BP-ENDURE

Faculty Mentor: Michael Paradiso (Neuroscience)

The role of saccadic eye movements in visual perception

Despite our experience of perceptual stability, our eyes are constantly in motion, darting around in subtle movements called saccades about three times a second. Saccades are used to sample important visual information from our environment, by quickly directing the fovea to relevant stimuli. Past studies have characterized perceptual changes that occur during saccade preparation, yet the physiological mechanisms that drive such changes remain elusive. In this study, we attempted to characterize these mechanisms by delivering transcranial magnetic stimulation (TMS) to human subjects' primary visual cortex, a region that has been implicated in saccade-based perceptual changes. We delivered rapid, single TMS pulses during a psychophysical discrimination task at various points relative to the saccade. In doing so, we attempted to abolish these perceptual changes leading up to saccades, and thus expose

one link in the chain between physiology and perception.

Sara Near Poster: E13

Home Institution: Brown

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentors: Judy Liu (Neurology)

BMP4 and Epilepsy

We are working with BMP4 and its ties to epilepsy. We are working with a second lab to observe brain slices in mice with a bmp4 deficiency and this will allow us to look at the cortex's. Also EEGs have been administered to try to pinpoint to onset of the seizures.

Abbigail Niewchas Poster: E14

Home Institution: Brown University

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

Faculty Mentor: William Park (Diagnostic Imaging)

Thermometric Measurements of Swine Liver By MRI During Microwave Ablation: The Use of Thermal Accelerant to Facilitate Complete Ablation of Tumors

My project will provide a detailed description of the thermal accelerant itself, a description of the goal for its use, the in vivo and ex vivo experiments ran with it and the corresponding data collected, and a discussion of its potential future in oncology.

Nancy Nkoudou Poster: E15

Home Institution: Brown University

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

Faculty Mentor: Oriel FeldmanHall (Cognitive, Linguistic and Psychological Sciences)

Can Anxiety Disorders be identified from imaging brain networks that mediate social risk?

The purpose of this study is to combine behavioral economic approaches and neuroimaging to examine the functional properties of brain regions involved in mediating risk in an adult sample. We will investigate the hypothesis that increased sensitivity in socio-emotional brain areas due to poor executive mediation of impulse-driven behavior results in increased patterns of social risk-taking behaviors and increased likelihood to anxiety disorders.

Margaux Zimmerman Poster: E16

Home Institution: Brown University

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

Faculty Mentors: Chun Lee (Molecular Microbiology and Immunology)

The role of IL-13Rα2/TMEM219 as a receptor to Chi3l1 in mediation of the EGF/EGFR pathway and the expression of immune checkpoint molecules in the pathogenesis of lung cancer

Previous studies have demonstrated that Chi3l1 binds to receptor complex IL-13-Receptor-α2/ TMEM219 to allow for downstream signaling. Initial studies demonstrate that Chi3l1 enhances immune checkpoint inhibitors (ICPIs) PD-1/PD-L1 expression in lung cancer cases. Upregulation of ICPIs have been shown to promote lung tumor development and metastasis through evasion of the host immune response. This project tested our hypothesis that tumor related growth factor EGF/EGFR activation contributes to lung cancer development and metastasis through the Chi3l1-(IL-13Rα2/TMEM219)-PD-1/PD-L1 signaling axis. Peritoneal macrophages collected from WT and IL-13Rα2 knockout mice were stimulated at various concentrations with recombinant Chi3l1. Results from protein and mRNA levels of expression of IL-13Rα2 and PD-1/PD-L1 allowed us to conclude that IL-13-Receptor-α2 plays an important role in Chi3l1 induction of PD-1/PD-L1 production in the EGF/EGFR pathway of lung cancer pathogenesis.

Jonathan Lee, Jacob Feder, Andrew Brodsky, Francis Cui Poster: E17

Home Institution: Brown University

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

Faculty Mentor: Anubhav Tripathi (Biomedical engineering)

Syringe PCR

Developing a device where we can perform PCR in the tip of a syringe. This allows for easy automation of diagnostic or laboratory protocols.

Alec Seidenberg Poster: F1

Home Institution: Hunter College, CUNY

Summer Research Program: BP-ENDURE

Faculty Mentors: Kevin Bath (Cognitive, Linguistic, and Psychological Sciences)

The effects of early life stress on development of circuitry underlying reward processing and depression

Exposure to early Life Stress (ELS) increases risk for neuropsychiatric disorders including depression and may impact reward processing. The prevalence of emotional and affective disorders is sexually dimorphic, affecting women nearly twice as often as men. However, the biological underpinnings of

these sex differences remain poorly understood. To investigate the effects of ELS on reward procession and depressive-like behaviors, we induce ELS in a mouse model by limiting a dam's access to bedding and nesting materials. Preliminary evidence suggests that exposure to ELS upregulates expression of striatal D2 and D4 receptors–implicated in pathology behind impairments in reward processing and depressive behaviors in females. To test the hypothesis that exposure to ELS impacts the development of circuitry underlying reward processing and depressive behaviors in a sex selective manner, we tested animals on measures including the light dark box, forced swim test and novelty induced hypophasia. We hypothesize that ELS females will exhibit increased depressive-like behavior. We predict that this increase in depressive-like behavior is, in part, the consequence of disruptions in signaling in the striatal dopamine pathway. To test this, we will attempt to rescue ELS-associated increase in depressive-like behavior with the dopamine D4 antagonist sonepiprazole... If correct, such findings may elucidate potential biological mechanisms underlying development of ELS associated pathology, mechanisms supporting sex selective risk, and identify novel pathways for intervention. Here, we report preliminary evidence where we directly test these hypotheses.

Catherine Seitz Poster: F2

Home Institution: Brown University

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

Faculty Mentor: Jessica Plavicki (Pathology and Laboratory Medicine)

The effects of sox9b on great vessel development in the heart

Congenital heart defects are the most common type of birth defect; however, most of the causes of CHDs are unknown. Using zebrafish as our model, we explored the effects of the high mobility transcription group, sox9b, on the development of the heart. We used a dominant negative sox9b, dnsox9b, construct to manipulate sox9b function. The dnsox9b is fused to a UAS (upstream activating sequence) element, so we can use a Gal4/UAS system to manipulate expression. When using a ubiquitous Gal4 promoter to drive dnsox9b, there is loss of sox9b function throughout the zebrafish, which causes malformations of the great vessels of the heart. When using a flia:Gal4 promoter to drive dnsox9b, the loss of sox9b is specific to the vascular endothelial cells, which does not cause great vessel malformations.

Joshua Pirl Poster: F3

Home Institution: Brown

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

Faculty Mentors: Laurent Brossay (Molecular Microbiology & Immunology)

Determining the role of Qa-1 in natural killer cell development and defense against murine cytomegalovirus infection

Natural killer (NK) cells are innate lymphocytes that are essential for host defense against viral infections and cancer. They recognize and eliminate cells termed 'altered self' based upon signals from activating and inhibitory surface receptors. These NK cell receptors bind a diverse group of ligands, which include both self and foreign proteins. One such ligand is Qa-1, a non-classical MHC molecule, which interacts with both activating and inhibitory receptors. Qa-1 also likely plays a role in the 'licensing' of NK cells, influencing their development of functional competence. We are using the in

vivo model of murine cytomegalovirus infection as well as in vitro activation assays to compare NK cell development and functionality between wild type and Qa-1-deficient mice.

Grace Plassche Poster: F4

Home Institution: Brown University

Summer Research Program: Weiss-Sipprelle Summer Intern Fellowship

Faculty Mentors: Dioscaris Garcia (Biology)

Novel Culture Methodologies to Maximize the Growth of Rare Actinomyces and their Production of Secondary Bioactive Metabolites with Antimicrobial Activity

In the post-antibiotic era, the need for novel antibiotics is one of the most pressing problems facing mankind. Actinomycetes sp. are a genus of soil bacteria responsible for several bioactive antimicrobials, but have been notoriously difficult to culture. This study focuses on the development of enviromimetic and heterogenic culturing techniques aimed at stimulating the production of novel metabolites. 3-Dimensional structures supplemented with chitin mimic the physical environment thus allowing for actinomycetes to anchor themselves to the structures. Co-culturing techniques antagonize the bacteria to augment their secondary metabolite production in response to a perceived threat. With methodologies in current practice, the majority of metabolites remain undiscovered, thus explaining the dire need for innovative methodologies such as those explored in this project.

Katerina Rademacher Poster: F5

Home Institution: Brown University

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

Faculty Mentor: Alexander Jaworski (Neuroscience)

Loss of Neuromuscular Innervation in the SOD-1G85R Mouse Model of ALS

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease, characterized by progressive loss of muscle function and motor neuron degeneration. Various genetic lesions, including mutations of the SOD-1 gene, can cause ALS, and current ALS mouse models rely on transgenic overexpression of disease-causing gene variants. Here, we characterize SOD-1G85R knock-in mice, in which the endogenous SOD-1 gene has been mutated, presenting a more accurate disease model. We observe pronounced degeneration of neuromuscular connectivity, reflected in a dramatic degradation and loss of motor neuron-muscle synapses in tibialis anterior muscles of SOD-1G85R/G85R mice, indicating that our ALS mouse model recapitulates a hallmark of disease progression in human patients. Continued development of better ALS models promises to elucidate disease mechanisms and possible therapeutic interventions.

Lizmaylin Ramos Poster: F6

Home Institution: University of Rhode Island

Summer Research Program: Summer Internship

Faculty Mentor: Carlos Aizenman (Neuroscience)

The Neurodevelopemental Effects of Early SSRI Exposure

One of the most commonly prescribed antidepressants, SSRIs (selective serotonin reuptake inhibitors), have been increasingly used over the last few years and continues on the rise. Mood-related pregnancy symptoms in combination with limited reports on the neuroteratogenic effects of this class of drugs have contributed to an increase in their use for maternal mental health. Despite their ability to reduce these symptoms, recent findings suggest a correlation between SSRIs and an increased risk of autism. Previous experiments done in the Aizenman lab show that early developmental exposure to SSRIs can cause behavioral deficits in Xenopus Laevis tadpoles. We hypothesize that developmental exposure to the agonist alone will produce neurobehavioral deficits and dendritic abnormalities that correspond to autistic-like phenotypes.

Andrea Rodriguez-Villafane Poster: F7

Home Institution: University of Puerto Rico

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentors: Jonathan Kurtis (Pathology and Laboratory Medicine), Jonathan Kurtis (Pathology and Laboratory Medicine)

Evaluation of the anti-parasitic effect of Plasmodium falciparum specific murine antibodies in in vitro assays

P.falciparum is responsible for the majority of deaths attributed to malaria. Murine models have been extensively used in literature to study host immune response against pathogens. In this project, we aimed to explore if mice vaccinated with P. falciparum infected human RBCs produce functional antibodies, which can inhibit the growth and multiplication of parasites in vitro. P.falciparum infected RBCs were enriched (up to 90%) from a culture with 5% parasitemia using immuno-magnetic enrichment methods and used for immunization of mice at 2-weeks interval. Four weeks after the first immunization, P.falciparum specific antibodies were measured in the serum to enrich then perform parasite growth inhibition assay (GIA). We predict P.falciparum specific murine antibodies will generate significant inhibition of parasite in GIA.

Carlan Romney Poster: F8

Home Institution: University of the Virgin Islands

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

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

Using CRISPR-mediated Mutagenesis to Analyze Protein Phosphatase Regulatory Subunit Function in Arabidopsis thaliana

In plants, protein phosphatase 2A (PP2A) modulates biosynthesis of the important signaling molecule ethylene (Booker and DeLong 2017). Members of the B72 family of PP2A regulatory subunits, B13, B16 and B17 genes, have been identified as candidate regulators of ethylene synthesis. The DeLong laboratory is using CRISPR-mediated mutagenesis to induce mutations in the B16 and B17 genes, a duplicated and very tightly linked gene pair. I am using a dark-induced leaf senescence assay to analyze ethylene-dependent phenotypes of adult b16b17 mutant plants. I also generated new CRISPR constructs

and introduced them into Arabidopsis via Agrobacterium-mediated plant transformation. These constructs are designed to create deletion alleles of B16 and B17 to knock out gene function.

Daniella Santos Hidalgo Poster: F9

Home Institution: University of Puerto Rico, Rio Piedras Campus

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Jonathan Kurtis (Department of Pathology and Laboratory Medicine)

Expression and Purification of MSP-7 and MSP-9 in E. coli for P. falciparum Malaria Vaccine Development

Malaria is a mosquito-borne infectious disease, caused by parasitic protozoans, commonly transmitted by an infected female Anopheles mosquito. Nearly all deaths of severe malaria are due to Plasmodium falciparum. The most vulnerable groups are children 0-5 years old who have not yet developed immunity. We have found that after years of exposure to malaria, some children have developed protective immune responses (antibodies). Our objective is to identify what differentiates children that are resistant to malaria with those who are susceptible. In order to reduce the burden that severe malaria causes, we are expressing and purifying these proteins: MSP-7 and MSP-9. Out of said proteins, MSP-9 displayed the most consistent expression. It is considered a promising vaccine candidate for malaria.

Douglas Shea Poster: F10

Home Institution: Brown

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

Faculty Mentor: Sarah Delaney (Chemistry)

Excision of DNA lesions in a nucleosome core particle by Thymine-DNA glycosylase

Each cell in the human body experiences hundreds of DNA nucleobase mutations daily, creating mismatches that potentially lead to unchecked proliferation. However, to maintain genomic integrity, cells employ base excision repair (BER): a proofreading mechanism in which incorrect nucleobases are enzymatically cleaved and replaced. The activity of Thymine DNA Glycosylase (TDG), an enzyme that rectifies lesions, is very well characterized in duplex DNA; however, cellular DNA is wound around histone proteins and packaged in nucleosome core particles (NCPs). My project is aimed at further understanding the ability of TDG to access and correct lesions at specific locations in the NCP, which has implications in the development of chemotherapeutic agents used in the treatment of cancers where these mutations are prevalent.

Daniel Shleifer Poster: F11

Home Institution: Brown University

Summer Research Program: Research Assistant

Faculty Mentors: Kevin Bath (CLPS)

Observing the Effects of a Limited Bedding Paradigm on Maternal Care

Early life stress (ELS) has significant consequences for neural and behavioral development, increasing risk for later pathology. Here, we tested the consequences of limited access to bedding on maternal behavior during early life as a model of ELS. We monitoring maternal behavioral of mice in control and limited bedding conditions from postnatal day 3 through 12. Rearing pups in limited bedding conditions led to a significant increase in sorties to and from the nest, increased locomotion, and in a subset of animals an increase in abusive behaviors compared to control rearing. This more precise understanding of the effects of this manipulation on maternal behavior will provide key insights into how the early environment impacts development.

Tara Srinivas Poster: F12

Home Institution: Brown University

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

Faculty Mentors: Eric Morrow (Molecular Biology, Cell Biology & Biochemistry)

Hippocampal synaptic protein levels in a mouse model of neurodevelopmental disorders

Glutamate pyruvate transaminase 2 (GPT2) catalyzes the reversible transamination between alanine and α-ketoglutarate to produce pyruvate and glutamate. Pyruvate can be utilized to support ATP production while alanine can serve as an alternative energy source for neurodevelopmental processes. Accordingly, GPT2 expression increases during the early postnatal stage, corresponding to high synaptogenic activity and a period of circuit development in mouse and human brains. Mutations in the GPT2 gene can alter the physiological postnatal function of the enzyme, resulting in neurodevelopmental deficits. Moreover, synaptic dysfunction, particularly in relation to neurotransmitter receptor density, is associated with various neurodevelopmental disorders. While Gpt2-null mice demonstrate neurological phenotypes and misregulated metabolic pathways, synaptic function in this model is less characterized. Here, we quantify glutamatergic receptor, GABA transport protein, noradrenergic precursor, and synaptic vesicle protein levels in Gpt2-null mouse hippocampi. Our studies could elucidate a relationship between Gpt2 and synaptic structure, function and transmission in a model of neurodevelopmental disorders.

Michael Stanger Poster: F13

Home Institution: Brown

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

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

Molecular Characterization of a Novel Ethylene Response Allele in Arabidopsis thaliana

The ethylene signaling pathway is critical to plant growth, opening of flowers, ripening of fruit, and plant defense. Initially, an Arabidopsis thaliana line carrying an insertion in a protein phosphatase gene demonstrated hypersensitivity to ethylene precursor ACC and an enhanced ethylene response phenotype. Further analysis revealed that the phosphatase mutation was not linked to ACC hypersensitivity, rather another unrelated mutation was present. This mutation (designated ahh1) is a small, in-frame deletion in the EBF2 gene, an important ethylene response regulator. Further work

has shown that ahh1 is a novel ebf2 allele. The characterization of ahh1 provides greater understanding of the interactions between signaling elements in the pathway. This insight could enable genetic manipulation of the pathway and have agriculturally-relevant applications.

Caitlin McElwee Poster: F14

Home Institution: Rowan University

Summer Research Program: Computer Research Association - Distributed Research Experience for Undergraduates

Faculty Mentor: Iris Bahar (Engineering)

Implementing New Neural Network Architectures

The project is part of a larger encompassing project in computer vision. The purpose was to conduct a study to evaluate the accuracy of new and currently used neural network architectures to find the best one for drawing and labeling bounding boxes on a photo of a cluttered surface. The end goal was to determine if squeezenet, a certain architecture, would perform on par with or better than other tested architectures (alexnet, VGG, Resnet). If it is at least on par with accuracy, the architecture would then be evaluated for speed, energy efficiency, etc for use onboard robots. The project also involved research into neural networks as well as Python libraries for machine learning.

Melanie Ortiz Alvarez de la Campa Poster: F15

Home Institution: University of Puerto Rico, Rio Piedras Campus

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Peter Belenky (MMI Department)

Impact of the Host Metabolism on Bacterial Antibiotic Responses

We aim to expand our understanding of the relationship between the host microbiome and the antibiotic responses of Staphylococcus aureus. We hypothesize that the state of a host's metabolism can affect the metabolism of the bacteria within it, and contribute to antibiotic tolerance. We aim to identify the genes that are involved in antibiotic tolerance and glucose metabolism in an in vitro model. We also seek to determine the impacts of induced hyperglycemia on the tolerance of S. aureus in an in-vivo mouse model. We expect to find that the composition of the microbiome has an effect on bacterial metabolism which could lead to the inactivation of CCR pathways that usually allow for glucose-protection when challenged with antibiotics.

Summer Research Symposium Posters

Friday, August 3

Physical Sciences, Social Sciences, and Team Presentations

Team Presentations

Reed Brown, Shaunak Shende, Aaron Brown — Poster: A1 & A2

Home Institution: Brown University

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

Faculty Mentor: Shreyas Mandre (Engineering)

Computational and Experimental Fluid Dynamics for Designing Arrays of Hydrokinetic Turbines

Increasing energy demands and the environmental challenges associated with them necessitate the investigation of renewable energy technologies. One approach is the use of hydrokinetic turbines (or underwater wind turbines). The effectiveness of such energy technology in meeting such a demand hinges on the practicality of their implementation. The amount of turbines available for a particular energy application is restricted by the provided land area, cost of turbines, and safe distancing of turbines. Typically, turbines are used in array configurations, in which several turbines in the same area are used to generate power. There are two direct ways of improving the efficiency: increasing individual turbine efficiency and increasing the efficiency of the entire array. The latter approach is explored in this project through computational fluid dynamics and wind tunnel experiments.

Charlie Steinman, Katie Concannon, Sam Wertheimer — Poster: A3

Home Institution: Brown University

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

Faculty Mentor: Sheila Bonde (History of Art and Architecture)

Excavating the Medieval Monastery of Tiron

The Tironensian monastic order, founded by Bernard of Tiron at the turn of the twelfth century, is an understudied example of the moment of monastic reform in the High Middle Ages. Our team excavated the now-collapsed east end of the mother abbey of the order in Thiron-Gardais, a small town in the Perche region of France. We found remains of the foundations of the east end, as well as numerous pottery fragments, decorated tiles, and architectural fragments. We effected a detailed plan of the church, and found convincing evidence for the presence of an extant second tower. Our findings form an important contribution to the study of high medieval monasticism and its architectures, and form an important foundation for future archaeological and historical study of the Tironensian Order.

Sumera Subzwari, Mary Dong, Yun Ho Kim, Harold Triedman, Amy Wang, Luke Zhu Poster: A4

Home Institution: Brown University

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

Faculty Mentor: Ugur Cetintemel (Computer Science)

Deep Learning in Emergent Large Vessel Occlusion Detection using Maximum Intensity Projections via CT Angiography

Emergent large vessel occlusions (ELVOs) are the most disabling acute ischemic strokes, causing disability and/or death without rapid endovascular thrombectomy. Since it takes almost 60 minutes for procedure initiation even with available radiologists, we tested the fidelity of convolutional neural networks (CNNs) to automate ELVO detection. After collapsing CT angiography scans into 2D maximum intensity projections (MIPs), we fed them into a modified ResNet-50 architecture with a 80/10/10 training/validation/test split and achieved validation accuracies around 92.3% with AUC of 0.946. Future plans include using model-specific features, 3D regions-of-interest, and additional data to improve results. Our results show that 2D-MIP-trained CNNs have potential to assist physicians in rapidly classifying ELVOs, vastly improving patient outcomes.

Harold Triedman, Amy Wang, Mary Dong, Luke Zhu, Sumera Subzwari, Andrew Kim Poster: A5

Home Institution: Brown University

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

Faculty Mentor: Ugur Cetintemel (Computer Science)

Applications of Machine Learning to Stroke Identification and Classification

We are an interdisciplinary research team developing a suite of deep machine learning models to solve high-impact problems in medical data analysis and prediction. Our projects involve the learning, development and application of machine learning (specifically deep learning) over real-world medical imaging data sets for real problems. We hope to make a significant impact on patient outcomes, as well as the productivity of medical staff, by more quickly identifying and classifying the most serious kinds of stroke, emergent large vessel occlusions (ELVOs). An ELVO is a particularly severe category of stroke whereby one of the major blood vessels feeding the brain is blocked. We use deep learning to improve a radiologist's workflow and prevent unnecessary disruptions by the stroke team waiting for rapid interpretation.

Jacob Marglous, Winnie Fan Poster: A6

Home Institution: Brown University

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

Faculty Mentor: Susan Gerbi (Molecular Biology, Cell Biology, and Biochemistry (MCB))

Mechanism of DNA re-replication in the fly sciara coprophila

DNA carries genetic information crucial for normal function of the cell. Abnormalities occur when

the perfect duplication of DNA to pass down to daughter cells is disturbed by DNA re-replication, a hallmark of cancer cells which occurs when a region of DNA is replicated more than once. However, DNA re-replication is a normal developmental event in the fungus fly Sciara. We use a variety of experimental strategies with this model organism to ask two questions: (1) which DNA sequences act as origins of replication, and are there any distinguishing characteristics of re-replication origins, and (2), what are the trans factors (e.g. proteins) that bind to the genome and override the normal cellular controls against re-replication?

Kevin Nguyen, Kiernan Bloye Poster: A7

Home Institution: Brown University

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

Faculty Mentor: Carl Saab (RIH Department of Neurosurgery)

Mechanisms of Spinal Cord Stimulation in Rat Models of Chronic Pain

Chronic pain is highly prevalent and expensive to treat. It is also contributing to the current opioid epidemic and deadliest overdose crisis in the United States. Modulation via spinal cord stimulation (SCS) is a non-opioid based, FDA-approved alternative for individuals experiencing severe pain. While research has shown that SCS can reduce the severity of pain by more than 50% in most patients, there is still considerable room for improvement. This endeavor has been impeded though by our incomplete understanding of the underlying mechanisms of SCS in the brain. Hence, more research is necessary to elucidate these brain mechanisms and optimize SCS. The goal of this project is to achieve the former in hopes of supporting research aimed at the latter.

Physical Sciences

Guillermo Alvarez Poster: A8

Home Institution: Cornell University

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

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

Insights into the Water Content of the Lunar Mantle from Pyroclastic Deposits

Pyroclastic deposits from volcanic eruptions on the Moon offer a window into the water concentration of the lunar mantle. Although we do not know the individual clast sizes and water contents of volcanic rocks in these deposits from remote sensing of the Moon's surface, we use numerical models to constrain clast cooling, water diffusion, and eruption dynamics for different rock sizes to estimate their pre-eruptive water content. Our estimate of water concentration of the lunar mantle could provide valuable insight for potential extraction for space exploration, magmatic processes within the Moon, and the formation and evolution of the Moon.

Jessica Bellows Poster: A9

Home Institution: Brown University

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

Faculty Mentor: Kareen Coulombe (Engineering)

Designing and Characterizing Anisotropy in Fibrous Scaffold Materials for Engineered Myocardium

Cardiovascular disease is extremely prevalent in the U.S. and is the leading cause of death worldwide. My project focuses on tissue engineering, which can be used to restore function to damaged or diseased myocardium. More specifically, I am characterizing the anisotropy of composite scaffold materials in order to improve the mechanical structure and function of engineered myocardium. Collagen fiber meshes are produced via wet spinning and cast in collagen and fibrin hydrogels to create tissue scaffolds. The scaffolds are then incubated and mechanically tested to determine effective stiffness, maximum strain, and ultimate tensile stress. Digital image correlation is also used to analyze anisotropy of the scaffolds. A precise understanding of anisotropic deformation will dictate the designs used to produce future engineered cardiac tissues with this scaffold material.

Laura Blackstone Poster: A10

Home Institution: Brown University

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

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

Analysis of Gas Emission Periodicity for Active Volcano Turrialba, Costa Rica

I am using crater photos taken every 10 seconds at Turrialba Volcano, Costa Rica, to study temporal variation of light scattering associated with the emission of water vapor from the volcano. Gas emission is often used as a potential proxy for magmatic activity and volcanic unrest. Here, we use this series of images to draw comparison about the periodicity of outgassing signals between and just prior to eruptions over January to April 2017. Preliminary results suggest that pre-eruption gas emissions have an abnormal increase in periodic emissions at around 100 seconds, when compared to background gas emission. This is important because eruption precursors could significantly help monitoring volcanoes and regulate access to or near the crater.

Alexander Brown Poster: A11

Home Institution: Bridgewater State University

Summer Research Program: Bridgewater State University Internship in conjunction with Brown

Faculty Mentors: Alexander Brown (Chemistry)

Synthesis and Characterization of Cyclen-derived Cationic Chelates

Magnetic resonance imaging (MRI) has become a crucial tool for modern medical diagnostics. High resolution scanning requires imaging agents which tightly chelate a highly paramagnetic ion while allowing for rapid water exchange. Agents are typically composed of a rare earth metal coordinated by a macrocyclic chelate, where cyclen-derived systems such as tetraazacyclododecane (DOTA) tend to display superior performance. This research presents a novel cationic DO3A derivative, where an

acetate arm of DOTA is substituted by a cycloalkane ring. This cationic fragment in the macrocycle has a dramatic impact on the structure and stability of the corresponding metal compounds, which may have implications in the future design of chelates and contrast agents.

Jason Chan Poster: A12

Home Institution: Brown

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

Faculty Mentor: Derek Stein (Physics)

Techstyle Materials: Prototyping An Energy Saving Multifunctional Membrane for Buildings

The Stein group is working to develop a membrane technology that increases the energy efficiency, durability and comfort of buildings. While energy efficiency of buildings is increasing due to better insulation and airtightness, the problem of moisture control has arisen. The reduced vapor permeability of building materials leads to a higher risk of costly moisture and mold issues. We are developing a composite membrane that can be used in buildings at a low cost and regulates humidity and temperature passively. Possible candidates for the variable vapor permeable membrane have been tested to determine their water vapor transmission rates at varying humidities. We are combining desiccants, binders, and variable vapor permeable membranes and testing their temperature and humidity regulating capabilities.

Daniela Chavez Poster: A13

Home Institution: Rhode Island College

Summer Research Program: Experimental Program to Stimulate Competitive Research (EPSCoR-NSF), Institute for Molecular and Nanoscale Innovation (IMNI)

Faculty Mentor: Rashid Zia (Physics)

Analysis of Grain Size Statistics of Perovskites through Photoluminescence Spectroscopy

Hybrid organic-inorganic perovskite (HOIP) materials are excellent light absorbers and have promising photophysical properties that make them ideal for solar cells. Grains boundaries in polycrystalline structures, however, hinder electron transport and introduce recombination sites that can degrade overall conversion efficiency. Conventionally, grain boundaries are identified by the presence of topographical grain grooves, which can be observed with scanning electron microscopy. Here we use photoluminescence microscopy to image grains. A focused laser excites a localized region of the sample, and the change in photoluminescence intensity across the boundaries helps delineate them. We then use image segmentation to identify the grain size, and then repeat measurements of many grains across the sample to study the grain size statistics.

Celine Chen Poster: A14

Home Institution: Brown University

Summer Research Program: Institute for Molecular and Nanoscale Innovation (IMNI)

Faculty Mentor: Ou Chen (Chemistry)

Solid-liquid-solid ion exchange reactions in CsPbxMn1-xCl3 nanocrystals

Lead halide (CsPbX3) perovskite nanocrystals (NCs), because of their superior optoelectronic properties, are promising materials for a range of applications, such as solar cells, light emitting devices (LED), and displays. Recent research has been exploring different methods to partially replace Pb through doping of Mn atoms, which introduce new optical properties to the perovskite NCs. In this research project, we studied two methods of Mn-doping. Specifically, CsPbxMn1-xCl3 NCs were first synthesized using a hot injection procedure. Additional Mn2+ was then doped into the NC post synthesis using a solid-liquid-solid cation exchange. We characterized the particles through structural and optical measurements and studied the effect of initial NC Mn2+ dopant concentration on the extent of additional Mn2+ doping.

Jungho Daniel Choi Poster: A15

Home Institution: Brown University

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

Faculty Mentor: Brenda Rubenstein (Brown Department of Chemistry)

Cancelling Signs: Exploiting Symmetry to Mitigate the Sign Problem in Quantum Monte Carlo Simulations

Quantum Monte Carlo (QMC) simulations are computational methods that numerically solve the Schrödinger Equation (in the absence of an analytical solution) by using random numbers to sample the equation. Unfortunately, QMC methods are plagued by the 'sign problem', which creates a signal-to-noise issue that prevents researchers from being able to use QMC to find reasonable solutions. This project attempts to mitigate the sign problem by seeing how physical symmetries in various systems impact the generation of Slater determinants in QMC and how those determinants cancel each other's signs. Ultimately, these findings will be used to develop codes and theory that improve the sampling process in QMC.

Carson Cole Poster: B1

Home Institution: Weber State University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Brenda Rubenstein (Chemistry)

Filtering Chemicals to Create the Ideal Molecular Computer Storage System

The human body performs some of the most complex computing tasks imaginable - ranging from maintaining biological rhythms to developing complex mathematical theories. However, unlike today’s silicon computers, the human body performs all of these tasks using molecules alone. Even so, few have ever thought about how a practical computer could be assembled out of small, organic molecules, and scaled up to the complexity of organisms. In this presentation, I will discuss how everyday molecules can be used to store information and perform meaningful computing tasks. After a general introduction to the field, I will discuss my personal efforts to exploit data mining techniques to identify small

molecules to store information. By identifying key characteristics of candidate molecules such as cross reactivity, solubility, and molecular size, controlling synthesis and degradation become more feasible. I used these attributes to filter through millions of small molecules that have been compiled from the literature. Key trends in reactivity that enabled the rapid identification of compounds that cannot be used at once for molecular memory because of their propensity to degrade were identified.

Michael Darby Poster: B2

Home Institution: Brown

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

Faculty Mentor: Steven Reiss (Computer Science)

Intuitive visual placement of code bubbles

Code bubbles, a software development environment by Professor Reiss, was meant to visually organize code files in a 2D environment, but the implementation needed improvement. This project is an attempt to reorganize the bubbles in a way that makes intuitive sense to programmers.

Eashan Das Poster: B3

Home Institution: Brown University

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

Faculty Mentors: Alberto Saal (Department of Earth, Environmental, and Planetary Sciences)

Collision between a mid-ocean ridge and South America: implication on the oceanic and continental volcanism

Volcanism is one of the major geological processes that brings material from deep within Earth. Volcanic material coming from different depths offer a cross-section view of the interior of the Earth, thus, providing an excellent opportunity to study the chemical composition of its interior. The Chile Mid Ocean Ridge in Pacific, forms the boundary separating the Nazca and the Antarctic plates, where new oceanic crust is being formed. This plate boundary plunges under South America forming a triple junction where three plates interact. In this project I study major, trace and volatile element contents and the Sr-Nd-Hf-Pb isotope ratios of a new set of ~50 submarine basaltic glass to characterize the Chile ridge mantle source composition.

Natalie Delworth Poster: B4

Home Institution: Brown University

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

Faculty Mentor: Elie Bienenstock (Applied Mathematics)

Neural Network Dynamics

We explore dynamics in various types of neural networks using a k-Winner Take All update scheme.

Eric DuBois Poster: B5

Home Institution: Brown University

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

Faculty Mentor: Ian Wong (School of Engineering)

Magnetic Nanocomposite Hydrogels with Responsive, Self-Healing Properties

Hydrogels are water-filled, polymer networks which can be used in drug delivery, tissue engineering and soft robotics. Existing hydrogels lack geometric complexity, mechanical strength and the ability to react to their environment. For this UTRA, I am developing designer hydrogels that can be 3D printed, using a dual-polymer network and magnetic nanoparticles to increase mechanical strength while imbuing dynamic functionality. By using a combination of ionic and covalent crosslinking, I can adjust mechanical stiffness as well as create self-healing behaviors. Furthermore, by incorporating magnetic nanoparticles or by ionic bonding I can remotely manipulate and actuate the hydrogels. These hydrogels exhibit improved material performance with biologically inspired functionalities via these mechanisms.

Natalie Feinstein Poster: B6

Home Institution: Brown University

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

Faculty Mentor: Jerome Robinson (Chemistry)

Lanthanum/Copper Bimetallic System as Catalyst for Oxygen Reduction to Make Hydrogen Peroxide Under Benign Conditions

As global energy consumption continues to rise, carbon-neutral energy carriers are increasingly important to prevent the release of carbon dioxide into the atmosphere. Hydrogen peroxide shows promise as a carbon-neutral energy carrier but requires a more efficient catalyst before it can be synthesized at the scale of a fuel cell for home energy use. Lanthanum and copper are commonly used in hydrogen peroxide synthesis – copper to reduce oxygen and lanthanum to make the exchange occur billions of times faster – but the amount of lanthanum required by these processes makes them unrealistic in a fuel cell. To resolve this issue, we propose a compound that holds the lanthanum and copper in close proximity so that significantly less lanthanum is required to catalyze the reaction.

Jasmine Gabor Poster: B7

Home Institution: Brown University

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

Faculty Mentor: Kareen Coulombe (Engineering)

Effects of BPA on Female Cardiomyocyte Function

My research focuses on the effects of BPA, an estrogen mimicking chemical, on female cardiomyocytes

as a model to study women's heart health. Cardiac disease manifests differently in men and women, suggesting that estrogen, and therefore estrogen mimicking compounds that bind to estrogen receptors, significantly affect heart function. This study was carried out using a 2D in vitro cell model and application of varying doses of BPA on female human induced pluripotent stem cell (hiPSC) derived cardiomyocytes, with male cardiomyocytes as a control. Cardiomyocytes were generated through cardiac differentiation of hiPSCs. After being exposed to BPA, cellular function was analyzed using videos of beating rate, analysis of gene expression for proteins in estrogen regulated pathways, and by quantifying cell death.

Gwen Gardner Poster: B8

Home Institution: Cornell University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Donald Forsyth (Earth, Environmental, and Planetary Sciences)

The Hawaiian Hotspot: Shear velocity and attenuation from Rayleigh wave amplitudes

Hawaii is a prime example of a "hotspot", or a volcanic region independent of plate boundaries. However, the details of the mantle convection and associated melt production responsible for the hotspot have been hotly contested because reliance on land-based seismometers does not give a wide enough geographic range to model the area. We have used Rayleigh wave phase velocities and amplitudes across the PLUME network of ocean-bottom seismometers, deployed from 2005 to 2007, to create a 3D shear velocity model and 1D shear attenuation model. Using noise removal techniques to increase the signal-to-noise ratio, we were able to achieve high resolution of the Hawaii area, which allows us to observe the structure of the lithosphere.

Gaia-marie Gerbaka Poster: B9

Home Institution: Brown University

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

Faculty Mentor: Jonghwan Lee (Biomedical Engineering)

Gold Nanorod-Enhanced Near-Infrared Neural Stimulation for Photonic Retinal Prosthesis

The project explores the concept of stimulating retinal ganglion cells with the use of Gold Nanorods and near-infrared laser with the ultimate goal of treating visual impairments without the use of invasive electrical stimulation or genetic manipulation. The study relies on the fact that pulsed near infrared stimulation of Gold Nanorods, attached to the ganglion cells, produces localized heat that allows for the opening of specific temperature sensitive ion channels. Moreover, the laser illumination induces a capacitive current that will favor the start of an action potential. Currently, the validation of this method is being tested on GCaMP mouse retinal tissue in vitro by treating the sample with Nanorods and antibodies and by observing changes in intracellular calcium concentration after stimulation.

Allen Green Poster: B10

Home Institution: Brown

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

Faculty Mentors: Robert Hurt (Engineering)

Biological and environmental interaction of mangenese dioxide

MnO2 nanosheets are a relatively new material that are used for MRI imaging technology. Due to the extremely close interactions between MnO2 nanosheets and humans, it is important to understand how the nanosheets interact biologically within human beings and cells. MnO2 nanosheets degrade into Mn and O2 and cause a decrease in mitochondrial membrane potential and mass showing cytotoxicity and sub-cytotoxic effects on the mitochondria of in vitro fish gill cells. Although the reductive dissolution of MnO2 has been proven, no work has been done to see the effects of various reductants such as Cystine/ Cysteine, Ascorbate, and Glutathione. This research hopes to advance the field of nanotoxicology with respect to MnO2 nanosheets and their degradants.

Allison Hands Poster: B11

Home Institution: Skidmore College

Summer Research Program: Skidmore Summer Experience Fund

Faculty Mentor: Jerome Robinson (Chemistry)

Ligand Synthesis-Hemilabile Donors for Controlled Biodegradable Polymer Synthesis

In this poster, I will share my recent progress on the synthesis, characterization, and reactivity studies of multi-functional bimetallic ligands.

Akire' Harris Poster: B12

Home Institution: Tougaloo College

Summer Research Program: Experimental Program to Stimulate Competitive Research (EPSCoR-NSF)

Faculty Mentor: Ou Chen (Chemistry)

Doping in Lead-Free Perovskites Nanocrystals

Lead-halide perovskite are novel semiconductor materials with wide application optoelectronics. Due to the level of toxicity and instability of the lead-halide perovskites, there has been much study to synthesize lead-free perovskites with structural and property similarities. In this study, monodispersed bismuth-halide nanocrystals were synthesized using a novel hot-injection methods. Bismuth-halide nanocrystals showed crystalline versality and interesting optoelectronic behaviors. The property-structure relationship of bismuth-halide nanocrystals was further characterized by doping. This work has proposed a novel strategy to synthesize and functionalize non-lead perovskite materials.

Jessie Huang Poster: B13

Home Institution: Wellesley College

Summer Research Program: Experimental Program to Stimulate Competitive Research (EPSCoR-NSF)

Faculty Mentor: Brenda Rubenstein (Chemistry)

Using computational methods to examine how antibiotics of different structure and class interact with beta-lactamase

Beta-lactamases are enzymes produced by bacteria that provide resistance to beta-lactam antibiotics. Beta-lactam antibiotics contain a beta-lactam ring and are classified into penicillins, cephalosporins, monobactams, and carbapenems. The beta lactam ring inhibits cell wall synthesis in bacteria. TEM-1 beta-lactamase is the most widespread and resistant to gram-negative bacteria but mutant beta-lactamases have gradually evolved to resist a much wider range of antibiotics. Different types of beta-lactamase mutants pose a threat to antimicrobial therapy and current antibiotics. The mechanism by which mutations are able to modify the structure and the substrate specificity of TEM-1 beta-lactamase can be studied with computational tools like Pyrosetta docking. Studying a variety of structures and classes of antibiotics and their interactions with beta-lactamase is also valuable.

Amy Huang Poster: B14

Home Institution: Brown University

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

Faculty Mentors: R. Iris Bahar (Engineering)

Power Modeling of Processing-in-memory Systems for Concurrent Computing

Memory access is slow, but computation is fast - this has been a computer architecture rule of thumb for decades. Until recently, there's been no reason to change it: developing processor and memory technology independently made great progress in performance and energy efficiency. As we see improvements slowing down, though, it becomes interesting to blur the dichotomy of computation and data storage that defines modern computer organization. My research group is investigating processing-in-memory (PIM) design, simulating systems with processors attached to main memory so that concurrent computation can be done very close to data. I've been comparing energy consumption across different applications and system configurations, figuring out what makes PIM efficient and how it can be even more so.

Matthew Ishimaru Poster: B15

Home Institution: Brown

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

Faculty Mentor: Humphrey Maris (Physics)

Detecting Dark Matter with Superfluid Helium

Based on observations about the structure of the universe, the matter that we see can only account for about twenty percent of the mass that must exist. We call the other eighty percent dark matter. We've never observed dark matter directly, but past experiments to do so have relied on detection methods that would only detect relatively large particles. Our experiment uses superfluid liquid helium as a detection medium. Because helium is a very light element, our detector should allow us to detect smaller interactions than ever before. My project involves building a proof of concept detector that is a laboratory model of the large-scale detector we plan to build.

Shoshana Simons, Andrew Wagner Poster: C1

Home Institution: Brown University

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

Faculty Mentors: Shriram Krishnamurthi (Computer Science)

Type Inference with SAT Solvers

Type inference is the process of assigning types to programs without type annotations. Traditional type inference takes a safe but pessimistic approach. It declines to assign types to programs that potentially, but do not necessarily, result in type errors at runtime. We provide a more optimistic approach than traditional type inference while preserving its safety. Programs that potentially, but do not necessarily, lead to type errors are assigned types, but they are accompanied by explanations as to why they may fail. We accomplish this by producing first-order constraints, rather than traditional equational ones, and by exploiting modern SAT technology to solve them and explore their properties.

Madeline Karod Poster: C2

Home Institution: Simmons College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Meredith Hastings (DEEPS)

Spatial Investigation of Atmospheric Ammonia and Ammonium Dynamics in Providence, RI

The EPA currently has no regulations or tracking data for gaseous ammonia. Ammonia is important for the formation of particulate matter in the atmosphere, and therefore impacts human health, and can influence changes in climate. Debating literature and a lack of databases identified a clear need for more information on both the sources and emission levels of ammonia, particularly in urban areas. To remedy this need, a spatial campaign was developed in Providence, RI that aimed to determine both the concentration and sources of the hazardous compound ammonia. This research can contribute to a better understanding of urban sources of ammonia, their influence spatially in a mid-size city, and the connections between spatial distribution and weather patterns.

Lucas Kasser, Henry Stone Poster: C3

Home Institution: Brown

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

Faculty Mentor: James Tompkin (Computer Science)

Lightfield Segmentation

Given a series of photos of the same scene taken from cameras at slightly different perspectives, we are creating an algorithm which finds occlusion-aware correspondence between the images using depth cues. Thus, we are able to extract individual objects from all of the photos, even if the object is completely or partially occluded in some of the views.

Nishan Khanal Poster: C4

Home Institution: Brown University

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

Faculty Mentor: Harvey Silverman (Engineering)

Objective Assessment of Newborn Infant Issues by Analyzing the Infant's Cry

It is not uncommon for babies to be born with pre-existing conditions. Therefore, it is important for doctors and nurses to be able to detect these conditions as early as possible so that treatment can be initiated. Acoustically analyzing the cries of infants has been a long-time focus of many researchers and organizations. Some of the goals are detecting pain, pre-natal substance exposure, and even opioid addiction. My part in this research is to write code for MATLAB programs that break down long audio files of cries and translate them into meaningful data that can be studied. Analyzing cries include examining the length of cries, number of cries, and the pitch of the cries among other things.

Elizabeth Kimmel Poster: C5

Home Institution: Brown University

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

Faculty Mentor: Gang Xiao (Physics)

Ultrasensitive Quantum Magnetic Sensor: Design, Fabrication, and Applications

Magnetic tunneling junction (MTJ) sensors consist fundamentally of two ferromagnetic layers, a free and pinned layer, separated by a thin insulating layer, in our case CoFeB/MgO/CoFeB. This arrangement allows for electron tunneling through the insulating layer, and a magnetoresistive response to external magnetic fields. By measuring the magnetoresistance they can sense very weak magnetic fields. In the most recent iteration, the sensitivity was greatly increased through the incorporation of two types of magnetic flux concentrators (MFCs), which both work to amplify the external field. A particular function of MTJs investigated in this research is how to use the MTJs to detect and measure a magnetic field over long distances, which can have important applications.

Isabela Lovelace Poster: C6

Home Institution: Brown University

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

Faculty Mentor: Li-Qiong Wang (Chemistry)

Developing a Laboratory Activity for a Chemistry and Art Course: The Chemistry and Color of Synthesized Copper-Based Paints and Pigments

The chemistry involved in art has been historically overlooked and vice versa. To keep students engaged and combine the arts and sciences, this laboratory activity focuses on the properties of color. A copper based pigment, malachite, when synthesized is turquoise but becomes dark green when mixed with linseed oil. While painters have noted this phenomenon, the mechanism has not been recorded. The synthesized malachite was mixed with linseed oil, painted on canvas and left to dry. It was then analyzed using FTIR, XRD, and SEM methods. We propose that this color change is due to a phase change as opposed to a physical change of particle size. The color shift serves to excite students and inform artists and chemists alike.

Iris Peng Poster: C7

Home Institution: Brown Univeristy

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

Faculty Mentor: Li-Qiong Wang (Chemistry)

Exploring the Colors and their Origins of Copper-Containing Ceramic Glazes

Colorful, glazed ceramic art objects have been created for thousands of years, but the underlying chemical principles for producing the final colors are not well understood. In this study, the colors and their origins of copper-containing ceramic glazes were explored for the undergraduate laboratory. For the glaze preparation, 1% black copper oxide (CuO) and turquoise basic copper carbonate (malachite) were used as colorants. Glazes were painted on bisque clay and fired to various temperatures. Samples were taken throughout the firing process and were examined by visual observation of the color changes as well as instrumental analyses, including FTIR, XRD, and Raman spectroscopies. The mechanism is proposed for the understanding of the underlying molecular origin that correlates with the color changes.

Jiaju Ma Poster: C8

Home Institution: Brown University

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

Faculty Mentor: Jeff Huang (Computer Science)

User-Centered Sensor-Fusion Systems

There are two systems that I am working on: one is called Portal-ble, an augmented-reality mobile system that enables interaction with virtual objects via direct hand manipulation. The other one is a smart pillow that tracks data during sleep and gives recommendation/direct feedback.

Sonny Mo Poster: C9

Home Institution: Brown

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

Faculty Mentor: Lai-Sheng Wang (Chemistry)

Carbon Phosphorus Chain Anion Formation Through Electron Attachment via Dipole-Bound Excited States

The rich chemistry in the Interstellar Medium (ISM) is dominated by ion-neutral reactions. Although there are roughly 200 unique molecules observed in the ISM, only 6 are anions or negatively charged. To aid in identifying promising anionic candidates for astronomical detection, we propose that molecules possessing dipole-bound excited states are ideal for astronomical observation. In addition to these anions possessing dipole-bound excited states, we propose a mechanism for anion formation through electron attachment via dipole-bound excited states. Here, we present formation mechanisms of large linear carbon clusters with a terminal phosphorus and predict the presence of dipole-bound excited states. This work will be used in conjunction with Photoelectron Imaging experiments to ideally lead to positive identification of these anions in the ISM.

PwintPhyu Nandar Poster: C10

Home Institution: University of California, Los Angeles

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Eric Suuberg (Engineering)

Investigating the Vapor Intrusion Issue: Developing an Active and Fast Air Sampling Method for Chlorinated Solvents

Toxic chemicals can enter homes built near contaminated soil via vapor intrusion. One such chemical, trichloroethylene (TCE), is a carcinogen even at low concentrations. Methods for TCE sampling need refining, because it is uncertain how often sampling should occur and what concentrations of TCE should be considered unsuitable for human health. This project focuses on developing an unobtrusive method for sampling TCE levels at low concentrations using a purge-and-trap sample collector and a Gas Chromatograph. The method allows sampling low concentrations of TCE in a short period of time at pre-programmed intervals. The results will help determine the duration for sampling TCE. This project seeks to better understand vapor intrusion and how to protect people from TCE exposure.

Lauren Neldner Poster: C11

Home Institution: Rollins College

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

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

Measuring Rayleigh wave phase velocity in Alaska from ambient seismic noise

Alaska is a geologically interesting region due to the subduction zone located at its southern margin, where the Pacific plate subducts beneath the North American plate. This has produced the Aleutian volcanic chain, the Alaska Range mountains, and the puzzling Wrangell Volcanic Field. To understand more about the structure of these features in the crust and uppermost mantle, we measured variations in the phase velocity of Rayleigh waves using ambient noise from 196 Transportable Array stations during August 2014 - June 2018. Ambient seismic noise is caused by interactions between ocean waves and the solid Earth. Maps of phase-velocity variations were obtained and the interpretation of the maps in terms of key geologic and tectonic features will be presented.

Zachary Neronha Poster: C12

Home Institution: Brown

Summer Research Program: DiMase Summer Research Fellowship

Faculty Mentor: Ian Wong (Biomedical Engineering)

Motility-Limited Aggregation of Mammary Epithelial Cells into Fractal-Like Clusters

Migratory cells have the potential to transition between dispersed individuals and multicellular clusters during development, wound healing, and cancer metastasis. Cells may exhibit coordinated motion and arrested velocities as their local density increases. Here, we utilize comprehensive, single-cell tracking to analyze directional migration and multi-cellular aggregation of human mammary epithelial cells. We find that in reduced epidermal growth factor (EGF) media, multicellular clusters form, and cell velocities arrest, at sub-confluent densities. Snail-1 expression was induced to initiate an EMT program, which led to the formation of fractal-like spanning networks under reduced EGF conditions. Interestingly, these clusters bear a striking resemblance to those formed by diffusion-limited aggregation of non-living colloidal particles. Overall, these results may have implications for collective migration during tissue morphogenesis and tumor cell recruitment to metastatic sites.

Teijiro Nishimura, Magnolia Pak Poster: C13

Home Institution: Brown University

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

Faculty Mentor: Brian Sheldon (Materials Science and Engineering)

Impedance Measurements in $LiMn_2O_4$ Spinel Cathodes for Li Ion Batteries

Our research focuses on trying to further $LiMn_2O_4$ cathodes. This research began with developing a method to consistently create pristine LMO thin film battery cathodes by spin coating and annealing at 750C. This technique is largely in place at Brown, but we will explore the key modification being able to control grain size. By varying grain size, we hope to probe the possible roles that grain boundaries play in delithiation and lithiation. All of these thin films will be characterized using High Resolution x-ray diffraction (XRD), Raman Spectroscopy, and scanning electron microscopy (SEM). Changes that occur during cycling will be monitored with electrochemical impedance spectroscopy (EIS)

Joseph Novak Poster: C14

Home Institution: Brown

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

Faculty Mentor: Yongsong Huang (DEEPS)

Breaking the Ceiling

I chracterized the relationships between long chain alkenone molecules in recent oceanic sediments to develop sea surface temperature and salinity proxies for paleoclimate reconstruction. I found that the relationship between the C39:2 ethyl and C39:3 ethyl alkenones is similar to the existing UK37 alkenone SST proxy. However, my data suggest that the C39:2Et and C39:3Et ratio reaches unsaturation at a higher temperature than the UK37 proxy. By raising the upper bound of alkenone-based paleoclimate reconstructions, I have found a new potential tool for investigating periods of Earth history analogous to our current changing climate that were previously inaccessible due to the technical limitations of the UK37 proxy.

Cadence Pearce Poster: D1

Home Institution: Brown University

Summer Research Program: RI-INBRE

Faculty Mentor: Amit Basu (Chemistry)

Unexpected Esters and an Alternative Ugi Reaction: Modifying Diamides as Antimicrobials

Antimicrobial activity has previously been found in several diamide compounds synthesized via the Ugi reaction,1 using isocyanides as a starting material. Few isocyanides are commerically available, limiting synthetic possibilities for the diamides. We are working on an alternate synthetic route that modifies the functionality of an initial diamide compound, hopefully allowing for the synthesis of higher potency antimicrobials. A starting diamide is synthesized using the Ugi reaction and subsequently alkylated, yielding a tertiary amide at the isocyanide-derived nitrogen. Unexpectedly, oxidation with ceric ammonium nitrate selectively transforms this moiety into a carboxylic acid or ester. Additionally, we are exploring a modified Ugi reaction utilizing secondary amines to synthesize molecules with a joint amine-amide backbone.

Ethan Pierce Poster: D2

Home Institution: Brown University

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

Faculty Mentor: Samiah Moustafa (IBES)

What Color is Greenland's Ice?: Evaluating the efficacy of ground-based weather stations for comparing space-derived albedo over non-uniform surfaces of the Greenland

ice sheet

Since 1992, meltwater runoff has overtaken accumulation on the Greenland ice sheet. Surface albedo (reflectivity), a critical component of Greenland's energy balance, is measured in situ by weather stations and estimated through remote sensing. Over spatially heterogeneous surfaces, where most of the melt occurs, discrepancies arise between measurements at different sampling resolutions. Here, we compare high-resolution albedo measurements from the PROMICE automated weather station network with coarser-resolution MODIS satellite product. Planet Labs and Sentinel-2 data are used to independently characterize surface complexities via semivariogram and show a relationship between spatial variability and albedo measurements. These findings will inform us of PROMICE data's ability to constrain MODIS albedo over uniform and complex surfaces – key input to represent albedo in regional climate models.

Dylan Quintal Poster: D3

Home Institution: Brown University

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

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

Rayleigh Wave Phase-Velocity Tomography Across Alaska

The tectonic processes that characterize Alaska and the surrounding region are relatively unstudied. Large-scale features of interest include the Queen Charlotte-Fairweather fault system (a source of powerful earthquakes), the Aleutian arc (a chain of volcanic islands along the North American-Pacific plate boundary), and the subducting Yakutat plate, but the complex interactions between these features and the tectonic plate motions that govern them need to be modeled with greater precision. My research seeks to learn more about these processes and to determine more about the crustal and lithospheric mantle structure beneath this region. My research uses wavefront tracking to perform surface-wave tomography, which generates images of seismic wave speed variations at different depths inside the Earth. I utilize data from the EarthScope Transportable Array, a dense network of seismometers that is currently deployed in Alaska. Using vertical-component data from distant earthquakes with depths < 50 km and Mw>6 that occurred between Month1 Year1 and MonthLast YearLast, I measure the travel times and amplitudes of Rayleigh waves at long periods (25-200 s), which are sensitive to the entire mantle lithosphere and even the upper asthenosphere (up to ~300 km depths). I use these measurements to generate maps of 2-D variations in wave speed. Lower velocities may indicate higher temperatures and perhaps the presence of partially molten rock, while higher velocities may indicate lower temperatures and the absence of partially molten rock. The ultimate goal is to use these results to elucidate how plate motions and other geophysical processes operating in the crust and mantle control the distribution of volcanism, seismicity, and surface deformation in Alaska.

Emily Reed Poster: D4

Home Institution: Brown University

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

Faculty Mentor: Björn Sandstede (Applied Mathematics)

Phase Transitions in Stripe Formation on Zebrafish Danio rerio

During early development, Zebrafish (Danio rerio) develop black and yellow stripes comprised of pigment cells. Volkening and Sandstede developed a model representing mechanisms governing cell shape transitions and pattern formation. After preliminary computations, they discovered that cell-to-cell distances jump from one value to another after crossing a certain threshold. By studying a reduced model with graphical and computational techniques in MATLAB, we aimed to understand these phase transitions. We discovered that the geometric interpretation of the conditions dictates sharp changes in the shape transitions of xanthophore and iridophore pigment cells. In understanding these phase transitions, results can be used to further study the pattern formation and robustness of mutants and other fish in the Danio family.

Kali Rigby Poster: D5

Home Institution: Brown University

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

Faculty Mentor: Vicki Colvin (Chemistry)

Removing Viruses From Drinking Water Using Magnetic Nanoparticles

Access to clean drinking water remains a major global health issue. In areas without sanitation facilities, bacteria and viruses can contaminate drinking water, resulting in waterborne diseases such as adenovirus and norovirus. While bacteria may be removed from water through filtration, this process only works on viruses when under high pressure, due to their small size. This project focuses on using magnetic nanoparticles as a means to remove viruses from water. By constructing a supported lipid bilayer on silica coated iron oxide nanoparticles, I will mimic the surface of cells to “trick” an inactivated virus into binding with the nanoparticles. These entities can be magnetically removed from water, and the effectiveness of viral removal will be determined by fluorescence.

Alicia Rocha Poster: D6

Home Institution: Brown University

Summer Research Program: School of Engineering Summer Research: Shukla Lab

Faculty Mentors: Anita Shukla (Biomedical Engineering)

Increasing Mesenchymal Stem Cell Viability on Gellan Hydrogels with Click Chemistry

Human mesenchymal stem cells (hMSCs) show great promise in tissue engineering and wound healing applications due to their immunomodulatory effects. However, hMSCs experience low viability after direct injection. Hydrogels, such as the FDA-approved polysaccharide gellan gum, may be used to increase hMSC viability. However, gellan gum is not cell-adhesive. Our approach utilizes click chemistry to covalently bond functionalized gellan to azide-bearing hMSCs to increase viability. Dibenzocyclooctyne (DBCO) and arginylglycylaspartic acid (RGD), a cell adhesive peptide, were functionalized to gellan, forming two unique hydrogels. Azide-bearing and non-azide-bearing hMSCs were seeded separately on each hydrogel. CCK8 was used to measure cell viability. RGD and DBCO gels with azide-bearing cells demonstrating greater viability over gellan alone or functionalized gels with non-azide-bearing hMSCs.

David Ryffel Poster: D7

Home Institution: Brown

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

Faculty Mentor: Amit Basu (Chemistry)

Investigating Carbohydrate-Carbohydrate Interactions with Multivalent Glycoconjugates

Carbohydrates are abundantly present on the surface of many cells. These carbohydrates are able to interact and these interactions govern many different biological processes, including myelination in the brain and central nervous system. However, carbohydrate-carbohydrate interactions (CCIs) are much weaker than protein-protein interactions. In biological systems, many carbohydrates are presented to interact with each other simultaneously. To mimic this presentation so that CCIs can be studied in laboratory, multivalent glycoconjugates are synthesized. These glyconjugates contain cores that are connected to multiple sugars. Using these compounds, advanced NMR studies can be carried out to shed light on the CCIs that are thought to cause myelination in the human body.

Hannah Safford Poster: D8

Home Institution: Brown University

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

Faculty Mentor: Anita Shukla (Biomedical Engineering)

Characterizing Chromogenic Beta-Lactamase Substrates for Diagnostic Hydrogels

Antibiotic resistant bacteria, such as Methicillin-resistant Staphylococcus aureus (MRSA), are becoming one of the most serious medical threats facing the world today (Ventola, 2015). Beta-lactamases are enzymes produced by these bacteria and are the major cause of antibiotic resistance. Exposure of antibiotics, containing a β-lactam ring, to these enzymes leads to ring cleavage and antibiotic degradation, facilitating antibiotic resistance (Shaikh, 2015). We seek to utilize this function to diagnose wound infections. We have developed our own chromogenic β-lactam molecule, ANT, as a diagnostic marker of beta-lactamase production. ANT can be conjugated to polymers while still maintaining its diagnostic color change from light yellow to dark yellow. The goal of this project is to develop diagnostic hydrogels for topical infection detection in order to improve antibiotic administration. Infection detecting hydrogels could provide physicians with rapid information about the infection so that proper antibiotic administration can occur, thus reducing antibiotic resistance.

Angel Santiago Poster: D9

Home Institution: University of Puerto Rico Arecibo

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Karen Fischer (Professor of Earth, Environmental & Planetary sciences)

Improving earthquake relocation to find faults in Nicaragua.

In Nicaragua, a key question is how earthquake faults enable the fore-arc to translate northwest with respect to the rest of the upper plate. Our goal is to identify whether double difference relocation could determine the orientation and location of the faults more precisely. To address this question, more accurate measurements of P-wave travel-times were needed. We found that the clearest P-waves and most precise onset times are obtained with a bandpass filter of 1-5Hz, and we determined a suitable magnitude range for each seismic station. We are relocating the April 2014 Lake Managua earthquake sequence to identify fault orientation. These results will aid in understanding how the fore-arc of Nicaragua is moving, and its potential for future earthquakes.

Sumaiya Sayeed Poster: D10

Home Institution: Brown University

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

Faculty Mentors: Anubhav Tripathi (Center for Biomedical Engineering)

Enrichment of JEG-3 cells by intrinsic surface adhesion properties

Investigating the physical properties of JEG-3 trophoblast cells and how they interact with cervical cells is important for prenatal testing applications. Because clinical cervical samples contain both cervical and trophoblast cells, [Jain 2016], we have optimized the design of a device for studying JEG-3 and cervical cell surface adhesion. This device was designed to meet consistent channel and outlet well dimensions for experiment repeatability. Ultimately, the goal of this work is to provide a method for collecting an enriched JEG-3 cell population.

Kathryn Scholz Poster: D11

Home Institution: Brown University

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

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

Volatile cycles in shallow magma reservoirs

Predicting the risks from volcanos to adjacent communities requires a better understanding of magma chamber dynamics. Previous approaches show gas content partially controls eruption dynamics. However, the majority consider the volatile phase as entirely water. While water is the most abundant volatile, carbon dioxide has the potential to alter chamber dynamics due to its effect on volatile solubility, thermal properties, and melting curves. Using thermo-mechanical modeling based on the work of Degruyter and Huber (2014), I derived governing equations, accounting for carbon dioxide, and implemented these equations in the magma chamber numerical model. Using outputs from this model, I explore how carbon dioxide and water affect the thermal and mechanical properties of a magma chamber and relate to eruptions.

Henry Stone Poster: D12

Home Institution: Brown University

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

Faculty Mentor: James Tompkin (Computer Science)

Intrinsic Light-field Decomposition

In editing photographs artist have difficulty isolating lighting and reflectance from the objects in the scene. The inability to separate these two light sources results in difficulty performing realistic edits. While the problem of performing this separation is highly under-constrained, we can leverage the spacial information provided by light-field photography along with priors implicitly imposed by a CNN in order to create plausible intrinsic separations. In order to train this network we render realistic scenes to capture object lighting and color separately. We then use a neural network to solve the inverse problem of separating these light sources from a regular image. This results in complete light-field images decomposed in a consistent and plausible manner empowering artists to make more photo-realistic edits.

Kyra Svoboda Poster: D13

Home Institution: Brown University

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

Faculty Mentor: Amit Basu (Chemistry)

Polar Opposites: Increasing solubility of non-polar antibiotic compounds in water

A class of diamide compounds with bacteriostatic abilities have been previously identified in the Basu lab that impede the growth of gram positive bacteria. These bacteria have a prominent peptidoglycan wall, and the diamide compounds interfere with the enzymes that regulate the wall during cell division, leading to cell death. The compounds are large, greasy organic molecules that have poor solubility in water and improving this is critical for further development. This project altered the carbon chains attached to the diamide functional group to reduce greasiness, and new ways to introduce polar heteroatoms like oxygen into the carbon chains were also investigated.

Hannah Szapary Poster: D14

Home Institution: Brown University

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

Faculty Mentor: Derek Stein (Physics)

Investigating the Use of a Nanopore Mass Spectrometer for Proteomic Analysis of Post-Translational Modifications

Post-translational modifications (PTMs) on amino acids are extremely important to cellular processes as they alter protein properties, but their discovery and localization on novel proteins has proved a difficult and complex task. Mass spectrometry (MS) techniques have advanced the field but conventional MS methods remain expensive, slow and resource heavy. We recently developed a technology that uses a nanopore ion source to transfer biopolymers in a linear configuration from liquid into a vacuum chamber, delivering them to a mass spectrometer. This nanopore mass spectrometer has previously analyzed simple salts and amino acids, and here we study the performance of the instrument

with water solutions of single amino acids as well as the tripeptide glutathione with its acetylated and nitrosylated modifications. We bias the pH of solutions below the isoelectric point of the solute tested to positively charge the amino acids and peptides. Our spectra show singly charged solute ions that are primarily unsolvated, providing an optimistic path towards developing a technique to determine post-translational modifications at the single molecule level.

Isabella Ting Poster: E1

Home Institution: Brown University

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

Faculty Mentor: Lorin Crawford (Biostatistics)

Developing A Unified Framework for Pathway Iteraction Analysis in Genome-wide Association Studies

Epistasis, the interactions between genetic loci, has been hypothesized to play a key role in the genetic architecture underlying complex traits. Current epistatic mapping methods explicitly search across all pairwise or higher-order interactions when identifying significant nonlinear effects among genome-wide variants. Our goal is to instead identify cross-talk between signaling pathways where we consider a pathway to be defined by a set of SNPs within a regulatory region of genes within it, revealing a method that lightens the statistical burden commonly linked with epistatic mapping.

Andrew Ton Poster: E2

Home Institution: Brown University

Summer Research Program: Royce Fellows

Faculty Mentor: Richard Stratt (Chemistry, Physics)

Onset of supercooling in a two-dimensional molecular liquid

Supercooled liquids are systems that are cold enough to solidify but haven't gotten around to it yet. It is well known that if we wait long enough, these liquids will become solid. Our work examines the motion of molecules in the supercooled phase before the liquid decides to solidify. The supercooled phase is characterized by an increasingly enormous viscosity as the temperature is lowered further - eventually the system gets so viscous that what was previously a liquid becomes unmistakably solid to the observer. Here we have been able to induce supercooling in computer simulations of a model two-dimensional molecular liquid.

Kevin Trinh Poster: E3

Home Institution: Bowdoin College

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentors: Zhitu Ma (Department of Earth, Environmental, and Planetary Sciences)

Measuring Rayleigh Wave Phase Velocity in the Antarctic Upper Mantle from Ambient

Seismic Noise

Numerous studies demonstrate that using surface waves measured from ambient seismic noise can improve the resolution of seismic images relative to those determined from earthquake data alone. Ambient noise data are independent of earthquake occurrence, which offers a great advantage in places like Antarctica where seismicity is scarce. Using long-period vertical component seismogram data from 126 Antarctic stations over an 11 year period, we measure the phase arrival times of ambient-noise Rayleigh waves and create phase-velocity maps for the period range 25-100 seconds. We can use these velocity maps to understand how the Antarctic continent was formed and modified over time. We can also use them to estimate surface heat flow, which affects ice sheet stability and motion.

Adam Tropper Poster: E4

Home Institution: Brown

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

Faculty Mentor: Jiji Fan (Physics)

Can Random Matrices With Localized Eigenvectors Explain Hierarchies

Our world is composed of a few dozen types of elementary particles – particles which cannot be broken down into smaller pieces. Overall, elementary particles are understood quite well, yet there is still much to explore especially concerning questions of “naturalness.” For example, the top quark (the heaviest elementary particle measured) is more than a million times heavier than the electron. This seems to be “unnatural,” and an underlying mechanism that forces the top quark to be so much heavier than the electron is anticipated. We hope to probe these hierarchies by identifying new ensembles of random matrices with exponentially localized eigenvectors and by building quantum field theories describing the hierarchies in particle physics in a more "natural" way.

Maria Vargas-Rivera Poster: E5

Home Institution: University of Puerto Rico

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Jerome Robinson (Chemistry)

Cation-Responsive Catalysis of Biodegradable Polymers

Biodegradable polymers are essential for the sustainability of plastics, as they are produced from renewable resources that can be broken down in the environment. Enhanced sequence control of biodegradable polymers is expected to produce plastics with tunable and superior properties; however, current synthetic methods are lacking. Switchable catalysis is a strategy to achieve enhanced sequence-specificity through chemical switches which can alter the length and order of the synthesized polymers. I will describe the synthesis, characterization, and reactivity of organometallic catalysts which display reactivity towards ring opening polymerization (ROP) upon exposure and removal of metal cations. The products of these organometallic catalysts were isolated and characterized by NMR and X-ray diffraction, while initial reactivity studies focus on the ROP of lactide.

Soobin Wang Poster: E6

Home Institution: Brown University

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

Faculty Mentor: Anita Shukla (School of Engineering)

Assembly of Polyelectrolyte Multilayer Films for Controlled Delivery of SHP099

SHP2 is a protein tyrosine phosphatase with key involvement in osteolysis and cancer cell growth signaling. We have employed layer-by-layer (LbL) self-assembly to construct films made of chitosan (CHT) and poly-carboxymethyl-ß-cyclodextrin (PBCD) to locally deliver SHP099, a small molecule inhibitor of SHP2. (CHT/PBCD-SHP099)25 films, 25 indicating number of bilayers, were assembled by dip-coating silicon wafers in CHT and PBCD-SHP099 solutions. Film thickness was examined via profilometry. Total quantity of loaded drug and its release over time were investigated by film degradation in 1M sodium hydroxide and phosphate buffered saline (PBS), respectively, with subsequent UV-Visible spectroscopy of degradation solution. We observed SHP099 release in therapeutic concentrations and rates, attesting to their potential clinical applicability in coating implants to inhibit osteolysis and tumor development.

Conrad Zborowski Poster: E7

Home Institution: Brown University

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

Faculty Mentors: Anna Lysyanskaya (Computer Science)

PiTree and Atom: an implementation and comparison of security protocols.

I have implemented a security protocol as provided by my faculty mentors that they have created themselves. I have plotted data of this protocol and compared to a competitor paper in order to test what kind of things you give up for higher security(latency, space, redundancy) and what you don't have to give up. We compared numerous protocols: the status quo, the closest competitor paper, and our own. To compare our own, I programmed the protocol exactly how it would be in the language the competitor paper used, so that it could closely emulate it.

Joy Zheng Poster: E8

Home Institution: Brown University

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

Faculty Mentor: Jay Tang (Physics Department)

Electric Field Drives Rolling Motion of Tethered Bacteria

The goal of this research is to understand the mechanisms of cell body tethering to solid surfaces. The project studies the tethering and detaching mechanisms of C. Crescentus SB3860 bacteria and whether applying an electric field causes detachment of the cell bodies from the surface. The experiments showed that electric fields can cause the more loosely tethered predivisional cells (older cells) to detach

from the tethered point but keep the rotating motion while the swarmer cells would remain tethered. It indicates that the tethering mechanisms of swarmer cells and predivisonal cells are foundamentally different.

Itzel Aponte, Bruno Felalaga Poster: E9

Home Institution: Brown University

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

Faculty Mentors: Jonghwan Lee (School of Engineering)

Test and optimization of high-throughput OCT assessment of cellular viability using liver tumor spheroids

2-D cell cultures are frequently used for testing toxins and measuring cellular viability. However, they provide limited information and do not mimic the complex 3-D architecture of in vivo tissue. Additionally, the methods used to determine cellular viability such as live/dead assays are invasive and damaging to cells. Our research will use Optical Coherence Tomography (OCT) and 3-D liver cancer spheroids to longitudinally and noninvasively measure cellular viability in a toxin response study. We will use intracellular motility as a measure of cellular viability as observed through OCT imaging and analysis. We hope to prove that this less invasive and label-free method can effectively measure cellular viability and test toxins.

Anthony Capobianco, Andrew Duncombe Poster: E10

Home Institution: Brown University

Summer Research Program: Space Grant/NASA

Faculty Mentor: Rick Fleeter (Engineering)

Brown Space Engineering: Space for the Masses

As of May 2018, the Brown Space Engineering program will have an active cube satellite (CubeSat) in orbit sending down data about the performance of its lithium iron phosphate ($LiFePO_4$) batteries. This will be the very first field test of $LiFePO_4$ batteries in space. We hope to show that these batteries are a significant improvement over the existing technology. To do this, we need to develop infrastructure that can gather and analyze data from the satellite, titled EQUiSat. First, we plan on constructing a ground-based tracking system to track and receive the signals sent by the satellite. Once data can be collected, it will then be analyzed and compared to observations of $LiFePO_4$ batteries used in non-space conditions and against other battery types conventionally used on satellites. The results of these trials will be compiled into a research paper for publication.

Social Sciences

Henry Jones Poster: E11

Home Institution: Brown

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

Faculty Mentor: David Badre (CLPS)

Dissociation of Value Signals and Task State Representations in the Brain

I have been fine tuning a task which will be used in conjunction with fMRI in order to examine the information encoded in the ventromedial Prefrontal Cortex (vmPFC). the vmPFC has been implicated in encoding the value of the decision/action currently being considered. At the same time, signals from the vmPFC also seem to reflect the current set of rules one must keep in mind in order to perform a task well, known as the task set and sometimes the schema. My task sets the values of certain items to depend on different contexts with the goal of finding which signal is more present in the activation patterns of the vmPFC.

Clara Alvarez Caraveo Poster: E12

Home Institution: Cornell University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Michael White (Sociology)

Poverty and Immigration: Poverty Rates by Country of Origin

While contemporary immigration research has focused on foreign-born Hispanic immigrant outcomes a whole, little attention has been paid to how their outcomes differ by country of origin. The importance of examining the internal diversity of this panethnic group is becoming increasingly apparent as a smaller share of the population is coming from Mexico and as migration from elsewhere in Latin America increases. This paper examines how immigrant groups progress in or out of poverty during their time in the United States. Using Integrated Public Use Microdata Samples census microdata, tabulations of poverty by age cohorts and country of origin between 2005 and 2015 are used to examine socioeconomic assimilation of different origin countries within Latin America. We find that poverty differs by country of origin, suggesting that the social, economic, and political factors driving migration from each country also influences their ability to succeed in the United States.

Morgan Astorino Poster: E13

Home Institution: Rutgers University - New Brunswick

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentors: Scott Frickel (Environmental Sociology)

How do Zoning Changes Influence Parks?

Parks provide numerous health benefits. But, no data exists on advantageous park qualities. When parks are created, inhabitants are often pushed out with increases in rents. Presently, there is no zoning solution that allows park access for all. For example, urban sprawl causes fragmented land. But, compact cities separate disadvantaged communities from parks. To measure park change, we created three Providence maps from different periods. The maps were georeferenced and park data was added. In early maps, most parks were in residential areas. Parks in industrial zones have decreased, but this raises a question: Should parks be in industrial zones to offset health hazards from industrial activity? Maps from the past can draw conclusions for future zoning.

Francelis Báez-Caraballo Poster: E14

Home Institution: University of Puerto Rico, Mayaguez

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Terry-Ann Craigie (Population Studies and Training Center)

Mandatory Minimum Reforms and Racial-Ethnic Disparities in Sentence Length, 2000-2015

In the age of mass incarceration, racial-ethnic disparities within the United States CJS are at an all time high. As a measure to combat high rates of crime and drug, the "War on Drugs" unfairly targeted racial and ethnic minorities in poverty ridden areas. With the implementation of Mandatory Minimum Sentences as a way to combat drug crimes, the carceral population in the United States has risen to an all time high. States' and the federal government have been working on implementing Mandatory Minimum Reforms which aim to lower carceral populations. The goal of this research is to analyze whether MMR's have actively reduced racial-ethnic disparities within the CJS by analyzing classified data from the NCRP from 2000 to 2015.

Harini Balakrishnan Poster: F1

Home Institution: Brown University

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

Faculty Mentor: Omar Galárraga (Health Services, Policy and Practice)

Are Adolescents Irrational? Age Differences in Consistency Tests in Discrete Choice Experiments

Discrete choice experiments (DCEs) are a survey instrument frequently used in health economics to elicit preferences if behavioral data that reveals preferences (e.g. already-existing market prices) are not present. Since it is a stated preference method, internal validity tests help ensure rationality of respondents' preferences. One such internal validity test is the consistency test, where the same question is asked twice. However, performance of adolescents compared to adults on these tests may vary due to their respective stages of neurodevelopment. Rates of failure of a consistency test in a DCE task implemented across adult and adolescent women were analyzed with logistic regression, using age and other population characteristics as covariates. Future DCEs should consider age differences when implementing consistency tests.

Kendall Clark Poster: F2

Home Institution: St. John's University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Marion Orr (Political Science)

Two Savannahs: Race and the Political Economy of a Southern Tourist City

Following the publication of the best-selling novel "Midnight in the Garden of Good and Evil" Savannah, Georgia, became a tourist mecca. Since the publication of “the book” (as locals call the novel), this southern city on Georgia’s coast has attracted millions of tourists annually. This analysis documents the rise of tourism and shows how attracting tourists has become key to the city’s economy. It also illustrates the lingering legacy of slavery, segregation, and racism. This charming city is racially divided, and its Black residents are disproportionately poor. Using data regarding hotel tax revenue, flight arrival and departure information, and demographic census data on population, poverty, and household occupancy, this research explores the political economy of the two Savannahs.

Gabrielle DeAngelis Poster: F3

Home Institution: Clark University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Kevin Escudero (American Studies)

Understanding Notions of Anti-Blackness Among Dominican Residents in the Northeastern United States

After the 22 year-long Haitian occupation of the Dominican Republic from 1822-1844, the rise of anti-Haitianism within the country established a shared national identity among Dominicans that included distancing themselves from blackness despite their significant African ancestry. Drawing on the in-depth interviews with Dominican community members, this research examines the complexities of blackness and black identity as manifested in Dominican culture. This analysis draws on fieldwork conducted with self-identified Afro-Dominican individuals in Rhode Island between the ages of 18 and 65 years old in order to understand whether anti-blackness manifests in Dominican-American communities and how it compares to understandings of blackness/black identity in the Dominican Republic. As a result, it makes the case that self-identified Afro-Dominican individuals, both in the Dominican Republic and the U.S. contexts, must strategically navigate the impact of anti-blackness on their daily lives. More broadly, this work aims to reveal the ways that anti-blackness, the prejudice against, hatred of or discrimination against those of African descent, exists and is navigated by Dominican community members.

Micah Holness Poster: F4

Home Institution: Xavier University of Louisiana

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentors: Ernestine Jennings (Psychiatry and Human Behavior)

Mindful Awareness Effects on Nicotine Addiction

Addiction has the ability to completely transform the chemical mechanisms of our brains, but mindful meditation can counteract these negative effects. Mindful awareness can be focused towards internal processes as in interoception or external sensations as in exteroception. In order to examine the relationship between mindfulness and nicotine addiction, secondary data analyses were performed from a dataset involving a smoking population that completed an 8-week Iyengar Yoga and behavioral smoking cessation program. Results showed that baseline interoceptive mindfulness had a significant positive correlation with internal cues while exteroceptive mindfulness had less correlation. This implies that interoceptive mindfulness may have a stronger effect on cue-elicited addiction and that

internal cues may play a bigger role in the maintenance of addiction.

Chun Hu Poster: F5

Home Institution: Brown University

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

Faculty Mentor: Steven Sloman (CLPS)

The Illusion of Understanding

People often hold extreme attitudes about complex policies. We hypothesized that people in fact know less about such policies than they think they do (the illusion of explanatory depth. We classified policies into those determined by sacred values (value-based) and those determined by their outcomes (consequence-based). Asking people to explain consequence-based policies in detail undermined the illusion of explanatory depth and led to more moderate attitudes. Values-based issues showed no such effect. When both types of policies were presented together, the effect did not occur either. To account for these results, we appeal to the perceived quality of consequence- and values-based explanations when considered separately and jointly.

Bethany Hung Poster: F6

Home Institution: Brown University

Summer Research Program: Working for Prof. Joo-Hyun Song, who requested that I present

Faculty Mentor: Joo-Hyun Song (CLPS)

How Actions Change What We See (Maybe): The Effect of Visuomotor Action Preparation on Visual Crowding

Crowding is a phenomenon of peripheral vision where a collection of objects can be detected, but not discriminated. When only one object is in the periphery, perception is nearly completely intact. Upon addition of neighboring objects, however, features and edges seem jumbled, which may occur due to lower attentional resolution in the periphery. Action preparation also modulates attention, but it is currently unclear how it influences crowding. This experiment assesses whether it can change the severity of the crowding effect. I will measure subjects' sensitivity to orientation change in the periphery, then determine whether sensitivity changes upon grasping the stimulus. As crowding is a form of nonconscious vision that affects behavior, it has implications in the formation of implicit biases.

Sydne Hunter Poster: F7

Home Institution: Stockton University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Amanda Lynch (Institute at Brown for Environment and Society)

Comparative Analysis of the Sami Context Across National Borders

The Sami have been the traditional inhabitants of Sápmi, located in Fennoscandia and north-western Russia, for over 8,000 years. Since international borders were imposed, the Sami people have negotiated complex relationships with the national governments of Norway, Sweden, Finland, and Russia. Context mapping (the temporal and spatial documentation of Sami history, institutions and experiences) has been used to analyze these relationships. We found substantial differences across countries in how Sami-related policy has developed. These differences can be linked to governance style in each nation, although democratic processes by themselves were not a good indicator of the extent of Sami self-determination. We were able to identify gaps in available data, which will be used to design upcoming field investigations in Sápmi.

Georgie McTigue Poster: F8

Home Institution: Brown University

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

Faculty Mentor: Jennifer Pellowski (Department of Behavioral & Social Sciences, International Health Institute)

Prenatal family planning intentions among HIV-positive postpartum women in Cape Town, South Africa

Supporting HIV-positive women's ability to avoid unintended pregnancy during the postpartum period decreases the number of pediatric HIV infections, reduces pregnancy-related morbidity and mortality, and is a cost-effective strategy of PMTCT. However, little is currently known about the fertility desires, contraceptive use, and family planning practices of postpartum women living with HIV. Thirty HIV positive pregnant women living in Cape Town, South Africa were recruited to participate in a series of four interviews starting during pregnancy and continuing up to 12 months postpartum. As part of this larger study, I developed a series of questions aimed at understanding fertility intentions and behaviors across time. Transcripts from the pregnancy interview were coded for future fertility desires and family planning intentions and these analyses are ongoing.

Marquisele Mercedes Poster: F9

Home Institution: Hunter College, CUNY

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentors: Ira Wilson (Professor of Health Services, Policy and Practice)

Social Influence and Medicare Advantage Plan Enrollment Decisions

During open enrollment periods, Medicare Advantage (MA) beneficiaries can keep their plan, switch plans, or shift to traditional Medicare. Information from official sources, like the CMS, may be more accurate, but there is power in information from individuals we like, know, and identify with because of social influence. Therefore, enrollees' peers may play an important role in simplifying decision making. The purpose of the study is to evaluate social influence as a means of choosing MA plans. When interviewing seniors with MA regarding this process, our preliminary findings indicate there is often consideration of information from enrollees' peers when choosing plans. Understanding how seniors make decisions is important, as they face disproportionate obstacles in securing appropriate coverage within market-based systems.

Sarah Parker Poster: F10

Home Institution: University of Central Florida

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: J. Timmons Roberts (Environmental Studies and Sociology)

Right Thinkin': The Formative Role of the Philanthropy Roundtable in Conservative Philanthropies and Higher Education

Activists and academics have raised alarms about the manipulation of culture and curriculum within colleges and universities in the United States by private foundations for decades, but little scholarly analysis of these efforts has been undertaken. One nonprofit network, Philanthropy Roundtable, serves the interests of conservative philanthropists and foundations through annual meetings, memberships, and a bimonthly publication called Philanthropy Magazine. Written by like-minded members of the Roundtable, the Philanthropy Magazine articles published online detail how theses conservative philanthropists play an active role in preserving their conceptualization of traditional ideals within higher education, by funding programs and research that strengthen their position. Using the Way Back Machine (https://archive.org/web/) to access the archives of philanthropyroundtable.org, this research systematically reviews over 200 articles from Philanthropy Magazine from 1997 to 2018 in order to understand how conservative philanthropies fund coordinated efforts to promulgate the conservative agenda in higher education and how these efforts evolved over time.

Eleanor Pereboom Poster: F11

Home Institution: Brown

Summer Research Program: IBES Internship

Faculty Mentor: Dawn King (Environmental studies)

How does Energy Management Work at the City Level?

I spent the first few weeks of the internship working closely with energy management software, such as Energy Star Portfolio Manager and Peregrine Focus, to record the City's energy and water usage for fiscal year 2017. I then shifted to a more qualitative approach of energy and emissions management by assisting in the update of the City's Carbon Disclosure Project report, which is completed annually. I have also worked on various smaller reports and memos, including a comparison of Rhode Island solar policy to the new solar mandate in California, and a cost benefit analysis of plastic water coolers versus bottle filler stations in city buildings. Recently I have been working more in community outreach. I published an Op-Ed in the Providence Journal describing the ways in which the City's sustainability efforts have combined a top-down approach with community involvement. I am also preparing to give a presentation on ways in which city workers can save energy in offices.

Denise Soriano Poster: F12

Home Institution: DePaul University

Summer Research Program: Leadership Alliance-Summer Research Early Identification Program

Faculty Mentor: Terry-Ann Craigie (Economics)

Marijuana Legalization and Racial-Ethnic Disparities in Incarceration Rates: 2000-2015

The "War on Drugs" began in the 1970s, producing an increase in carceral population resulting in a disproportionately population of Black and Latino males. In 2011, 2.3 million people were imprisoned, an increase of over 500% since the 1970s. Both Latino and African American males face a higher probability of imprisonment. Many scholars predicted that marijuana legalization would reduce discrepancies in incarceration rates between racial minorities and whites. The results of this study test the validity of these predictions, revealing changes in incarceration rates from 2000-2015 from states that have legalized marijuana for decriminalized and recreational use. While incarceration rates have diminished across all groups studied, African-Americans and Latinos are still targeted and incarcerated at a higher rate than Whites.

Sarah Saxe, Morgan Awner Poster: F13

Home Institution: Brown University

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

Faculty Mentor: Jin Li (Education)

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

This three-year study examines the development of learning beliefs in European American and Chinese immigrant children. Learning beliefs concern children's attitudes towards learning, the way they acquire knowledge, and evaluations of the value of learning. This project seeks to understand how socialization, in a culturally-specific sense, aids the development of these beliefs. Data were collected from 300 children and their families in three groups: European American middle-class, Chinese immigrant middle-class, and Chinese immigrant low-income class. These children were tracked from ages four to six. Various qualitative methods of data collection were employed including week-long daily diaries kept by mothers. This UTRA team is in the process of coding and analyzing these diaries based on early observations.

Alexi Kim Poster: F14

Home Institution: Brown University

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

Faculty Member: Timothy Edgar (Computer Science)

The American Way of Surveillance

The American Way of Surveillance places the debate over the intelligence and civil liberties in historical context. Summer research included a comprehensive examination of the story of how the United States has addressed (and has failed to address) these tensions. It is both a critique and a qualified defense of the American system of intelligence surveillance, which is based on a unique system of checks and balances, adapted to address the demands of secrecy.

Summer Research Programs at Brown

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California State University, Long Beach
Clark University
Cornell University
DePaul University
Hunter College, CUNY
New York University
North Carolina A&T State University
Rhode Island College
Rollins College
Rowan University
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