ABSTRACT BOOKLET 2019

THE CENTER FOR CIVIC LEADERSHIP PRESENTS

RICE UNDERGRADUATE RESEARCH SYMPOSIUM

CELEBRATING THE UNCONVENTIONAL RESERACH OF UNDERGRADUATES

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Student Opportunity Center

Visit: https://studentopportunitycenter.com

Letter from the Steering Committee

Hi all,

I am so excited to present the abstract book for the 2019 Rice Undergraduate Research Symposium (RURS). Within this booklet, you will find countless examples of our very own Rice students working on research projects stemming from all different fields, each meaningfully contributing to the advancement of our understanding of the world.

Now in its eighteenth year, RURS is the premiere event for Rice undergraduates to showcase and share research from all disciplines to their peers, mentors, and the greater Houston community. This exchange of knowledge and new ideas is at the heart of the symposium's mission, which is to promote enthusiasm and excitement for undergraduate research. Research is a crucial component to the undergraduate experience, allowing students to expand their studies beyond the classroom. We hope that you too, when reading this booklet, will be just as inspired as we are by the research our amazing peers are doing.

This celebration of scholarship would be possible without mentors from both Rice and beyond who are dedicated to supporting students and their research endeavors.

Best,
Jessica Weng
Chair, RURS 2019
Evelyne Tantry
Assistant Chair, RURS 2019

Letter from the Center for Civic Leadership

Dear Symposium Attendees,

Welcome to the 17th annual Rice Undergraduate Research Symposium!

As part of Rice University's Inquiry Week, this event showcases our commitment to promoting inquiry-based learning through course-based undergraduate research experiences (CURES), research assistantships, and independent projects. Two thirds of Rice students report participation in an undergraduate research experience by the time they graduate. In addition to making these opportunities available, we ensure students are able to share the outcomes of their research by hosting on-campus symposia, providing funding for students to present at professional conferences, and encouraging publication.

Today 367 undergraduates will present 261 projects that highlight the diversity of scholarship across the schools and the many mentors who make this work possible—Rice faculty, graduate students, and staff as well as leading researchers at medical, civic, and cultural institutions across Houston. As you engage with presenters, we ask you to keep a few things in mind in order to achieve a productive experience for all. For three quarters of our presenters, RURS is their first conference. Some are in the nascent stages of the research process, while many are sharing results of a multi-year project. Half of them will go on to present their work at a professional conference. They have chosen to participate because they wish to develop their skills in communicating to a diverse audience and to increase their confidence in public speaking. We hope that conversations with you will refine their ideas and provide encouragement to pursue further work.

We would like to give a special thanks to the mentors and judges who make today's symposium possible. We hope you enjoy this wonderful celebration of undergraduate research at Rice!

Sincerely,
Caroline K. Quenemoen
Associate Dean of Students and Director of Inquiry-Based Learning

CENTER FOR CIVIC LEADERSHIP
RICE UNIVERSITY

Take your research to the next step with the CCL through Rice Nominated Fellowships, The Loewenstern Fellowship, Rice Undergraduate Scholars Program (RUSP), the Rich Family Endowment, and the Houston Action Research Team (HART).

Rice Nominated Fellowships
The Center for Civic Leadership advises on several nationally competitive fellowships to continue your current research, start new projects, or attend graduate school. Through fellowships advising, we seek to build upon your academic and leadership experiences to identify undergraduate and post-baccalaureate options that best meet your future goals. Depending on your year, there are options both domestically and internationally, including the chance to teach English abroad or explore a personal passion for a year. The Faculty Committee on Fellowships and Awards selects the Rice nominees for national fellowships and the finalists for the Rice fellowships. The CCL coordinates workshops on fellowship preparation and interviewing, provides one-on-one advising, and reviews application drafts to help you submit competitive applications.
For more information contact Dr. Danika Burgess, Dr. Jessica Khalaf, or Fatima Raza.

Loewenstern Fellowship
Through a generous donation by Walter Loewenstern (’58), the Loewenstern Fellowship provides preparation and funding to students for a summer experience conducting critical service and civic research abroad. Through classroom work, independent research, and experiential learning students engage with cultures, people, and problems different than their own. The program aims to develop student capacity for leadership while also providing value to partners and communities where students are placed in order to prepare students to become principled, civic-minded leaders.
For more information contact Fatima Raza.

Rice Undergraduate Scholars Program (RUSP)
The Rice Undergraduate Scholars Program (RUSP) is a two-semester, for-credit undergraduate research program aimed at students interested in pursuing a research career. Senior (and in some cases junior) Rice students engage in a year-long research project and attend weekly seminars on topics related to graduate school, research careers in various sectors, and academic life. The program is focused on developing research and presentation skills, an understanding of a research career, and how to apply to graduate education and nationally competitive fellowships that support research careers. In addition, all students in the program have access to funding that may be used for research materials or conference attendance.
For more information contact Dr. Mary Purugganan.

Rich Family Endowment

For students interested in community-based research, the Rich Family Endowment supports student leadership development with a societal impact through research projects. Successful

proposals will engage the Houston community, the Rice University campus community, and foster leadership and creativity among Rice students.
For more information contact Dr. Jessica Khalaf.

Houston Action Research Teams (HART)

Houston Action Research Teams (HARTs) are interdisciplinary groups who work together with a graduate student coach and Rice staff and faculty advisors in collaboration with community partners to address issues and challenges facing Houston and its residents. HARTs provide Rice students with opportunities to apply what they learn in the classroom to real-world issues, learn from their teammates and community partners, expand their awareness of social issues and civic actions being taken to address them, develop team- and community-based leadership skills, and communicate their ideas effectively to various stakeholders.

Examples of past projects include:

Promoting Civic Engagement in the Classroom
In collaboration with Mi Familia Vota (MFV) this team will develop a handbook of civic education activities for use by high school government teachers and other civic educators to increase youth civic engagement. Results from a previous HART project suggest that high school government classes do not lead to more engaged youth and identified a series of learning outcomes that could address this deficit. This project will operationalize that previous work by combining that work with current statewide standards to create a resource that both meets the standards and incorporates best practices of civic education.

The Past, Present and Future of Camp Logan
This project will support the Memorial Park Conservancy (MPC) by identifying options for preserving the history of Camp Logan, a World War I training camp existing from 1917 to 1919 on the land that is now Memorial Park. Archaeological surveys are on-going at Memorial Park to learn more about Camp Logan's history and MPC desires to preserve remnants of Camp Logan and possibly create a means for the public to engage with the site. Ideas for engagement include: memorials, reflective space, educational programing, interactive exhibits, or other options. The team will focus on gathering and compiling multiple sources of information about Camp Logan and its transition into Memorial Park, with a focus on African American military history at the site, as well as how similar sites are preserved and their history communicated to the public.

Undies for Everyone Disaster Relief Plan
In collaboration with Undies for Everyone (UFE), a non-profit organization committed to the self-esteem, dignity, and success of disadvantaged students in North America by providing them new underwear, this team will work to develop a plan to allow the organization to best respond during natural disasters. In the wake of Hurricane Harvey, UFE collected and distributed 1.5 million pairs of new underwear to people in need of all ages. This experience demonstrated to UFE the unmet need for underwear donations

following such events, and they have responded by expanding their organizational mission beyond elementary and middle school students to include people affected by natural disasters in the United States. UFE would like to develop a similarly effective and efficient set of organizational practices for responding to natural disasters.

For more information contact Dr. Alan Steinberg.

For more information about CCL programs and initiatives, please visit: https://ccl.rice.edu

2017-2018 Rice Distinction in Research and Creative Works Recipients

Anthropology
Charles Max Ronkos
Monica Bodd
Manasi Joshi

Bioengineering
Alexander Lu
Hanyang (Quentin) Li
Zilu (Peter) Tang
Leah Sherman

BioSciences
Lucrecia Kaye Aguilar
Monica Bodd
Andrew Chang
Kevin T. Chang
Corrinne Elizabeth Dunbar
Alexandra Figel
Jovany Jeomar Franco
Rohit Gupta
Mia Elizabeth Hofstad
Benjamin Johnson
Sean Liu
Rosa Elena Martinez
Anna Monet Meyer
Khushali Jitendrakumar Patel
Gia Francesca Rivera Longsworth
Elaine Shen
Amber Song
Michelle Alyssa Tran

Center for the Study of Women, Gender, and Sexuality
Elizabeth Martinez

Chemical and Biomolecular Engineering
Jacob Behling
Josiah Yarbrough

Chemistry
Samantha Donaldson
Angel Garces
Andrew Ligeralde
Surached (James) Siriwongsup

Civil and Environmental Engineering
Jose Alberto Maldonado

Classical and European Studies
Susannah Wright

Computer Science
Ethan Perez
He Jiang
Tim Van Baak
Yufeng Zhou

Earth, Environmental and Planetary Studies
Alexandra Holmes
Leila Wahab

Electrical and Computer Engineering
Yoseph Maguire
Yujun Chen

English
Asena Alay
Erica Wing-Chin Cheung
Marley Foster
Sonia Ann Hamer
Taegan Kate Howells
Reagan Woodson Kapp
Alison J. Liu
Elizabeth Martinez
"Emily" Zhizhen Rao
Sophie Marie Schnietz
Natalie Anne Swanson
Sarah S. Wozniak
Chelsea Shea Wu

History
Gary Dreyer
Benjamin Jones
Oliver Lucier
David Ratnoff
Corinne Wilkinson

Kinesiology
Akash Gupta
Lavan Rajan

Linguistics
Eugene Yeom
Natalie Grothues

Materials Science and NanoEngineering
Ajay Subramanian
Daniel Suzuki
David Pham
Lidia Kuo
Richard Branscomb

Mechanical Engineering
Andrew Gatherer
Jiaming Clark Zha
Jiejie Zhou

Physics and Astronomy
Elena Busch
Osmond Wen
Kevin Ewart
Raymond Fang
Nicolas Menendez
Tony Mirasola
Marielle Morris
Jake Spisak

Political Science
David Ratnoff

Psychology
Anamely Salgado
Courtney Wang
Colleen Philips
Elisabeth Kalomeris
Kristina Dickman
Serena Brandler

Religion
Jacob Blumencranz

Shepherd School of Music
Brian Mangrum
Gabriel Maffuz-Anker
Grant Wareham
Michael Ferri
Sarah Grace Graves
Noah Hester
Shichun Cindy Qin

Spanish, Portuguese and Latin American Studies
Alexia Rauen
Emily Foxman
Hannah Todd

Statistics
Alexander Hayes
Sathya Ramesh
Tiffany Tang

Sociology
Rita Reilly Brooks

Visual and Dramatic Arts
Alexander Shultz
Huidi Xiang
Marley Foster
Mark Bramhill
Nikola Dyulgyarov
Rob Katz

Inquiry Week

RURS is just one part of the larger, campus-wide Inquiry Week. This week of programming is a celebration of research, design, and creative work and a time to discover future opportunities at Rice. Check out the events around campus via the schedule below. Inquiry Week is put on by Rice's Office of Inquiry-Based Learning. To learn more about this initiative and find research resources and opportunities, visit https://ibl.rice.edu/.

INQUIRY WEEK April 8-12, 2019

a celebration of undergraduate research, design, and creative work

MONDAY

Pub Trivia with Hutch
Willy's Pub, free beer/soda & chips
8 – 9 PM, emcee Dr. John Hutchinson

WEDNESDAY

Rice Undergraduate Research Symposium
Poster Presentations
Autry Court, Tudor Fieldhouse
Session A: 1:30 – 3 PM
Session B: 4 – 5:30 PM

Thank Your Mentor
during RURS check-in, Autry Court

Oral Presentations
Session A: 12 – 4 PM
Herring 224
Session B: 3 – 5 PM
Humanities 116
Session C: 4 – 5 PM
Humanities 315
Session D: 12 – 1 PM
George R Brown E128A

Dinner and Awards Ceremony
RMC Grand Hall
6 – 7:30 PM

THURSDAY

Humanities Showcase of Research and Creative Works
Sewall Hall 305 and 309 with refreshments in hallway
3:30 – 5 PM

Natural Sciences Research Meet & Greet
Farnsworth Pavilion
3:30 – 5 PM

Social Sciences Research Showcase
Huff House
3:30 – 5 PM

Engineering Design Showcase
Autry Court, Tudor Fieldhouse
4:30 – 7 PM

Shepherd School Opera Undergraduate Students Scenes Program
Wortham Opera Theater, Alice Pratt Brown Hall
5:30 PM

FRIDAY

Podcast Launch
featuring undergraduate research and scholarship
ibl.rice.edu/podcast

RICE

IBL.RICE.EDU

RURS 2019 Schedule

12:00-5:00 Oral Presentations:

12:00-4:00 Oral Presentations A – HRG 224

2:30-5:30 Oral Presentations B – HUMA 116

2:30-5:00 Oral Presentations C – HUMA 315

1:30-5:30 Poster Presentations:

1:30-3:00 Poster Session A – Tudor Fieldhouse

4:00-5:30 Poster Session B – Tudor Fieldhouse

6:00-7:30 Dinner and Awards Ceremony – Grand Hall, Rice Memorial Center

RURS Map pdf

Session A

ENGI A1
Novel, versatile viral vector-cross linking platform for targeted, localized and sustained gene delivery
Brian Kang
Mentor: Dr. Jaehyung Jang
Despite great success, there still exist some unmet needs in achieving targeted, localized and sustained gene expression through Adeno-associated virus (AAV) vector mediated gene therapy. In this study, a simple, versatile AAV conjugation platform using a cross-linking agent, 3,3'-Dithiobis(sulfosuccinimidyl propionate) (DTSSP) is proposed. Depending on the concentration of DTSSP used, the AAV-DTSSP conjugate can either be further linked with specific ligands or relevant biomolecules for targeted gene therapy applications or aggregate for localized, sustained gene delivery. At lower concentrations of DTSSP, AAV-DTSSP was further conjugated with L-fucose, an important ligand in pancreatic cancer cells, to generate L-fucose bound AAV as a proof of concept. As a result, gene delivery level was significantly enhanced in pancreatic cancer cell. At higher concentrations of DTSSP, an implantable AAV aggregate was fabricated. In vitro and in vivo functional characterization reveal that the AAV aggregate is capable of localized, sustained gene delivery. Therefore, the AAV-DTSSP cross linking platform shows a great potential in its use as targeted, localized and sustained gene therapy vector

ENGI A2
Investigating Nanoparticle Monolayer Self-Assembly at Liquid/Liquid Interfaces Using Small Angle X-Ray Scattering and Visible Wavelength Reflectance
Takuma Makihara
Mentor: Dr. Irving Herman
Two-dimensional monolayers of nanoparticles have garnered recent interest for their application as building blocks in vertical heterostructures. Nanoparticle self-assembly, where nanoparticles in solution spontaneously form monolayers on a substrate, is a simple method for fabricating these exciting new materials. This study explores the poorly understood kinetics of nanoparticle self-assembly onto a liquid substrate. Real-time small-angle X-ray scattering (SAXS) measurements of the liquid substrate revealed that a monolayer forms before the nanoparticle solution evaporates. Although SAXS provides global data along the X-ray path, measurements are still limited to the narrow width of the X-ray beam. Therefore, we developed a complementary characterization technique for self-assembly that exploits visible wavelength reflectance from the liquid substrate and can probe vastly larger areas than the width of the X-ray beam. We used this technique to reveal the time-dependence of self-assembly on the concentration of nanoparticles in solution.

ENGI A3
Factorial Study on Effects of Parameters of Gelatin Microparticle Synthesis on Size Distribution of Particles
Tate Shannon
Mentor: Dr. Antonios Mikos
Tissue engineering seeks to meet the need for replacement tissue resulting from trauma or disease. Tissue engineering systems frequently consist of a scaffold with bioactive factors and/or cells. Gelatin microparticles are often used in tissue engineering as a platform for cell or drug delivery. Previous work has demonstrated excellent biocompatibility of the microparticles as well as their ability to promote cell adhesion and proliferation and control the release of growth factors. The microparticles are synthesized using a water in oil emulsion, then crosslinked to set their final shape. Several factors of the synthesis affect the size distribution of the microparticles including the stirring speed of the emulsion, the concentration of the gelatin-water solution added to the oil phase, and the number of active groups available for crosslinking. To test each of these factors, a factorial study has been developed to analyze the effects of differing stirring speeds during particle formation, the effects of differing gelatin concentrations of the water solution added to the emulsion, and the effects of using thiolated gelatin on the final size distribution of the microparticles.

ENGI A4
PET-RAFT polymerization catalyzed by cadmium selenide quantum dots for synthesizing polymer-coated quantum dots
Grace Wickerson
Mentor: Dr. Eilaf Egap
Light-controlled radical polymerizations are a robust technique for preparing well-defined polymers with complex architectures under mild reaction conditions and with temporal control over the reaction. Coating quantum dots (QDs) with polymer can modify the surface chemistry, tailoring QD size, changing the optical properties, as well as improving the dispersibility in the solvent, which is vital for medical applications. We were able to successfully implement light-controlled radical addition-fragmentation transfer (RAFT) polymerization in polar solvents photoinitiated by cadmium selenide (CdSe) QDs for the synthesis of polymer-QD nanocomposites. The CdSe quantum dots can undergo monophase ligand exchange with the RAFT agent, which binds to the quantum dot surface via the bithiol side of RAFT compound. The polymer can then be “grafted-from” the QD without additional purification steps to obtain well-dispersed polymer-coated quantum dots. A multitude of functional monomers can be polymerized through this process with low dispersity. In the future, this method will be useful for simply synthesizing defined polymer-coated QDs for a variety of optical and biological applications.

ENGI A5
Osteochondral Tissue Engineering Using 3D Printed Peptide-Patterned Scaffolds

Bonnie Wang
Mentor: Dr. Antonios Mikos
The main goal of this project is to develop constructs to repair osteochondral tissue, with the use of complex multi-layered 3D printed scaffolds with user-specified patterns of peptides. Two main components of the scaffold are needed: the chondrogenic and osteogenic layers. Starting by using alkyne-functionalized poly(ε-caprolactone) (PCL-Alkyne), we will use an alkyne-azide click reaction to conjugate azide-presenting peptides to PCL and form PCL-peptide conjugates. These peptides are small, bioactive sequence portions of growth factors. The PCL-Alkynes are used to make two specific conjugates: PCL-N-cadherin (PCL-NC), which is chondrogenic, and PCL-bone morphogenetic protein (PC-BMP), which is osteogenic. Both PCL-peptides will be each tagged conjugate with a specific fluorescent dye for identification and visualization purposes once the scaffold is printed; 5(6)-TAMRA and Pacific Blue will be used to tag these PCL-peptide conjugates. Printing of the dye tagged PCL-peptides in various patterns can be visualized by using the fluorescent dyes and will show the potential of how this peptide patterning methodology can be used to generate scaffolds similar to native tissue.

ENGI A6
Residue Importance Processing - ((In silico)) Design of Adeno-associated Viruses to Increase Transduction Efficiency.
Hoang Anh Vu
Mentor: Dr. Junghae Suh
Adeno-associated viruses (AAV) have been proved to be a very promising vector for gene delivery, due to their non-pathogenic, low immunogenic, and non-mutagenic properties. They are capable of transducing both dividing and none dividing cells, allowing for broad expression of delivered transgene. Each AAV serotype has a preferential transduction target, specific AAV capsids are selected based on their ability to transduce different tissues. However, it has been shown that there is an increase in neutralizing anti-bodies response as a result of prior exposure to specific AAV serotypes, making repeated dosage of the same AAV serotype ineffective. We seek to recapitulate the different AAV serotypes' ability to transduce specific cells in other AAVs so that we can create AAV variants with similar transduction capabilities while maintaining serotypical diversity. Using machine learning algorithms, we have identified important residues on the AAV9 capsid that maybe modified to increase its ability to transduce HEK293T cells, which is usually very poorly transduced by AAV9.

ENGI A7
Mechanically Induced Endothelial Cell Inflammation

Dora Huang
Mentor: Dr. Jane Grande-Allen
Inflammation drives the formation and progression of atherosclerotic plaques. Pathological mechanics such as disturbed flow (d-flow) and large-amplitude dynamic stretch cause pro-inflammatory signaling between two key vascular cell types, endothelial cells (ECs) and vascular smooth muscle cells (VSMCs) through the activation of ribosomal S6 kinase (p90RSK). To examine this pathway's effect on vascular cell signaling, 3D hydrogel models were constructed with modified polyethylene glycol and seeded with ECs and VSMCs. The cells were tested under laminar and disturbed shear-flow using a modified cone-and-plate viscometer. Other hydrogels were cyclically stretched using a Flexcell bioreactor. 3D and 2D monocultures were used as controls. As a result, the hydrogels exposed to physiological laminar flow exhibited fewer pro-inflammatory signs than the hydrogels tested with d-flow. With laminar flow settings, the ECs exhibited elongated shape in comparison to their normal "cobblestone" appearance. Through examining the way cells react to mechanical forces, we gain a better understanding of how pathological mechanics affects arterial inflammation and atherosclerotic plaque progression.

ENGI A8
3D-printing patterned biocompatible hydrogels to promote angiogenic sprouting
Charlene Pan
Mentor: Dr. Jordan Miller
Engineered tissues with clinically relevant size are generally beyond the diffusional limit (200 um) for nutrients and oxygen, thus requiring a vascular network to supply nutrients to the cells within the tissue. There are two ways of forming new blood vessels, vasculogenesis and angiogenesis. Vasculogenesis is the de novo formation of blood vessels from endothelial cells, while angiogenesis the formation of new vessels from existing vessels. Here, we sought to create high-resolution, pre-defined hollow channels, which can later be seeded with endothelial cells to allow angiogenic sprouting into the matrix. We used a 3D printing technique based on stereolithography to create hydrogels with defined 3D geometry and varying stiffness that induces sprouting. We achieved proof-of-concept mechanical enhancement of the printed channels and designed new serpentine 3D models with selective, more compliant regions. However, more work is required on fine-tuning the printing parameters and seeding the endothelial cells in the heterogeneous hydrogel for observations of sprouting. This work represents a preliminary step towards achieving robust angiogenic sprouting for engineered tissues.

ENGI A9
The Effect of Substrate Stiffness on Human Intestinal Enteroids Differentiation and Infectability
Chenlin Huang
Mentor: Dr. Ganesh Swaminathan

The purpose of this study is to investigate the effect of substrate stiffness on human intestinal enteroids (HIEs) differentiation and infectability. Hydrogels are tunable compared to conventional tissue culture plastics, and their material properties allow for incorporation of biochemical cues that mimic human intestinal microenvironment. We fabricated poly(ethylene-glycol)-based soft, medium, and stiff hydrogels using thiol-ene 'click' chemistry. The modulus of hydrogels was determined using compression testing. To support cell culture, the hydrogels were functionalized with basement membrane proteins. HIEs were seeded on surface-modified soft, medium, and stiff hydrogels and differentiated for one week. HIEs seeded on 96-wells coated with basement membrane protein were used as controls. Analysis of the effect of substrate stiffness on HIE differentiation was conducted using protein staining, confocal imaging, and qPCR, while infectability was determined by bacterial and norovirus infection. The results of this experiment will be useful in determining the appropriate substrate for studying intestinal diseases using HIEs.

ENGI A10
Rice Wearables Lab: Digital Phantom Model for the Assessment of Novel Bio-Imaging Systems
Jason Dennis
Mentor: Dr. Ashutosh Sabharwal
Recent research in bio-imaging methods have been focused on creating non-invasive technologies that allow for deep-tissue imaging. Currently, operating in a visible, near-infrared wavelength range, where light absorption by tissue is relatively low, only enables us to see just a few millimeters beneath the skin. The desire for safe, deep-imaging modalities have motivated the development of computational photo-scatterography techniques that involve light transport numerical models to solve the very large-scale inverse problem of de-scattering light. Monte Carlo (MC) simulations for light propagation have become the gold standard for modeling light transport in tissues. MC approaches are based on the Radiative Transfer Equation (RTE) that describes light propagation in terms of discrete photon transport. Although numerically accurate, MC algorithms are limited by their heavy computational demands. We outline an efficient volumetric mesh-based MC procedure to model light transport through heterogeneous, multi-layered tissue. A digital phantom model will help with the overall goal of creating novel senor and camera platforms, ranging from wearables to non-invasive point-of-care devices

ENGI A11
The Effects of AAV9 Capsid Mutation on Transduction Ability
Jiayu Liu
Mentor: Dr. Junghae Suh
In Suh lab, we focus on the application of Adeno-associated virus (AAV) as a therapeutic gene delivery vector. AAV has shown to be a promising instrument for gene

therapy and can tolerate peptide insertions at various sites on viral capsid genes. Therefore, we are motivated to investigate the incorporation of adaptor domains on viral capsid genes and its application on large protein binding. I will engineer peptide and protein display on AAV to promote AAV9 binding with adaptor domains. First of all, I will continue to troubleshoot for the cloning project that incorporates adaptor domains inserts into AAV9 plasmids. After the adaptor domains incorporated AAV9 plasmids are successfully cloned, I will perform plasmid and virus preparation to produce the AAV9 virus used for testing for large protein binding. I will conduct characterization assays (qPCR, western blot, nickel columns assay and transduction etc.) to test binding between the AAV9 variants and large protein attached with adaptor domains. The goal is to investigate the application of AAV9 as a viral vector to transport specific large proteins to target cells to achieve desired gene modification.

ENGI A13

Tuning the reactivity of Fe supported by Graphene toward the Oxygen Reduction Reaction

Daniel Martinez

Mentor: Dr. Thomas Senftle

In this project, the reactivities of nitrogen and oxygen doped graphene toward the oxygen reduction reaction (ORR) were examined with density functional theory (DFT). ORR in this work provides an alternate method to form hydrogen peroxide, which is currently synthesized by energy-intensive processes. Using DFT, a standard method in computational chemistry and materials science, the adsorption energies of O2 (ΔEads) on Fe supported by either pristine or modified graphene were calculated. ΔEads is important to tune ORR reactivity and selectivity. For this project I first examined the structure and formation energies of multiple Fe/graphene surfaces to identify the most stable structures. Then, I further modified the graphene surface with nitrogen and oxygen impurities to alter its electronic structure, which in turn alters the reactivity of the adsorption site. This data will be used to identify correlations between the chemical properties of the modified graphene structures and ΔEads. This knowledge can then be used to design more effective catalysts for ORR, as well as other similar reactions.

ENGI A14

Leak Optimization of a Mutagenesis Plasmid
Jacob Mattia
Mentor: Dr. Matthew Bennett
Synthetic biology is centered around the premise of modifying biological systems to change or improve their function. One broad technique for modifying biological systems is directed evolution. This procedure involves linking a specific trait to survival in a population, then inducing high DNA mutation rates throughout the population. While directed evolution promises unpredictable and novel mutations, it is challenging to setup and run successfully due to the constantly high rates of mutation. We are optimizing a pre-existing mutagenesis plasmid to maximize its signal-to-noise ratio. We inserted an additional system of suppression entirely orthogonal to the plasmid's pre-existing arabinose-induced, glucose-suppressed toggles. We will test the functionality of the new system and determine whether suppression of the plasmid confers a dramatically reduced mutagenic leakage, compared to the pre-existing control plasmid. Future work will involve implementing the optimized plasmid in a variety of directed evolution approaches to increase experimental control.

ENGI A15
Optimization of Bacterial Nitrogen Fixation Using Metabolic Engineering Principles
Michael Lee
Mentor: Dr. George Bennett
Nitrogen is a major building block in many biological processes, but it is unusable in its most abundant form – N2 gas. Bacteria are one possible avenue of converting nitrogen gas to a more biologically relevant product, ammonia, through the nitrogenase enzyme. Increasing NH3 production from bacteria could potentially lower agriculture costs in fertilizer and increase food supply without further environmental impact. However, nitrogenase is a complex enzyme, and previous efforts to rationally modify it have been limited. To expand our understanding of the relative component functions, we developed a kinetic model for the metabolic engineering of nitrogen fixation in the model organism Azotobacter vinelandii using reported literature Km values. Our aim is to test the kinetic model while identifying viable metabolic targets for increasing total ammonia synthesis. To validate the model, we modify the electron transport complex (ETC) proteins selected using an SmR – LacI – LacPro vector and observe the effects on nitrogen fixation. These results may have a role in identifying future genetic modifications for optimization to maximize NH3 production in A. vinelandii.

ENGI A16
Designing Novel Light Sources with Perovskite Metasurfaces
Frank Yang
Mentor: Dr. Guru Naik
Light sources with specific spatial and temporal properties are required for many applications in our daily lives, including telecommunications, medicine, and scanning. However, in order to achieve these specifications, these sources can become bulky and inefficient, combining a dedicated light source, such as a laser, with different filtering

apparatuses. We seek to design a novel light source that is both compact and efficient by combining a perovskite gain medium with an optical device called a metasurface. Perovskites are a class of materials exhibiting high optical gain with tunability over a large wavelength range and are therefore excellent candidates for a light emitting medium. A metasurface is a device composed of many optical scatterers and allows for control of the light emitted from the perovskite material. Using finite difference simulations of the Maxwell Equations, we investigate the properties of perovskites and incorporate perovskites in the design and optimization of metasurface scatterers. Simulations show that a perovskite metasurface can control both the phase and intensity of emitted light, demonstrating its potential as a compact, efficient light source.

ENGI A17
Development of a Mechanically Tunable 3D Microenvironment for Osteosarcoma Study
Maria Salazar
Mentor: Dr. Antonios Mikos
Osteosarcoma (OS) is the most common primary malignancy of bone. Although OS outcomes have improved, for patients with metastasis on presentation, overall five-year survival remains at 20%. Most preclinical research is based on growing cells in monolayer culture on hard plastic surfaces which do not mimic ((in vivo)) tumor environments. Thus, we set out to develop a three-dimensional (3D), mechanically tunable model that is suitable for the study of OS cell phenotype and drug response. Our investigation involved electrospinning coaxial fibers to vary the bulk tensile properties of the model. We found that variations in scaffold stiffness affected the localization and expression of the mechanoresponsive Hippo pathway effectors, YAP and TAZ. Moreover, we observed upregulation of the cancer stem cell marker, Sox2, and downregulation of the IGF-1/mTOR axis in 3D cultures. To evaluate the clinical utility of our model, we examined tumor samples from 37 OS patients and established that cells cultured on our models recapitulated these clinical outcomes. Our study highlights the need for more accurate preclinical models in the identification of molecular targets and therapeutic testing.

ENGI A18
Caspase-Activatable Adeno-Associated Virus for Targeted Gene Delivery ((in vivo))
Kefan (Stella) Song
Mentor: Dr. Mitchell Brun
Adeno-associated virus (AAV) is a promising gene delivery vector for gene therapy due to its non-pathogenic nature. To increase the specificity for targeted gene delivery, we have developed a caspase-activatable AAV vector by inserting peptide locks on the AAV9 capsid to block cell binding. The peptide locks are cleavable by caspases, which are upregulated in sites of cardiovascular disease. In the presence of caspases, the

vector can be switched on to transduce cells. The lead variant we developed demonstrates switchable transduction ((in vitro)) when exposed to caspase-3. We are characterizing the ((in vivo)) delivery performance of the engineered vector in comparison to the wild-type AAV9 in healthy mice with a disease model of myocardial infarction (MI). The biodistribution, blood circulation profile and neutralizing antibody generation are being investigated. We hypothesize that AAV9 will deliver to organs throughout the body and the engineered vector will deliver site-specifically to the injured heart with minimal off-target delivery, thus allowing for the delivery of a clinically relevant transgene which would be harmful if delivered to healthy tissue.

ENGI A19
Incorporation of Ceramic and Pore Size Gradients into 3D Printed Scaffolds Containing Gelatin Methacrylate Fibers for Tissue Repair
Carrigan Hudgins
Mentor: Dr. Antonios Mikos
Cartilage degeneration and injuries impact about one-fifth of adults in the U.S. However, clinical techniques to treat these conditions have yet to produce sufficient outcomes. The goal of this study is to develop 3D printed multilayered scaffolds that mimic the physiology of the osteochondral unit and promote regeneration of tissue. The scaffolds are comprised of a poly(ε-caprolactone) (PCL), nano-hydroxyapatite (HA), and β-tricalcium phosphate (β-TCP) framework with vertical porosity and ceramic content gradients. In a previous study, we evaluated PCL scaffolds with gradient HA concentration and pore size, concluding that HA incorporation (to mimic bone) does not impact compressive properties, and smaller pores increase compressive moduli and yield stress. The scaffold framework in this study adds β-TCP to investigate its effect on spatial segregation of seeded cells. Separately, inside the porous PCL/HA framework, 3D printed gelatin methacrylate (GelMA) fibers are incorporated, which will contain growth factor laden microparticles to stimulate regeneration of tissue. Moving forward, optimal GelMA properties for extrusion printability and the impact of β-TCP will be determined.

ENGI A20
Identifying peptide inhibitors of ((S. typhimurium)) PhoPQ using engineered ((E. coli))
Andrew Mu
Mentor: Dr. Jeffrey Tabor
Antibiotic resistance is a mounting public health concern. Antimicrobial peptides (AMPs) are a promising source for novel antibiotics; however, bacteria have evolved two-component systems (TCSs) to sense these peptides and resist their effects. One such TCS is PhoPQ, an important regulator of AMP resistance genes and virulence factors in

many Gram-negative bacteria, including ((Salmonella typhimurium)). Due to the role of PhoPQ in AMP sensing and resistance, therapeutically relevant AMPs must avoid activating this sensor or actively inhibit it. Here, we seek to identify peptides with those properties. First, we ported ((S. typhimurium PhoPQ)) to ((E. coli)) for more precise control of gene expression. Next, we introduced a previously-developed peptide display system to enable high-throughput screening for peptide activity. We validated this approach by testing peptides known to activate PhoPQ. We then tested targeted libraries to identify peptide properties that affect interaction with PhoPQ, such as charge or size. A better understanding of these interactions will help us develop novel antibiotics.

ENGI A21
The Effect of Adult-Born Granule Interneurons on Output Neurons in the Olfactory Bulb
Aneel Damaraju
Mentor: Dr. Ankit Patel
The olfactory bulb (OB) in the mouse is the first layer of a multilayer cascade of olfactory processing. This area has been hypothesized to be involved in separating odorants into different classes, in order to compare them in an efficient manner, mainly using a locality sensitive hashing (LSH) algorithm. One of the key components of this network are the adult-born granule interneurons (vGAT), which are in charge of modifying the activity of the output neurons (Glomeruli, Mitral and Tufted Cells) through lateral modulation. With a calcium imaging dataset of simultaneously recorded output neurons of the OB with and without vGAT, we were able to create predictive models of the output neurons through linear models of the tufted and mitral cells as functions of the glomeruli response. Through exploring the differences in Oracle predictability and Pearson correlation between the knockout and control mice, we study the effect of lesioning adult-born granule interneurons on the population of output neurons. These statistical tests suggest that these interneurons reduce the large multicollinearity that exists between neurons in the OB, and are involved in implementing the LSH algorithm.

ENGI A22
Experiments involving the hydrodynamics of deformable particles
Alex Acosta
Mentor: Dr. C. Fred Higgs III
Deformable fluid-particle interactions occur in a range of different applications. Structural failure of a particle due to hydrodynamic stresses is particularly important in hemodynamics and algal green energy extraction. However, no reliable failure criterion currently exists, which makes predicting the failure event a formidable challenge. While computational modeling is an invaluable tool for this problem, experiments are needed to improve current constitutive laws and for validation of the numerical models. This

project focuses on designing a microfluidic experiment that can be used to quantify the deformation---and ultimately, failure---of capsules in various flows. Our approach to this problem is twofold. First, we constructed a cost-efficient microfluidic apparatus, featuring a custom-built syringe pump that provides precise, controllable flow through the channels. Secondly, we developed a post-processing tool to extract high-resolution particle flow data from high-speed video. We demonstrate how we combine our flow apparatus and motion-tracking code to construct a robust framework for extracting reliable particle flow data to be compared with models in the future.

ENGI A23
Engineering Sub-second Bacterial Sensing with Localized FRET Probes
Chad Fisher
Mentor: Dr. Jeffrey Tabor
Two component systems (TCSs) are a well-conserved family of bacterial sensors, canonically consisting of a membrane-bound sensor kinase (SK) and a cytoplasmic response regulator (RR). TCSs can sense diverse inputs like aromatic pollutants, soil nutrients, ions, hormones, and light. Some TCS pathways have been successfully modified to create genetically-encoded sensors capable of detecting spatially and temporally varied stimuli, but these systems have slow responses since they primarily rely on a translational reporter. This project aims to directly detect RR dimerization to bypass typical reporters and engineer sub-second, reversible bacterial sensors with Förster Resonance Energy Transfer (FRET) between fluorescently labeled dCas9 and RRs. We promote localization with an array consisting of alternating DNA binding sites for the labeled proteins. Upon phosphorylation by the SK, RRs will dimerize and bind to the appropriate DNA sequence, producing a FRET response between the two DNA localized proteins. This novel approach can be applied to creating bacteria that can sense, compute, and respond to their environment or rapidly assay environmental samples for different compounds.

ENGI A24
Influenza pEpitope quantifies a novel antigenic distance to predict vaccine efficacy
Rachel Kim
Mentor: Dr. Rachel Kim
Though seasonal influenza affects millions of individuals worldwide each year, vaccination has been shown to prevent hospitalizations, lessen severe illness outcomes and reduce the public health burden. Serological experiments with ferrets are the current gold-standard approved by the WHO, however, these animals models have inconsistent predictability for vaccine efficacy in humans. Here we show that our theoretical work on the human antibody response to infection following vaccination yields a robust quantifier of antigenic distance, called pEpitope. Our pEpitope model is consistently able to explain the variance in A(H3N2) vaccine efficacy from 1971 to 2017,

with an r^2 of 0.78. We demonstrate that it has high predictability especially over the past decade when tested on data collected in lab-confirmed influenza studies from the CDC's five Flu Vaccine Effectiveness Network sites. The pEpitope model has multiple possible entry points into the WHO's vaccine virus selection and development protocol. The integration of theoretical modeling with experimental testing offers a powerful analysis tool for selecting and developing an effective influenza vaccine.

ENGI A25
Development of ceramic-based bioink to prepare gradient scaffolds for osteochondral regeneration
Maryam Elizondo
Mentor: Dr. Antonios Mikos
Bone defects caused by disease or trauma is a prevalent condition that has proved to be a clinical challenge. The repair of damaged bone is clinically targeted using autografts and allografts, but recent progression in the field of bone tissue engineering has paved the way for bone scaffold fabrication using 3D printing. The use of ceramic materials such as hydroxyapatite and beta-tricalcium phosphate provide the osteoconductive environment for bone repair and regeneration through osteoblast infiltration into the scaffold. Porosity at a micro-level is needed for optimal native tissue ingrowth into the fabricated scaffold. By sintering ceramics we can create the needed porosity within the scaffold for cell integration. Additionally, the scaffold creates the proper environment for osteochondral regeneration due to its inorganic ceramic components that make up the 3D printed scaffolds. The sintered scaffold is evaluated with microCT and SEM techniques. With this formulation, we can create gradients within each scaffold that can lead to better integration of fabricated scaffolds in native tissue.

ENGI A26
Trident: Team DISSECT"s Bite-Sized Microcontroller
Ronaldo Sanchez
Mentor: Dr. Ray Simar
The goal of the Trident project is to produce a versatile printed circuit board that is similar in size to a quarter that can be used for prototyping due to the amount of input/output ports present on the board. By the end of the Spring 2019 semester, we are striving to have boards produced that may be used in senior design projects and other ELEC-related projects in the future.

HUMA A27
Imagining LGBTQ Cultural Competence in Psychiatry
Katie Lobodzinski
Mentor: Jonathan C. Findley

Research indicates that significant psychiatric health disparities are prominent within the LGBTQ population. Despite this, a third of medical schools do not include content on LGBTQ topics in the curriculum for students' clinical years, and fewer than 35% include content related to hormone therapy and gender-confirming surgery. This project involves an assessment of psychiatric residents' beliefs and practices in relation to LGBTQ patients. With interview and survey data, we illuminate gaps in LGBTQ cultural competence within the field of psychiatry. While all residents that were interviewed recognized that LGBTQ identities significantly influence psychopathology, around half voiced discomfort about discussing these identities with patients because they lack knowledge on them. Findings suggest that there are significant gaps in knowledge among this population both in relation to LGBTQ identities and how to address them in practice. Data from this project may aid in the development of improved practices to ensure that sexual orientation and gender identity are accounted for in patient interactions.

HUMA A28
The Shadows of Death on the Human Mind in the Kaderli Letters
Tristan Boss
Mentor: John Mulligan
This spring, I worked in the Woodson archives with the Kaderli letters, a set of documents containing responses to letters sent by Mrs. Kaderli concerning death in the early 1960s. The responses to Mrs. Kaderli contain letters from respected leaders in art, politics, science, and religious thought. Each responder provided a different perspective on death, its role in human life, and how to explain it. What is evident from reading the variety of responses is that death casts a long shadow across the lives and minds of humans of all ages. Humans attempt to find meaning in the presence of death in order to bring peace of mind. In these explanations, there are consistent themes about death that bridge the gaps between the letters. These themes can be categorized together to demonstrate what the important beliefs and attitudes of a culture are and how they interact with the lives and understanding of humanity. Using these themes, I will discuss the archive I made with the Kaderli letters to better explore the different perspectives on death.

NSCI A29
Computationally efficient depth-mapping scheme for human midbrain
Paulina Truong
Mentor: Dr. David Ress
"Human midbrain contains a variety of nuclei. In particular, superior colliculus (SC) has a distinct laminar functional organization consisting of superficial layers corresponding to visual stimulation, intermediate layers for oculomotor control, and deep layers for multisensory integration. Likewise, inferior colliculus has laminar segregation by

auditory frequency. High-resolution functional MRI allows for detailed laminar analysis of the functional topography of colliculi.

In convoluted brain tissue, precisely specifying ""depth"" is difficult because of its variable curvature and thickness. Previously, we utilized a nearest-neighbor Euclidean approach from the superficial surface of the colliculi. This scheme was satisfactory for depth mapping in superficial layers, but better methods are needed for the deeper tissue. We offer a simple surface-based approach based on an algebraic level-set scheme, and demonstrate its efficacy in distinguishing laminar profiles of activity within SC."

NSCI A30
Effect of Produce Distribution Bags on School Lunch Fruit & Vegetable Plate Waste
Candise Tat
Mentor: Shreela Sharma
"To improve fruit and vegetable (F&V) intake, Brighter Bites (BB) provides evidence-based interventions to low-income families. During the 2017-2018 school year, plate waste data of lunch F&V were collected and analyzed to determine whether increased exposure to F&V at home through BB would decrease F&V plate waste.
Plate waste data were collected, and participants' school-purchased F&V waste was weighed.
The amount of F&V each student was exposed to depended on how often families obtained distributions. The types of F&V students received from BB and selected at lunch were matched, to correlate how often students were exposed to those F&V and how much they wasted.
An average of 69.8% of school lunch F&V matched with distributed F&V. Each student's average amount of F&V wasted was then correlated with the total amount of F&V they received from BB. A correlation of $R = -0.0338$ was determined, with a statistical significance of $p = 0.0072$. This indicates a modest but significant negative correlation between the amount of F&V a child received from BB and the F&V they wasted, suggesting increased exposure through intervention may decrease the amount of F&V wasted at school lunch."

NSCI A31
Multiphoton Microscope Imaging of Carbon Nanomaterials
Eugenia Kakadiaris
Mentor: Dr. Stuart Corr
Though fluorescence has been traditionally used to tag, identify and image various cellular pathways, metabolites, and proteins, these fluorescent tags may alter the molecule they seek to track. Thus, it is important to study imaging methods in which materials that do not alter the molecules tagged can be used. Multiphoton microscopy

offers an exciting alternative to traditional imaging methods. In multiphoton microscopy, near-infrared femtosecond lasers excite optical processes in fluorescent molecules using two or more photons1. The use of long wavelengths (700nm-1000nm) enables deep tissue penetration of up to 1000 micrometers without inducing harmful biological effects2,3. Pairing multiphoton microscopy with of non-fluorescent carbon-based nanomaterials offers an exciting new alternative to traditional fluorescent tagging techniques. We demonstrate that carbon-based nanomaterials such as C60 fullerenes, single-walled carbon nanotubes and graphene nanoribbons can be used to image cancer cells using multiphoton microscopy though they exhibit no inherent fluorescent properties.

NSCI A32
Examining the Role of the Superior Colliculus in Sensorimotor Decision-making Tasks
Kylie Swiekatowski
Mentor: Dr. Nuo Li
This study uses a loss of function strategy to examine the role of the superior colliculus in the behavioral planning circuit. Mice trained in a delay-response discrimination task underwent superior colliculus (SC) inactivation. The use of optogenetics allowed for only the region of the SC to be inactivated due to photostimulation of GABAergic neurons through a fiber optic cable. Photostimulation was performed during the sample, delay, and response period of the decision-making task. Unilateral inactivation of the superior colliculus produced selective contralateral deficits and ipsilateral biases in the directional licking responses.

NSCI A33
Effects of Water System Intervention on Water Quality and Health Outcomes in Rural China
Srinithya Gillipelli, Lillian Wieland, Ashley Tsang
Mentor: Dr. Jorge Loyo
Underserved communities in China cannot access clean water, despite needing it for crops, livestock, and drinking water. Using unsanitary water causes health issues such as gastrointestinal disease and oral decay. Project 25 (P25) installed a water system in Xishipo Village to increase access to clean water. The water system was investigated to see if it improved the water quality, livelihood, and health education of the villagers. Interviews were conducted with the families of the village, asking about health, education, and access to water. The data shows that water quality and health improved due to the water system’s filtering of pathogens. Education improved likely because villagers installed and maintained the water system and because of the education initiatives of P25. These results demonstrate that the water system improves health and quality of life for those who cannot access clean water. By extending these results to other rural areas, more people can access clean water, which improves their health and

socioeconomic status. Future studies can look to test the longevity of this solution by studying health and hygiene habits several years post-intervention.

NSCI A34
Bimanual perceptual interaction in the frequency domain differ for flutter and vibration cues
Sriparna Sen
Mentor: Dr. Jeffrey Yau
While bimanual motor processing is well-studied, much less is known regarding bimanual touch. We recently showed that the perception of high-frequency vibrations (100-300Hz) on one hand is systematically influenced by distractor vibrations experienced on the other hand. Distractors biased frequency perception and modulated perceptual thresholds in a frequency-dependent manner, and the strength of bimanual interactions varied inversely with the distance between the hands in peripersonal space. Because vibrotactile stimulation spans a wide range of temporal frequencies, here we tested subjects' ability to discriminate the flutter frequencies (16-36Hz) on their right hand while they ignored distractor cues on their left hand. We manipulated the frequency of the distractors and the separation between the hands. Preliminary results indicate that the distractors induced attractive biases in the perceived flutter frequency, similar to distractor effects at higher frequencies. Unlike interactions at higher frequencies, biasing effects on flutter perception did not differ according to hand positions and effects on perceptual thresholds were inconsistent across participants.

NSCI A35
Pediatric-Onset Bipolar Disorder Gene Knockdown Neuron Analysis
Alison Oh
Mentor: Dr. Jimmy Holder
Bipolar disorder is a mental illness characterized by extreme shifts in emotion and activity, manifesting in manic and depressive phases. Pediatric-onset bipolar disorder, specifically, is associated with a worse prognosis later in life, including increased drug and alcohol abuse, comorbidities with other mental illnesses, and occurrence of rapid cycling. Previous studies have suggested a strong genetic basis for this subtype and it therefore provides a promising model on which to study the impact of mutations on neuronal structure. In this study, we investigated five gene variants (ankrd34a, commd10, gpr89, kmt2c, mpdz, pak2) identified in patients and their effects on neuronal structure. Neurons were grown in culture with siRNA knockdown of the gene variants and then imaged with GFP fluorescence. Through computer tracing and analysis we investigated the relationships between these genes and their role in neuronal function and development. The dendrites and spines were traced and analyzed according to number of nodes, number of intersections, dendrite length, spine morphology and spine density to determine the structural differences associated with each of the gene variants.

NSCI A36
Inhibition of Signal Transducer and Activator of Transcription 3 (STAT3) Gain-of-Function (GOF)
Isabella Osuna
Mentor: Dr. Tiphanie Vogel
The transcription factor signal transducer and activator of transcription 3 (STAT3) regulates genes involved in inflammation. JAK inhibitors are approved to treat inflammatory diseases, and are effective at inhibiting STAT3-dependent signals. We tested if direct STAT3 inhibitors could be equally effective using cell lines carrying gain-of-function (GOF) mutations in STAT3. A cell line with the STAT3 GOF mutation (p.G421R) was stimulated with interleukin-6 (IL-6) to activate STAT3 and inhibited with different STAT3 inhibitors, or a JAK inhibitor as control. RNA was extracted and transcripts were quantitatively analyzed for the STAT3 target gene suppressor of cytokine signaling 3 (SOCS3). Atovaquone and pyrimethamine were not found to be effective STAT3 inhibitors, but, surprisingly, induced SOCS3. We determined that STAT1 also increases SOCS3 expression in this cell line. Consequently, STAT3 inhibitors may appear ineffective using this readout because additional SOCS3 is being driven by STAT1. Thus, our future work on direct STAT3 inhibitors will be conducted in cell lines in which we have confirmed SOCS3 increases only in response to STAT3.

NSCI A37
Object curiosity in orangutans ((Pongo abelii, P. pygmaeus)): relation to tool use
Ilana Nyveen
Mentor: Amy Dunham
Variation in tool use among species, especially among the great apes, remains largely unexplained. Variability in object curiosity across great ape species may help clarify trends in tool use. Understanding object curiosity is crucial to comprehending the origins of tool usage in hominids and apes, as well as bettering enrichment for captive primates. We conducted an exploratory investigation of orangutan object curiosity by introducing three familiar objects and three novel objects to five orangutan subjects at the Houston Zoo. Familiar objects came from enclosure enrichment collections, while novel objects were fabricated out of diverse materials such as wrapping paper or PVC pipes. Subjects were significantly quicker to interact with novel objects than with familiar objects, and overall interacted with novel objects more. This suggests that orangutans have a higher affinity for novel objects, which may have contributed to their development of tool use traits. This study should serve as a starting point for more investigations regarding the links between object curiosity and tool use.

NSCI A38
The role of lipid metabolism and nuclear receptor TLX in adult neurogenesis
Kevin Chen
Mentor: Dr. Mirjana Maletic-Savantic
Adult neurogenesis is the generation of new functional neurons from neural stem cells and is heavily correlated with levels of cognitive functioning. Unfortunately, human aging results in decreases in the rate of adult neurogenesis, ultimately leading to cognitive deficits. Lipid analysis is important for NSC fate and function due to their involvement in the synthesis of new membranes and in various cell signaling pathways. Thus, to find new ways to maintain rates of adult neurogenesis, we will examine lipid metabolism in the context of the TLX orphan nuclear receptor, which is an integral transcription factor that regulates the proliferation and renewal of NPCs by regulating TLX downstream target genes that encode proteins important for senescence and cell cycle progression. The 18:1 cis-9 fatty acid has been identified as a potential endogenous ligand to TLX. Through mass spectroscopy and confocal microscopy imaging of wild type mice and Lfng-eGFP mice injected with the 18:1 cis-9 fatty acid, we will test our hypothesis that this fatty acid is the endogenous ligand for TLX and its binding will increase TLX activity, ultimately improving rates of adult neurogenesis.

NSCI A39
Optical Design for Motion Compensation in Wearable Devices
Belviane Songong
Mentor: Dr. Ashutosh Sabharwal
Wrist-based Photoplethysmography (PPG) sensors can potentially be used for robust continuous monitoring of vital signs, which is desirable for the diagnosis and monitoring of many health conditions. However, a major barrier to continuous monitoring is a reliable and accurate measurement of vital signs in presence of motion artifacts in the PPG signal. Current wearable devices use a single photodetector to measure changes in the intensity of the skin over time, making them susceptible to motion artifacts. We created a prototype for a wearable device that uses a micro-lens array in parallel with a CMOS sensor and we propose an optical scheme for spatial information capture. The resultant spatial mapping can be used to track the motion of the device across the skin, allowing us to account for the movement of the wearable device and reduce motion artifacts in the PPG signal. For testing, we will capture videos of the wrist and extract PPG signals which we will use to calculate heart rate. Participants of the study will be fitted with a finger pulse oximeter so that the accuracy of our calculation can be assessed. We will report on the result of this experiment and its implications.

NSCI A40
Elucidating the Mechanism of Restoring Growth to pex12-1 by Reducing PEX3B protein
Raj Dalal
Mentor: Dr. Bonnie Bartel
Peroxisomes are eukaryotic organelles that house a variety of important reactions including the beta-oxidation of fatty acids, that are vital for the growth and development of plants and humans. For proper function, enzymes that catalyze peroxisomal reactions must be imported into the matrix of the organelle. PEX12 is a peroxisomal membrane protein that supports this import. PEX12 is a ubiquitin-protein ligase that ubiquitinates a matrix protein receptor, tagging the receptor for removal from the membrane and freeing it for subsequent rounds of matrix protein import. The pex12-1 mutation results in impaired peroxisomal matrix protein import and stunted plant growth. Our suppression screen uncovered a mutation in PEX3B that rescued the pex12-1 growth defects. Paradoxically, pex3b-2 did not improve the pex12-1 matrix protein import defect that is thought to cause the stunted growth in pex12-1. Our aim is to determine the mechanism through which pex3b-2 restores growth in pex12-1, which we expect will provide insights into peroxisome function.

NSCI A41
The SNARE Regulator Complexin 3 is a Target of the Cone Circadian Clock Mechanism in the Mouse Retina
Jacob Bhoi
Mentor: Dr. Christophe Ribelayga
The retina contains a number of cell-type specific circadian clocks that regulate function with time of day. BMAL1 is an essential and non-redundant component of the mammalian circadian clockwork, responsible for a number of downstream effects. We generated cone-specific ((Bmal1)) knockouts (cone-((Bmal1-/-))) and conducted RNAseq and analysis to determine which genes are differentially expressed in wild-type (WT) mice and cone-((Bmal1-/-)) mice. Complexin 3 (((Cplx3))), a SNARE regulator at retinal ribbon synapses, was downregulated fivefold in the cone-((Bmal1-/-)) mice. We used immunocytochemistry to compare the protein expression of CPLX3 in cone-((Bmal1-/-)) retinas and WT retinas. In cone-((Bmal1-/-)) mice there was a threefold decrease in CPLX3 levels compared to WT. Additionally, we found a decrease in CPLX3 in WT retinas at night, regardless of lighting, providing further evidence that ((Cplx3)) is under control of the circadian clock. This indicates a role for BMAL1 in ((Cplx3)) expression in the cones. The modulation of ((Cplx3)) at the first synapse of retinal circuits may be an efficient way for the circadian clock to modulate function according to the time of day.

NSCI A42
Isolation of ((pex12-1)) mutant suppressors in ((Arabidopsis thaliana))
Hazel Shen

Mentor: Dr. Bonnie Bartel

Peroxisomes are organelles that house fatty acid beta-oxidation and hydrogen peroxide decomposition. Peroxisomes use peroxin (PEX) proteins to import the enzymes that catalyze these reactions into the organelle from the cytosol. Mutations in ((PEX12)) genes in plants lead to peroxisomal defects that cause stunted growth and insensitivity to a peroxisomally-processed hormone precursor. We are seeking to learn more about peroxin function by alleviating ((pex 12-1)) mutant growth defects with novel secondary mutations. We screened thousands of mutagenized ((pex12-1 Arabidopsis)) seedlings for improved growth. We are using physiological and molecular assays to retest progeny from these isolates to confirm suppression and prioritize lines for whole-genome sequencing. We will use recombination-mapping techniques to identify the causal suppression mutations and will develop and test hypotheses based on known functions of the identified genes to determine the mechanisms of suppression. This screen will further our understanding of specific PEX12 peroxisomal functions and may also reveal novel genes contributing to peroxisome functions.

NSCI A43

NCAM Regulates Actin Cytoskeletal Processes in Human Immune Cells

Amera Dixon

Mentor: Dr. Emily Mace

Natural killer (NK) cells are essential to the innate immune system and are defined as being CD56+CD3−, however the functional role of CD56 on immune cells has not been described. We have discovered that CD56 ligation is required for NK cell motility on stromal cells and fibronectin. Lymphocyte migration is dependent upon integrin and actin-mediated cell adhesion and cytoskeletal turnover. Confocal and super resolution (STED) microscopy show that $\alpha 4\beta 1$ integrin and CD56 co-localize in the uropod of wild-type NK cells. Deletion of CD56 by CRISPR-Cas9 in a human NK cell line leads to an increase in actin foci, decreased filopodia length, and increased colocalization of actin and vinculin at the actin foci, lamellipodia, and filopodia of CD56-KO NK cells when compared to wild-type NK cells on activating surface. Cell spreading on integrin ligands is impaired in CD56-KO NK cells, as is cell migration, chemotaxis, and NK cell lytic function; reconstitution of full-length CD56 rescues these defects. These data suggest that CD56 is a regulator of cortical actin and integrin function in human NK cells, a finding that has profound implications for human immune cell function.

NSCI A44
Symptom Lesion Mapping Using DTI
Shreya Ingle
Mentor: Dr. Simon Fischer-Baum
Stroke is the leading cause of serious, long-term disability in the United States. A stroke occurs when an interruption in blood flow causes damage to the brain. Strokes to the left hemisphere of the brain result in difficulty producing language, a condition known as aphasia. The inability to speak causes much difficulty to daily life. Classic approaches to aphasiology have treated areas of the brain affected by a stroke as independent areas. However, certain functions like language production are unlikely to be localized in specific cortical areas of the brain, but instead emerge from a network of interconnected regions. My plan is to use DTI tractography to look at three white matter pathways in particular: the arcuate fasciculus, the inferior longitudinal fasciculus, and the uncinate fasciculus. This additional information about which pathways have been disconnected could help clarify some of the unexplained variance in gray matter lesion location and language impairment. Utilizing DTI analysis would allow for a more nuanced investigation of a wide variety of conditions resulting from brain trauma, including but not limited to aphasia.

NSCI A45
Experimental Evidence for Immigrant Inviability among Host-Associated Populations of the Gall Wasp (((Belonocnema treatae)))
Elaine Hu
Mentor: Dr. Scott Egan
Because plant-feeding insect specialists are tightly associated with their host plant species, different host species are hypothesized to exert divergent selection on insect populations that feed on them. This local adaptation can promote reproductive isolation between different host-associated insect populations via immigrant inviability (reduced gene flow among populations due to lowered immigrant fitness on a non-native host). Differences in insect populations' abilities to circumvent host plant defenses have been proposed as one mechanism contributing to immigrant inviability. Here, we use ((Belonocnema treatae), a specialist gall-former that feeds on two sister species of live oak tree hosts, as the study system to test (1.) whether immigrant inviability reduces gene flow among host-associated gall wasp populations and (2.) whether host defense rates promote immigrant inviability. We measured immigrant inviability by comparing rates of a specific immune response in oaks, called the hypersensitivity response, that stops egg-laying attempts. Preliminary results show that populations on non-native hosts trigger significantly higher plant defenses than populations on native hosts.

NSCI A46
Exploring Gene Product Significance in Pathogenesis of Candida Albicans

Allison Jaffe
Mentor: Dr. Julia Saltz
The human fungal pathogen Candida albicans is an opportunistic organism that is most commonly associated with oral and vaginal infections. While often harmless, C. albicans is a significant contributor to morbidity and mortality in patients with suppressed immune systems (1). Its obligate diploid genome has been fully sequenced, which allows for identification and study of particular genes of interest. In an attempt to eventually understand the mechanisms of the infectivity of C. albicans, 13 confirmed deletion mutants were transformed with a green fluorescent plasmid via electroporation. These mutants will then be injected into zebrafish embryos, which serve as suitable hosts for infection. The varying success of infection will then be recorded to attempt to understand the underlying mechanism of infectivity and the critical biological processes of pathogenesis in C. albicans.

NSCI A47

Clinical Pharmacokinetics of Erlotinib and its Metabolite OSI-420 in Infants and Children with Primary Brain Tumors

Samuel Reddick
Mentor: Dr. Clinton Stewart
Erlotinib, a potent small molecule inhibitor of the epithelial growth factor receptor tyrosine kinase, has been evaluated as a therapy to treat infants and children with primary brain tumors. This study aimed to characterize the pharmacokinetics (PK) of erlotinib and its primary metabolite OSI-420 in this population to identify the sources of PK inter-patient variability. Erlotinib and OSI-420 concentrations were assayed from 47 patients (mean age: 6.25 years; range: 0.7-19 years) using high-performance liquid chromatography and mass spectrometry. A population PK analysis and covariate testing were performed using nonlinear mixed-effects modeling. A one-compartment model with linear absorption and elimination best fitted the data. Erlotinib and OSI-420 clearances (CLERL and CLOSI) were significantly higher in younger patients ≤5 years compared to older patients (mean CLERL: 7.0 vs. 3.6 L/h/m2, and mean CLOSI: 63 vs. 32 L/h/m2). In addition, CLOSI was on average 42% higher in males compared to females. This study was performed in the youngest population of infants and children receiving erlotinib to date and could potentially alter the way erlotinib is dosed for pediatrics.

NSCI A48
The Effect of Extended Exposure to a Positive Stimulus on Habituation Rate in Drosophila melanogaster
Simone Maddox
Mentor: Dr. Julia Saltz
"Habituation to a stimulus is crucial to an individual's long-term survival, acting as the mechanism by which they filter out unimportant environmental factors in favor of novel stimuli. This experiment explores the interaction of prolonged exposure and subsequent habituation to a positive stimulus, ethyl acetate (EA), as it varies across genotypes. Five such genotypes of Drosophila melanogaster were habituated onto EA for variable amounts of time, then given a choice of EA or mineral oil. We predict that extended exposure to EA will result in diminished preference for EA, and thus faster habituation to EA. Likewise, we expect the genotypes to vary in their rate of habituation. Findings will have broader implications into the potential range of natural variation in habituation rates, as well as insights into a genetic basis for habituation itself."

NSCI A49
Utilizing PINK-1 GFP ((C. elegans)) assay to identify precocious activation of mitophagy
Julie Thamby, Allison Taffet, Hannah Boyd
Mentor: Dr. Natasha Kirienko
Cancer cells use glycolysis as the primary metabolic pathway instead of oxidative phosphorylation. This causes overproduction of reactive oxygen species, promoting mitochondrial dysregulation and leading to mitophagy, selective autophagy of mitochondria. Members of the lab identified common mutations among several human cancer cell lines that have C. elegans homologs. Three different C. elegans assays were then used to select for mutations which cause precocious mitophagy and are sensitive to chronic and acute mitotoxins, phenanthroline and Carbonyl cyanide m-chlorophenyl hydrazone (CCCP) respectively. This data yielded a gene network from which 400 highly connected genes were found to test. These genes underwent the primary screen, using PINK1-GFP as a reporter. Significant fluorescence is indicative of PINK-1 accumulation and precocious mitophagy as PINK-1 is normally cleaved by healthy mitochondria. Hits from this screen will undergo CCCP and phenanthroline assays and be used to generate a fuller gene map of cancer mutations which confer increased sensitivity to mitotoxins. The map will serve as a predictive model for cancers which will be selectively sensitive to mitotoxins.

NSCI A50
Guava Invasion Endangers Epiphytes in a Diverse Tropical Forest
Ella Matsuda

Mentor: Dr. Amy Dunham
Strawberry guava (((Psidium cattleianum))) is an aggressive invasive tree that dominates many tropical forests. While guava significantly impacts animal populations, hydrology, and terrestrial plants, little is known about how guava invasions affect epiphytic plants. Epiphytes are overlooked in most studies of invasive species, despite their importance for water storage, nutrient cycling, and animal habitat. We investigated the impact of guava on epiphytes in Madagascar, where guava are invading the diverse native rainforests. We found that epiphyte coverage is three times higher on native trees than on guava trees, a pattern driven by lower bryophyte and lichen coverage, and that guava supported no vascular epiphytes. The low epiphyte coverage on guava may be due to its smooth, shedding bark, which may limit epiphytes to early-successional species and prevent later establishment of orchids or ferns. Previous studies have shown that guava invasion reduces tree diversity, and our results suggest guava can also harm diverse and ecologically important epiphyte communities. These results increase the urgency of finding solutions to control guava invasions in tropical forests worldwide.

NSCI A51
Health-Related Physical Fitness in Homeschool versus Public School Adolescents
Kendall Brice
Mentor: Dr. Laura Kabiri
Homeschool children aged 5-11 years have been shown to have significantly lower muscular strength than public-school children, but no significant difference in cardiorespiratory fitness. The purpose of this study was to look for similar differences in older homeschool students aged 12-17 years. Data from homeschool adolescents was matched by sex and age to de-identified public school FitnessGram® data. Results from push-up, curl-up, Progressive Aerobic Capacity Endurance Run, and body mass index were compared for significant differences between groups. T-tests were used to compare mean number of each fitness metric, and chi-square tests were used to compare health classifications. There was a significant difference in mean number of curl-ups (((t))(64) = 8.080, ((p)) = .000) and in the health classification for push-ups (((χ2))(1) = 39.72, ((p)) = .000). No other tests were significant. The results, by and large, suggest that homeschooled adolescents are not falling behind their public-schooled counterparts in their physical fitness levels.

NSCI A52
Missense mutations in essential splicing factors PRP8 or BRR2 restore splicing and protein to a mis-spliced mutant of ((PEX14))
Stephanie Xiong

Mentor: Dr. Bonnie Bartel
Mutations in peroxisome biogenesis proteins (peroxins), which help import essential metabolic enzymes into the peroxisome, can lead to developmental defects in eukaryotes and underlie human peroxisome biogenesis disorders. PEX14 is a peroxin that facilitates this import at the peroxisomal membrane. However, the detailed mechanism of this import is not well understood. The ((Arabidopsis pex14-6)) mutant has physiological and molecular defects that suggest inefficient peroxisomal import, resulting in defective peroxisome function. We isolated two ((pex14-6)) suppressors that carry secondary mutations restoring peroxisome function. We found these suppressors fix mis-splicing found in the original ((pex14-6)) mutant. This restored splicing likely contributes to the observed restoration of PEX14 protein accumulation and peroxisomal import. Intriguingly, both suppressors carry a missense mutation in a gene encoding essential splicing factors PRP8 or BRR2. We introduce these splicing factor mutations into other mis-spliced mutants to assess splicing of the mutated splicing factors. Analysis of splicing alterations in these mutants may illuminate determinants of overall splicing fidelity.

NSCI A53
Influence of Defaunation in the Amazon Basin on Genetic and Spatial Characteristics in Hyperabundant Animal-Dispersed Neotropical Palm, ((Euterpe precatoria))
Jordan Graves
Mentor: Dr. Amy Dunham
Hunting has resulted in the decline of large frugivores that eat fruit and disperse seeds in tropical forests worldwide. Loss of seed dispersers may increase clustering of related seedlings and saplings, with consequences for disease resistance, genetic diversity, and evolutionary potential of plant populations. Six subpopulations of a highly abundant, animal-dispersed palm, ((E. precatoria)), were sampled from three forests in Peru, ranging in hunting pressure. Coordinates and recruitment stage of all encountered individuals were recorded at each site. We are using genetic and spatial analyses of individuals to quantify consequences of disperser loss on cohort spatial patterns, and patterns of genetic diversity. We hypothesize that in defaunated communities that have lost frugivores we will see lower genetic diversity and more spatial clustering of related ((E. pracetoria)) seedlings and saplings. If this pattern is not observed, smaller seed-dispersers may be maintaining gene flow and dispersal services. This analysis will allow us to better understand consequences of defaunation in a changing world where ecosystems are increasingly at risk due to human behaviors.

NSCI A54
Generation of TLR9 knock out human lung epithelial cells by CRISPR CAS-9
Tanner Reese
Mentor: Dr. Yongxing Wang

Our respiratory surfaces are constantly exposed to pathogens and other microorganisms. Lower respiratory tract infections results in more quality-adjusted life years lost due to death or disability than any other condition worldwide. Specifically, chemotherapy patients are extremely susceptible to these pathogens. A combination of TLR2 and TLR9 agonists has been shown to protect against pneumonia and other influenza infections in mice. I was tasked with conducting TLR9 knockout in human bronchial epithelial cell lines using CRISPR CAS9 gene-editing strategy to eventually examine the effect of TLR agonists on preventing respiratory infection in the knockout cells. After troubleshooting, TLR9 gRNA insertion into px458 Cas9 GFP-plasmid using golden gate cloning process was successful. Currently, transfection of this plasmid into human bronchial epithelial cells is being attempted through multiple means, including electroporation and Lipofectamine-aided transfection, in an effort to identify a TLR9-knockout colony.

NSCI A55
RNA Nanoparticle-based Colon Cancer Therapy
Christina Oh
Mentor: Dr. Tae Jin Lee
Use of microRNA as a potential therapeutic against colorectal cancer requires a stable vector scaffold system for efficient delivery and a specific targeting strategy to treat the malignancy with a higher efficacy compared to conventional treatment options. Here, we constructed RNA nanoparticle (RNP) derived from the motif of robust customizable pRNA three-way junction (3WJ) of bacteriophage phi29 to specifically deliver tumor suppressive miR-34a to the colon cancer cell line LS174T by including a CEA targeting RNA aptamer (YJ1). Using the miR-34a carrying RNP (named 3WJ-YJ1-MiR34a), we tested two goals: 1) optimizing specific binding capability; and 2) evaluating the anti-cancer cell effects onto the colon cancer cells. We showed optimized binding conditions, sufficient uptake of miR-34a in vitro, and a decreased expression of NOTCH1, a known target of miR-34a, at the protein level. These results demonstrated the potential of 3WJ-YJ1-MiR34a RNP as an efficient and promising miRNA delivery system for treatment of colorectal cancer.

NSCI A56
Herbarium Genome Assembly
Rishi Ramesh
Mentor: Dr. Erez Aiden
Today, it is easier than ever to sequence a genome with the veritable explosion of genomic sequencing by large consortia such as DNA Zoo and the Earth BioGenome Project (dnazoo.org; earthbiogenome.org). A big challenge to these sequencing projects is access to interesting samples. Museums and herbaria are a treasure trove of genetic material, but it is unclear if sample degradation levels associated with these collections

are compatible with modern genome assembly methods, particularly Hi-C (Burton et al., 2013; Dudchenko et al, 2017). In this work, I am going to explore how the current protocols for Hi-C-based plant genome assembly work on herbarium samples while exploring their limitations and range of application.

NSCI A57
Sub-Second Temporal Coding by Ensembles of Neurons in a Cortical Network
Aadith Vittala
Mentor: Dr. Javier Medina
Precise timing is a remarkable feature of cognition, providing us the ability to tell apart intervals that vary by only a few milliseconds. However, we know little about how we accomplish this feat or even how neural activity represents time. In this study, we investigated how neurons in the prefrontal cortex code for time between stimuli. We studied high-density single-unit recordings from the prefrontal cortex of mice while they experienced trains of ten to fifteen light flashes at 3.33 Hz. To investigate temporal coding in the recorded cells, we applied statistical machine learning to train and test a time-decoding model. The trained model has moderate decoding accuracy and makes errors preferentially, supporting its ability to extract timing information from neural activity. The accuracy of the model increases asymptotically with the number of cells and depends strongly on the noise in the dataset. In addition, the model suggests that most cells contribute equally to timing information and that this information is non-additive. Our results provide insight into the neural basis of sub-second timing and support the hypothesis of distributed time coding by ensembles of neurons.

NSCI A58
PRP Therapy for the Treatment of a Post-traumatic Mouse Model of Osteoarthritis
Christina Liu
Dr. Matthew Grol
Post-traumatic osteoarthritis (PTOA) is a degenerative joint disease caused by injury and characterized by loss of articular cartilage, subchondral bone remodeling and synovitis leading to chronic pain and disability. Emerging literature suggests that platelet-rich plasma (PRP) has both anti-inflammatory and regenerative tissue repair properties; however, the effects of PRP on PTOA are unknown. Destabilization of the medial meniscus (DMM) surgery was performed on 3-month-old male mice to induce PTOA. Sham surgery was performed on separate mice and served as controls. At 3-, 14- and 28-days post-surgery, mice received intra-articular injections of either phosphate-buffered saline (PBS), PRP containing four-times (4x-PRP), or 8-times (8x-PRP) platelet concentrations. 3-months post-surgery, knees were collected for phase-contrast μCT and histopathological analyses. Compared to PBS, 4x-PRP had cartilage volume and surface comparable to sham indicating a protective effect of treatment. In contrast, 8x-PRP displayed intermediate protection though not statistically significant compared to either PBS or sham. These results suggest that PRP therapy may be beneficial for treatment of PTOA.

NSCI A59
Boat strike trends and reporting errors in south Florida marine turtles
Dana Lim
Mentor: Dr. Amy Dunham
As boat traffic has increased over the past few decades, marine turtle strandings and fatalities caused by vessel strikes have likewise risen. Southeastern Florida has seen boat strikes cause as much as 42.7% of total strandings in some counties. This study assesses a decade of marine turtle stranding and rehabilitation data documented by the Loggerhead Marinelife Center in Juno Beach, FL. It compares variables such as size class and time of year with incidence and type of boat strike to identify particularly high-risk life stages, times of year and geographical areas in which to target enforcement of protective laws. It also identifies boat strikes that went unreported in government records, helping to evaluate accuracy of current records and provide more compelling numbers. Initial results show that contrary to hypotheses, boat strike incidents do not markedly rise during the summer months with higher boat traffic, nor during nesting season when more adults reside close to shore. It also appears that boat strikes in juveniles have gone severely underreported. Continued analysis will elucidate further patterns that can assist in mitigating this anthropogenic threat.

NSCI A60
Aberrant Hippocampal Neurogenesis in Mouse Models of Alzheimer's Disease
Jason Lee
Mentor: Dr. Jeannie Chin
Alzheimer's disease (AD) is associated with impaired function of the hippocampus, which is crucial for learning and memory. Adult neurogenesis in the hippocampal dentate gyrus is critical for normal hippocampal function and is altered in both AD patients and mouse models. Both AD patients and mice have increased incidence of seizures that begin early in disease, and seizures acutely increase neurogenesis by stimulating neural stem cell (NSC) division. However, NSCs can only undergo a finite number of divisions, which limits the NSC pool's capacity to generate new neurons. Seizure activity may thus accelerate the use and depletion of hippocampal NSCs, causing increased neurogenesis early on, but decreased neurogenesis at later stages of disease. Using doublecortin to label newborn neurons and nestin to label NSCs, we demonstrated this in a mouse model of AD. To determine whether these changes are really due to AD-related mechanisms, and not model-specific artifacts, we quantified newborn neurons and NSCs in two additional AD mouse models. Our results suggest that the observed changes are generalized across different mouse models of AD. This work is supported by NIH grant NS086965.

NSCI A61
Effect of Competition and Heat on Grasses and their Fungal Mutualists
Andressa Viol, Ella Segal
Mentor: Dr. Tom Miller
In a rapidly changing climate, ecosystems will be introduced to new stresses of heat and competition. To most effectively conserve and predict changes in ecological communities, it is essential to have an understanding of mechanisms that may alleviate the consequences of these environmental changes. Epichloe are fungal mutualists with many plant species that have been hypothesized to play a role in the plant's ability to survive heat, drought, and competition; they are found in many common perennial grasses species, including ((Argrostis hyemalis)) and ((Lolium multiform)). To determine the role Epichloe plays in grass fitness, we exposed seeds to heat treatments at varying temperatures and lengths of time. By successfully removing endophyte presence from some of the grasses, we created three distinct populations: naturally endophyte-positive, naturally endophyte-negative, and artificially endophyte-negative. We then subjugated these populations to a competition treatment to determine if endophyte-positive grasses are at an advantage. We will monitor this experiment over the coming weeks and measure the reproductive output of each population to determine relative fitness.

NSCI A62
Effects of Fire Frequency on Soil Water Potential in the New Jersey Pine Barrens
Kendra Baldwin
Mentor: Dr. Caroline Masiello
A soil water potential (Ψ) curve describes the amount of water held in a soil under varying suction values. It is used to determine the availability of soil water to plants and microorganisms and understand water and solute movement in unsaturated soils. In this work, I studied the effect of fire frequency on the shape of the Ψ curve of soils from the Silas Little Experimental Forest (SLEF) located in the New Jersey Pine Barrens ecosystem. These soils are poorly drained, nutrient poor, and vary significantly in SOM. Controlled burns have been conducted at the SLEF since 1935, creating several replicated fire treatments. I measured Ψ as a function of site fire history using a WP4C Potentiometer. To generate a cohesive curve, I plotted average Ψ against water content. I report samples from four sites within the SLEF, varying fire frequency and time since fire. At SLEF time since fire is strongly correlated with SOC content and properties, and in sandy soils such as these, SOC content strongly influences soil water properties through its effects on soil porosity and pore volume. I therefore anticipate that changes in Ψ will be strongly correlated with changes in SOM properties.

NSCI A63
Transdifferentiation of Endothelial Cells into Cardiomyocytes
Anna Jang
Mentor: Dr. Deepthi Sanagasetti
Cardiac problems arise from myocardial infarctions, which result from the death of heart muscle cells. This can cause scar tissue formation and ischemia, leading to further heart health complications. Previous studies explored the direct reprogramming of cardiac fibroblasts into cardiomyocytes with combinations of reprogramming factors. These factors were tested on rat and human fibroblasts in vitro, as well as rat cells in vivo. The transcription factors Gata4, Mef2c, and Tbx5 revealed an up regulation of cardiac troponin T expression, a cardiomyocyte marker, showing potential for direct cardiac reprogramming. However, further in vitro studies showed a possibility of endothelial cells in the heart being more malleable than fibroblasts for reprogramming. The transdifferentiation efficiency into cardiomyocytes via treatment with transcription factors Gata4, Mef2c, and Tbx5, of rat endothelial cells compared to rat fibroblasts was tested. Immunofluorescence, RT-qPCR, and FACS analyses were performed, and the results showed a significant improvement in cTnT expression in transdifferentiated endothelial cells compared to transdifferentiated cardiac fibroblasts.

NSCI A64
The Role of the Superior Colliculus in the Motor Planning Process
Mahima Tatam
Mentor: Dr. Alyse Thomas
We make numerous decisions every day, but have you ever wondered why you made the choice to turn left at an intersection? Decision making requires sensory integration, motor planning, and movement initiation. Sensorimotor transformations arise from circuit interactions across multiple brain regions. To investigate how different brain regions influence behavior, we developed a sensory-guided decision-making task, which tested for directional licking. We hypothesized that the superior colliculus (SC), a subcortical motor structure, participated in planning and execution of movement during our task. To test this hypothesis, optogenetic perturbation was performed during either the sensory integration, decision-making/planning, or response period of the task. Preliminary data suggest that manipulation of the SC during the decision-making or response period induces specific directional biases in behavior. These results suggest that the SC mediates planning as well as movement initiation, revealing a broader function for the SC in behavioral control than previously appreciated.

NSCI A65

Exploring the Use of Biomphalaria glabrata as a Model for Snail Development
Heather Tsong
Mentor: Dr. Daniel Wagner
Biomphalaria glabrata, a freshwater snail, has been the subject of research due to their essential role in the life cycle of parasitic worms that cause schistosomiasis in humans. B. glabrata also has many of the hallmarks of a developmental biology model organism; it is robust in culture, it has high fecundity, a short generation time, and accessible easy to observe embryos. What it lacks are robust tools for examining gene expression and gene function. I am developing methods to address these gaps by developing in situ hybridization and transgenesis methods. Optimizing in situ hybridization requires cloning genes that have strong localized expression and determining the best methods of fixation and hybridization. Transgenesis requires cloning regulatory elements from the snail genome into reporter constructs and developing methods to introduce these constructs back into the snail genome. Completion of these aims will open the door to utilizing this snail as a new model organism to examine embryo development as well as permitting development of genetic tools to disrupt transmission of schistosomiasis, improving the lives of hundreds of millions of people.

NSCI A66
The Role of ((IFA)) genes in ((Candida albicans)) Pathogenesis
Maya Levitan
Mentor: Dr. Michael Gustin
((Candida albicans)) is a commensal organism that can transform into a major fungal pathogen. Previous research has shown that the ((IFA)) gene family has a greater presence in the genome of ((C. albicans)) than related, less pathogenic ((Candida)) species (Jackson et al. 2009). Therefore, IFA proteins are likely important for ((Candida)) pathogenesis. To determine the function of ((IFA)) genes and their role in infection, I am looking at gene expression in strains with ((IFA18)) or ((IFA20)) deleted and observing the progression of infection by the mutated strains in a zebrafish embryo model. Using RNA sequencing, I will find out how deleting ((IFA)) genes affects gene expression. I will also observe the progression of infection. I used a plate reader to compare growth rates between strains. I have created strains that express a green fluorescent protein, making them visible in a zebrafish embryo. I will inject these into zebrafish embryos to look at how many ((C. albicans)) cells are yeast or hyphae and watch the dissemination of the pathogen. Through these methods, I will determine the effects of deleting ((IFA)) genes on ((C. albicans)) function.

NSCI A67
Structural Investigation of Arabidopsis thaliana Peroxins: Purifying PEX4 and PEX22 for Crystallization
Sarah Bradford
Mentor: Dr. Bonnie Bartel

Peroxisomes are essential organelles that host metabolic reactions such as the breakdown of fatty acids. Peroxisome function and biogenesis are controlled by proteins called peroxins (PEX). Structural data exist for several peroxins from various organisms, but no structures for Arabidopsis thaliana peroxins have been solved. PEX4 is a ubiquitin conjugating enzyme that ubiquitinates peroxisomal membrane proteins. PEX22 anchors PEX4 to peroxisomes with a transmembrane domain. PEX22 is necessary for the function of PEX4 beyond its role as a membrane anchor, but this relationship is incompletely understood. We are investigating the structure of Arabidopsis PEX4 and PEX22 in complex. We have generated four constructs of PEX4 linked to a soluble portion of PEX22 with a protease cleavage site and varying linker lengths of PEX22. We have expressed these constructs in E. coli with a 6xHis tag and an MBP tag and have purified the proteins for crystallization. This research will further our understanding of peroxin structure in Arabidopsis and elucidate the role of PEX22 in PEX4 function. This work was supported by a supplement to the National Science Foundation BioXFEL STC award No. 1231306.

NSCI A68
Testing the parallel divergence of gall size between two host plants across multiple cynipid gall wasp species
Briley Mullin
Mentor: Dr. Scott Egan
Convergent evolution occurs when similar traits evolve independently in unrelated species due to similar environments. Gall-forming insects induce plant tissue to develop an incredible variety of gall structures across different insect species. Investigating the evolution of intraspecific gall variation could provide insight into the macroevolution of the diversity of gall morphology. Here we aim to determine whether divergence of gall size between two host-associated populations occurred repeatedly across the gall-forming insect community on the host plants ((Quercus virginiana)) (Qv) and ((Q. geminate)) (Qg). Previous studies show that two cynipid gall wasp species tend to produce larger galls on Qg; we are testing whether this trend holds true across four other gall-forming species that parasitize these two hosts. To do this, we measured the length and widths of galls formed by multiple gall wasp species on both Qv and Qg host plants in order to determine whether there were consistent differences in gall size across multiple wasp species. Preliminary data indicate that there is a tendency for larger gall size on Qg for the cynipid species tested.

NSCI A69
Evaluating the Effect of Recombining Distantly Related Ferredoxins on Cellular Electron Transfer
Jinyoung Kim
Mentor: Dr. Jonathan Silberg
Ferredoxins (Fds) are small proteins containing Fe-S clusters that mediate electron transfer in diverse metabolic pathways. To test whether distantly related Fds can be

recombined to create useful proteins, we recombined Fd homologs from a thermophilic cyanobacterium and a phage using a computational algorithm called SCHEMA. To evaluate whether these chimeras fold and transfer electrons in cells, plasmids expressing each Fd chimera fused to RFP were constructed. These plasmids were then transformed into ((Escherichia coli)) EW11, a strain that requires Fd electron transfer from Fd-NADPH reductase (FNR) to a Fd-dependent sulfite reductase (SIR) for growth. When Fd transfers electrons from FNR to SIR, this synthetic metabolic pathway converts sulfite to sulfide. Growth complementation revealed multiple chimeras that transfer electrons in cells. Estimates of cycling efficiency were calculated for each chimera by measuring the half-maximal growth normalized to Fd concentration. The findings from this study will be useful for designing synthetic Fds that control electron flow in engineered organisms for metabolic and sensing applications.

NSCI A70
Investigating Activity of Host-takeover Genes 55-53 of Bacteriophage SPO1
Asli Yilmaz
Mentor: Dr. Charles Stewart
When phage SPO1 infects ((B. subtilis)), it converts the cell from its original function as a bacteria factory into a phage-producing factory. A cluster of 24 SPO1 genes is primarily responsible for this host-takeover process, and we are studying the mechanisms by which they function. My project studies genes 55-53, a 3-gene operon within that cluster, by observing the effect of expressing those genes in uninfected cells. A single preliminary experiment suggested that this caused immediate inhibition of protein synthesis without affecting RNA synthesis. My early experiments showed that this took up to 4 hours to stop cell growth. I then found that while expression of genes 55-53 caused a very slight decrease in RNA synthesis for the first few hours, the next 2 hours saw a marked increase in RNA synthesis, conceivably explained by induction of genes whose function is to repair damage done by expression of genes 55-53. Future experiments will test the relationship between these effects on RNA synthesis, and previously observed effects on protein synthesis. Since host-takeover genes inhibit essential bacterial processes, they represent the potential for development of new antibiotics.

NSCI A71
Small Molecule A (smA) as a Means of Cell-Cell Signaling in Bacteria
Sydney Parks
Mentor: Dr. Joanne Ho
Bacterial cell populations use the expulsion and detection of small molecules to communicate and regulate their gene expression in a process known as quorum sensing. The principles of quorum sensing have been used to transcriptionally regulate gene expression. Unfortunately, promoters used in transcriptional regulation are often “leaky” by failing to yield binary ON/OFF responses. To overcome this imprecision, we controlled gene expression at the translational level. Small molecule A (smA) was used

to regulate the translation of a reporter protein: sfYFP. In a cell expressing smA aminoacyl-tRNA synthetase (smARS) and transfer ribonucleic acid (tRNACUAsmA), the presence of smA allows production of aminoacylated tRNA, causing read-through of amber (TAG) stop codons in sfYFP. ((Escherichia coli)) was transformed in two ways: “cell A” was engineered to produce and secrete smA, while “cell B” was engineered to detect smA. Cells A and B were spotted on LB agar plates; smA secreted from cell A diffused through the agar to cell B, allowing for read-through of TAG, as measured by cell B sfYFP fluorescence. We are currently optimizing the experimental setup and experiments are ongoing.

NSCI A72
Glyoxal Fixation Increases the Repertoire of Useful Antibodies for ((Drosophila)) Embryo Immunohistochemistry
Xi Wang
Mentor: Dr. Anna Sokac
The dialdehyde glyoxal has been suggested as an alternative fixative for tissue immunohistochemistry due to its lower toxicity and higher retention of protein antigenicity compared to formaldehyde or glutaraldehyde. However, glyoxal has not been widely adopted for use in biomedical research yet. Here, we developed a method for fixing ((Drosophila)) embryos with glyoxal in an attempt to expand the number of already available antibodies that could be used for immunostaining. We find many antibodies that had previously failed to give any specific staining in formaldehyde fixed embryos, showed clear staining patterns following glyoxal fixation. We also found other benefits when using glyoxal as an embryo fixative: The methanol “popping” step that removes the protective outer vitelline membrane shell from embryos works more efficiently for glyoxal fixed embryos. Embryo shrinkage is avoided by glyoxal fixation compared to dramatic shrinkage and flattening seen following formaldehyde fixation. Glyoxal fixation is compatible with our FISH protocols. Thus, we suggest glyoxal fixation as a viable and broadly applicable option for immunohistochemistry studies in ((Drosophila)) embryos.

NSCI A73
Modeling Li-Fraumeni Muations in ((Xenopus))
Amisheila Kinua
Mentor: Dr. Rachel Miller
Li-Fraumeni syndrome is caused by mutations in the tumor suppressor gene, p53, resulting in patient predisposition to cancer. Though p53 is most well-known for its role as a tumor suppressor, it is also important for normal processes during embryogenesis, including kidney development. Previous studies have shown that p53 knockout mice exhibit renal phenotypes resulting from failure of renal cells to differentiate. Additionally, preliminary clinical data indicate that p53 mutations identified in Li-Fraumeni patients are associated with an increased prevalence of urogenital anomalies. Given that nephron structure and function are highly conserved among vertebrates, ((Xenopus

laevis)) (frog) embryos will be used to model Li-Fraumeni patient mutations associated with urogenital anomalies. We will express patient-identified dominant negative mutations in the ((Xenopus)) kidney to determine whether these mutations lead to kidney malformation. Establishing the clinical relevance of p53 in kidney development will enable future research using ((Xenopus)) to model human p53 mutations.

NSCI A74
Quantifying Anti-((Borrelia)) Immunogenic Protein A Antibodies' Limit of Detection
Orlando Cervantes
Mentor: Dr. Job Lopez
Tick-borne Borrelia spirochetes cause relapsing fever (TBRF), a debilitating illness characterized by recurrent febrile episodes, chills, nausea, vomiting, and pregnancy complications. The most common diagnostic method for TBRF is to conduct a patient blood smear and observe the blood for spirochete bacteria. However, this method is very difficult unless the clinician or lab technician is well-trained and experienced with diagnosing TBRF. Therefore, there is a need to develop more accurate and precise diagnostic techniques. A promising route is to use relapsing fever spirochete surface antigens, such as Borrelia immunogenic protein A (BipA), in immunological assays that make use of the interfacing of host antibodies with these antigens. My project seeks to determine the level of detection that can be achieved using antibodies isolated from rabbit blood serum. I have performed Western blots of Borrelia turicatae protein lysates and used the aforementioned antibodies to measure limit of detection. My anticipated result is a consistent level of detection across lysates which will aid in development of diagnostic immunoassays for this oft-neglected global disease.

NSCI A75
Effect of pH, temperature, and ionic strength on the physical properties of Multidomain Peptide Hydrogels
Rolando Marquez
Mentor: Dr. Jeffrey Hartgerink
The self-assembling Multidomain Peptides form nanostructured materials with high water content or hydrogels. The Multidomain peptides are designed to contain flanking charged domains and an amphiphilic domain that alternates hydrophilic and hydrophobic amino acids. This design creates molecular frustration between the hydrophobic packing and hydrogen bonding of the amphiphilic core and electrostatic repulsion of the ionic residues. Therefore, multivalent ions such as magnesium (Mg^{2+}) are used to screen the charge repulsion and promote the self-assembly of peptide nanofibers. These nanofibers can then entangle to create a fibrous network or hydrogels. The mechanical properties of the MDP hydrogels are influenced by many factors including peptide concentration, identity of the solvent and ionic strength, temperature, and pH. Here we tested how the viscoelastic properties of MDP hydrogels made from E2(SL)6E2RGDS, E2(SL)6E2, and K2(SL)6K2 are affected by temperature, buffers and pH using oscillatory rheology.

NSCI A76
Synthesis of Enantiomerically Pure Orthogonally Protected Monosubstituted Piperazines as Intermediates for Library Production
Manuj Shah
Mentor: Dr. Damian Young
In recent time, fragment-based drug discovery (FBDD) has quickly emerged as a widely recognized principle to discover lead compounds and chemical probes. In the Young Lab, we strive to achieve early-stage drug discovery through fragment library syntheses that emphasize the establishment of scaffold families, or groups of molecules that systematically and incrementally vary. More importantly, scaffold families invite the efficient exploration of chemical space through utilization of a central molecular template and generation of many substitution and stereochemistry patterns. The piperazine-based platform has been extensively used in many FDA approved drugs and many biological compounds, but its chemical diversity has been limited to nitrogen diversifications. We look to introduce substitutions on the sp3-hybridized carbons and explore their powerful stereochemistry potential. Starting from various commercially available amino acids, a diverse array of monosubstituted piperazine scaffolds was constructed efficiently in a three-step process: the key step was an annulation reaction between a modified amino acid and bromoethylsulfonium salt to produce the desired piperazine compound.

NSCI A77
Investigating the eco-evolutionary dynamic between host-plant-associated variation in gall morphology and its associated natural enemy community
Charles Davis
Mentor: Dr. Scott Egan
The dramatic phenotypic diversity of cynipid galls presents an intriguing question about the underlying evolutionary forces generating this variation. The natural enemy hypothesis proposes that gall morphology is a result of coevolution between the wasps and their natural enemies. We investigated whether selection from the natural enemy community drives intraspecific variation of gall size, and in return whether the intraspecific variation affect the community composition of natural enemy, with ((Andricus foliatus)) as the study system. ((A. foliatus)) induces galls on host plants ((Quercus virginiana)) (Qv) and ((Q. geminata)) (Qg). Unpublished data shows that ((A. foliatus)) form bigger galls on Qg. To test this, we isolated 500 galls of Qv and Qg populations to see selection for gall size in Qg than Qv, and we identified 29 natural enemies to see how the communities differ. Preliminary data shows that community composition varies between hosts: most of parasitoids are ((Orymus)) and ((Brasema)) species in Qv, while ((Orymus)) and ((Sycophila)) species dominate the Qg associated community. Gall size and host may act as environmental filters for different community members.

NSCI A78
Investigating the Novel Relationship between Nephrolithiasis and a Human Mutation in Perlecan Domain V
Vikram Aggarwal, Akash Dhawan
Mentor: Dr. Mary C. Farach-Carson
Background: Perlecan/HSPG2 is a large matrix proteoglycan with 5 domains. A family with idiopathic juvenile nephrolithiasis presented with a previously unreported single amino acid mutation in domain V (A3934T). We hypothesize this mutation creates a calcium (Ca) nucleation site for crystal formation and mineralization. Methods: Perlecan structure was modeled near the mutation using Phyre. To test if the mutation alters Ca binding, we will transfect constructs encoding normal and mutated genes into HEK293a cells and measure calcification. If mutant cells show more calcification, we will report an association between mutation and Ca deposition in renal stones. Results: The predicted misfolding of the mutant protein rearranged hydrogen bonds created a potential site for Ca binding. While calcification was observed in bone-forming osteoblasts (positive control), we observed no significant calcification in normal renal epithelial cells (negative control), even in osteogenic media. We now will see if mutation increases calcification in cells transfected with mutant domain V. Conclusions: These findings suggest a new calcification disorder associated with mutations in domain V.

NSCI A79
Synthesis and application of a novel red-shifted photocaging reagent
Reyner Vargas
Mentor: Dr. Alicia Mangubat-Medina
Protein backbone modifications give new possibility to control the folding and activity. In the Ball lab, a new UV-sensitive photocaging method was developed, capable of selectively modifying proteins and peptides backbone by a His-directed reaction. With this technique in hand, it becomes possible to not only change these molecules functionality with one addition, but to also recover it through photo-release. Under the limitation of UV-light, a known cancerogenous stimulus, we present an update to this method by designing and synthesizing a molecule capable of achieving the chemistry of its precedent, while using a safe, visible light.

NSCI A80
Characterization of the Ethanol and Stress Response Element (ESRE) Network in ((C. elegans))
Aidan McAnena
Mentor: Dr. Natasha Kirienko
All forms of life experience a variety of stressors that disturb their carefully maintained homeostasis. In ((C. Elegans)), reactive oxygen species (ROS) disturb mitochondrial homeostasis such that defense pathways in their genome are activated. Two of these responses are the mitochondrial unfolded protein response (UPR) and the ethanol and

stress response element (ESRE) network. These networks are both regulated by a large number of genes encoding regulatory transcription factors. However, the details of the ESRE network are largely unknown. Using RNA Interference, the expression of these genes was blocked, thus inhibiting the normal process of ((C. elegans)) defense. Over the course of this semester, I was able to verify that a set of ((C. Elegans)) genes whose expression has been shown to activate the mitochondrial UPR (Runkel et. Al) also activate the ESRE motif.

NSCI A81
((Fam57b)) deletion causes retinal degeneration phenotype in mice
Kaitlyn Xiong, Chinthana Thangavel
Mentor: Dr. Rui Chen
Stargardt disease (STGD) and cone-rod dystrophy (CRD) are inherited retinal diseases characterized by loss of photoreceptor cells leading to irreversible vision loss. STGD is characterized by death of photoreceptor cells in the macula, while CRD is characterized by primary loss of cones followed by loss of rods. Previously, a mutation in the ((FAM57B)) (family with sequence similarity 57, member B) gene was identified in three STGD patients and one CRD patient. ((Fam57b)) has been linked to obesity, but its function in the eye has never been studied. We investigated the role of ((Fam57b)) on retinal function and morphology in ((Fam57b)) knockout mice. Electroretinograms revealed that ((Fam57b)) knockout mice exhibited significant reduction in scotopic and photopic responses by 3 months, indicating rod and cone dysfunction. The retina of 3-month-old ((Fam57b)) knockout mice also exhibited significant thinning of the outer nuclear layer and reduced number of nuclei. Overall, these results suggest that ((FAM57B)) plays an important role in photoreceptor survival and retinal function

NSCI A82
Effects of Mimicking Vegetation in Hatchery Tanks on the Post-Release Behavior of Stocked Common Snook
Sarah Glover
Mentor: Dr. Ryan Schloesser
Common Snook (((Centropomus undecimalis))) is the third most targeted species of Florida’s Gulf Coast anglers and therefore holds economic, in addition to ecological, value in the region. The vulnerability of Snook to mass mortality events following cold snaps or Red Tide outbreaks make it a candidate for stock enhancement, and a better understanding of how hatchery-reared fish behave once released may inform ways to improve the efficacy of stock enhancement. In this study, we investigate the effects of exposure to vegetation-like structure in hatchery tanks prior to release on the behavior and recapture rate of Snook following their release into a tidal creek in Sarasota, Florida. 1,080 juvenile Snook were released across three sites in the creek featuring varying amounts of vegetation over a period of 3 weeks. All Snook were tagged with Passive Integrated Transponder tags prior to release, and all release sites were flanked by antenna arrays, allowing for continuous passive recapture of fish visiting the sites.

Preliminary regression analysis indicated that post-release behavior may be affected by hatchery treatments but is more significantly associated with release site.

NSCI A83
Mechanism of PU.1 and its Effect on UCP1 Expression
Nicole Limberg
Mentor: Dr. Qiang Tong
Type 2 diabetes is characterized by insulin resistance. In obese individuals, the amount of proinflammatory markers, which leads to the development of insulin resistance, is increased. Obesity increases the expression of a PU.1 pro-inflammatory transcription factor. Previous research shows that in PU.1 knockout cells, there was improved insulin signaling. While we know that those who are obese have higher levels of PU.1, it is not clear how obesity induces adipocyte expression of PU.1. Obese individuals tend to have a temporary post-absorption elevation of blood glucose but we don't know if this increased glucose is what causes the elevation of PU.1. In PU.1 knockout mice, expression of UCP1, an uncoupling protein, was upregulated. If we can upregulate UCP1, we can reduce obesity and improve insulin sensitivity through thermogenesis. Here we aim to determine the effects of elevated glucose and other central metabolites on PU.1 expression and further see its effect on UCP1 expression. Although preliminary data has shown that PU.1 suppresses UCP1 expression in mice, further evidence is needed through cell culture to determine if PU.1 suppresses UCP1.

NSCI A84
Nutritional Effects on Male ((Drosophila Melanogaster)) Aggression
Ceyda Kural
Mentor: Dr. Julia Saltz
Conspecific Individuals differ in levels of aggression and will display aggressive behaviors in order to obtain or protect resources such as food or mates. Previous experiments provided a ranking of six genotypes of drosophila melanogaster from most aggressive to least aggressive. Individuals males of six different genotypes of drosophila melanogaster are placed in an arena containing two different food patch qualities, normal and dilute. It is hypothesized that higher aggression males would behave aggressively towards lower aggression males (by lunging, chasing) and displace them on to dilute quality food patches. Therefore, the higher aggression males would probably monopolize the normal food patches. Preliminary data suggests that the hypothesis generally hold true, although the genotypes that were previously established as most aggressive are actually in the middle of the aggression scale, and the genotypes previously placed on the middle of the aggression scale are exhibiting the most aggressive behavior.

NSCI A85
TSPO and the Inflammatory Response

Tolu Morohunfola
Mentor: Dr. Tatiana Barichello
Translocator protein (TSPO), a biomarker and crucial neuroimmune mediator, is expressed in activated microglia and astrocyte cells. TSPO increases the permeability of the mitochondrial membrane and is involved in cell proliferation, the transport of cholesterol to the inner membrane, and is a biomarker for injury and inflammation. In this study, we investigated the activity of TSPO during the neuroimmune response to sepsis, which is the body's response to infection which can cause organ dysfunction, increased blood-brain barrier permeability, and thus is believed to cause cognitive impairment. Understanding function of biomarkers such as TSPO and thus the TSPO pathway is a crucial way of understanding the mechanism in how inflammation leads to neurological disorders. Inflammation and the immune response have been thought to lead to brain damage and neurological dysfunction that can lead to neuropsychological disorders. The aim of our research strategy was to quantify neuroinflammation via the amount of protein expressed, TSPO. Methods The project employed animal model of sepsis via cecal ligation and perforation (CLP) surgery in adult Wistar rats. At 24 hours after experimental sepsis induction, Wistar rats were evaluated via the brain for TSPO, microglia and astrocyte markers. Western blotting was used to see the expression of TSPO, ionized calcium-binding adapter molecule 1(Iba-1), and glial fibrillary acidic protein (GFAP). Results TSPO expression was higher for the CLP group 24 hours after sepsis induction when compared to the control group. The Iba-1 expression increased at 24 hours ($p < 0.05$) and GFAP did not change its expression. This result demonstrated that there was an increased expression of TSPO during the onset of sepsis in comparison to the control group 24 hours after sepsis induction. In conclusion, the increased expression of TSPO and Iba-1 suggests that microglia cells were activated at 24 hours after sepsis.

SOSC A86
¡Vota!: Testing the Impact of Spanish-Language Ballots on Election Results and Preferences
Connor Rothschild, Maddy Scannell, Eric Stone
Mentor: Dr. Robert Stein
Prior research suggests the existence of group status threat; when a majority group feels threatened, it takes action to protect its status. The present study investigates if backlash can occur against Spanish-speaking populations in elections when voters are exposed to an English-Spanish bilingual ballot. Utilizing Amazon's Mechanical Turk, 723 participants voted in a mock election with either a monolingual English or bilingual ballot. The ballot included a bipartisan mayoral race and a proposition to support Deferred Action on Childhood Arrivals (DACA). Participants also answered questions about perceptions of group status. The results indicate that white, non-Spanish-speaking conservatives report a higher group status threat in the post-election survey. In terms of altering election results, we found that the mayoral race was not significantly affected by the presence of Spanish. However, white moderates tended to vote against DACA when exposed to Spanish. As demographics change in the United States, there

may be an increased need for bilingual ballots as stipulated under the Voting Rights Act, and given the results of this study, that increase could have electoral consequences.

SOSC A87
The Influence of Political Priming on the Socio-Political Beliefs of Rice Students
Mira Dani, Sriparna Sen, Serra Sozen
Mentor: Dr. Sandra Parsons
The effect of priming can influence the decision making behaviors of individuals. Specifically, priming an individual's political beliefs could potentially influence the way they vote, form their political opinions, and engage with politics and social issues. This research attempts to elucidate mental frameworks that can influence the way people make decisions on socio-political issues. We hypothesize that subjects primed to think in a 'hard work' frame of mind versus a 'good fortune' frame of mind will vote more conservatively on socio-political issues. By administering a short writing task that features either a 'good fortune' or 'hard work' introductory prompt, we hope to influence the way participants respond to a range of socio-political survey statements. We predict that the type of priming condition will influence the responses given by the participants. Students who are primed with the "personal merit" essay condition will give more conservative survey responses, while those in the "good fortune" essay condition will give more liberal survey responses. The information we obtain can help individuals better evaluate political media and propaganda.

SOSC A88
Culture and Campus Health Resources
Julissa Garcia, Cassie Jennings, Arya Jones, Shelby Armstrong, Gabby Acosta
Mentor: Dr. Sandra Parsons
This study explores how thoughts of one's own or another's mental health can influence a person's ideas about mental health care access and how one's culture can influence those ideas. This study attempts to solve the problem of stigmatization of mental health care by evaluating what factors impact care seeking. We expect that in identical situations, people will be more willing to recommend mental health care to others than to themselves and that students from non-white cultures will be less likely to seek mental health care than white students. 60 Rice students age 18 and older will fill out a Qualtrics survey describing 3 scenarios depicting diagnosable mental health conditions and 1 control condition about themselves or a classmate. They will rate their likelihood to recommend mental health care resources to the subject in the scenario and their attitude toward the subject. They will also indicate their race/ethnicity. The findings of this work may aid in developing methods to advertise mental health resources on Rice campus to POC in the student body as well as in designing ways to more effectively destigmatize mental illness for different cultural groups on campus.

SOSC A89
Student Athlete Stereotype Intervention
Tim Harrison, Sarah Jin, Pamela McInturff, Cordy McJunkins
Mentor: Dr. Sandra Parsons
This research provides the best methods to deal with stereotype threat among student-athletes. More specifically, we hope to find effective solutions to ensure an equal opportunity for success among all college students, regardless of athletic status or race. This work could prove to be significant because stereotype threat affects a significant majority of American students in how they perform in the classroom. We will separate participants into two groups: self-as-target (ST) and a combination of self-as-target and group-as-target (COMBO). The ST group will be prompted to affirm a non-academic attribute about themselves, while the COMBO group will receive both this affirmation and a reading comprehension passage about a successful black athlete. We hope to find that the group in which both interventions are implemented performs significantly better on the assessment than the groups in which only one intervention is implemented. By separately evaluating the results of different interventions on different types of stereotype threat, we can isolate the most effective practices and encourage researchers in education and psychology to implement them in classrooms.

SOSC A90
Will Pizza Save Your Meeting?
Rebecca Artall, Sunny Chen, Alyssa Curry, Isabel Jiang
Mentor: Dr. Sandra Parsons
Framing a potential benefit as losing out on something has a different effect on an individual's motivation to accept the benefit than framing it as a something to be gained. This study examined whether a loss or gain frame on pizza presented at a hypothetical club meeting would have a greater effect on college students' motivation to attend. We hypothesized that presenting pizza in a loss frame would result in greater ratings of the likelihood of attending the meeting than presenting pizza in a gain frame. The independent variable of time was included as a potential factor that could influence whether people were more or less likely to attend a club meeting. 147 undergraduate students were administered a short survey consisting of demographic questions, a randomly-assigned scenario, and questions investigating how they made their decision regarding the scenario. The scenario presented a hypothetical club meeting at one of two times with an opportunity to obtain free pizza framed as either a loss or gain. A two-tailed between-subjects analysis of variance revealed that our hypothesis was not supported. The main effect of time was not found to be statistically significant.

SOSC A91
Regional Differences in Texas of Poverty Levels Among Children of Immigrants
Elizabeth Hang, Abigael Odwuor, Arianna Napieralski
Mentor: Dr. Özge Gürcanlı

Children of immigrants are now a significant portion of the United States' child population, making up 24% of the school-age group (Migration Policy Institute, 2011). Studies have shown that the category 'children of immigrants' can be broken down into two groups, foreign- and native-born, due to disparities existing between the two, such as poverty and educational levels (Borjas 2011). The current study addresses regional differences, namely in border-cities versus non-border cities in Texas, between the two groups using the open-science data tool by Urban Institute. Our report focuses on El Paso and McAllen as border cities, and Houston and Dallas as non-border cities. Poverty levels were higher for foreign-born, versus native-born, children in all cities, and generally higher in border cities. For border cities, the percentage of family incomes below poverty level for immigrant children were 30.72% for El Paso and 56.39% for McAllen, while the percentages for non-border cities were 25.63% for Houston and 30.41% for Dallas. Through this study, we aim to better understand the implications of these differences with a focus on children of immigrants' developmental trajectory.

SOSC A92
Analysis of Stable Carbon, Oxygen, and Strontium Isotopes from Human Tooth Enamel from Jenné-jenno, Mali
Paige DeVos
Mentor: Dr. Jeffrey Fleisher
This research focuses on isotopes in human teeth from twelve archaeologically-recorded individuals from the ancient city of Jenné-jenno in Mali's Inland Niger Delta (IND) region. By examining isotopic values from thirty teeth from these burials, this project aims to reconstruct dietary and mobility patterns over the period the site was inhabited, c. 250 BCE to 1400 CE. Jenné-jenno was an urban complex and trade hub for both regional and trans-Saharan trade where people engaged in craft and subsistence specialization. Most of what archaeologists know about this site comes from excavation and survey, but isotopic analysis of human teeth is another tool that helps reconstruct the lifeways of people in the past. This research builds on previous studies of human isotopes that showed that Jenné-jenno drew its urban population from settlements located in the local landscape, but not from further away. People in this region also ate a mixed diet of African rice, millet, and sorghum. By expanding the data set of human isotope values from Jenné-jenno, this research will test these previous conclusions and ultimately strengthen archaeological understandings of the IND.

SOSC A93
Self-Efficacy and Video Games: Translating Confidence Across Subjects
Jacqueline Chamberlain, Yu-Hsuan Chen, Jennifer Truitt, JeeHyuk Wi
Mentor: Dr. Sandra Parsons
While past research indicates that perceived academic self-efficacy is positively associated with performance (Parajes, 1999), and that self-efficacy influences motivation and expectations of achievement in academic environments (Yusuf, 2011),

at the same time there is new evidence that video games may have a positive psychosocial impact. This study explores whether manipulated video game self-efficacy may translate into an influence on students' academic self-concept. Looking at 84 Rice undergraduate students, we administered a survey designed to temporarily increase the salience of video game skill in participants' minds and provided random feedback about their relative game performance before springing a short series of standardized questions on them. By measuring participants' academic confidence for the upcoming questions, we hoped to capture the influence of the video game confidence manipulation (random feedback), in the form of varied confidence ratings. However, there was no significant result of providing negative or positive video game performance feedback.

SOSC A95
The Archaeology of Recreation at Amache, a World War II Japanese-American Internment Camp
Emma Satterfield
Mentor: Dr. Jeffrey Fleisher
This project uses archaeological data from Amache, a World War II Japanese-American internment camp in southeastern Colorado, to investigate patterns of internee recreation. In spite of the restrictive conditions of their incarceration, internees at Amache found ways of improving their situation and building community, including through participation in recreational activities. To determine where different types of recreation were occurring at Amache, I analyze artifact distributions from archaeological surveys conducted at the camp in 2016 and 2018. I compare artifact patterns in different areas at Amache: four residential areas, a sports field, and an empty lot. Artifacts identified as recreation-related are associated with either adults or children, and labeled as indicative of child's play, adult games, gardening, or drinking. Using ArcGIS to map the distribution of these artifacts, I examine patterns of dispersal and clustering. I interpret these patterns in association with archival data, oral histories, and previous archaeological research to understand what spaces were considered 'recreational' and how these activities served to structure public space at the camp.

SOSC A96
The Dark Side of Accountability: Regime Type and Responses to Domestic and Transnational Terrorism
Philippine Kugener
Mentor: Dr. Sara Polo

My Honors Thesis aims to determine whether leader accountability constrains or enables the use of violence as a response to terrorist attacks. I analyze the difference in response to domestic and transnational terrorist attacks and put forth the theory that the higher the level of accountability of a country the more likely they are to respond nonviolently to domestic attacks and violently to transnational attacks. Accountability will not be treated as a tool that promotes a general respect for human rights but rather it will be addressed as a mechanism that creates potentially damaging ingroup and outgroup divisions. This paper explores the dark sides of democracies to show that even democratic mechanisms can lead to undemocratic outcomes.

SOSC A97
The Impact of Choice and Nature on Mammography Experiences
Marie-Claire Schilinger
Mentor: Dr. Mikki Hebl
There is significant research that supports the positive effects and stress reduction of nature and patients need for a sense of control in hospital settings (Ulrich, 2001). This study proposes that if during a mammogram, a stressful medical procedure for breast cancer screening, depictions of nature are displayed and a choice is given between different scenes, patients will report less resulting anxiety and stress, show decreases in measures of physical stress, and have more effective mammography sessions. The study used new mammogram patients (164) at Hospital de Amor in Barretos, Brazil. Analysis of the results didn't provide support for our initial hypotheses. Further analysis found no main effects other than that of choice on pain, such that patients reported significantly greater pain when given a choice of image type, compared to patients not given a choice. One possible explanation is that during high-stress medical situations, patients don't want added pressure of making a decision. With no effects of control or nature on the other outcomes, our results suggest that interventions related to control and nature might not be worthwhile investments in healthcare settings.

SOSC A98
Party Factions and Contestation in State Legislative Finance Networks
Avesh Krishna
Mentor: Dr. Keith Hamm
State legislative races rarely raise the high dollars seen in congressional races therefore small donations can shift the financial competitiveness and viability of candidates. I examine the role of formal party organizations in the network of campaign donors and analyze how electoral contestation shapes the inter and intra party network. Through a multi-state study over a 10 year period, I see how these networks change in character and whether decreasing inter party competition fosters factionalization within a party. My key research question is if ideological interest groups follow a party oriented electoral strategy and bridge the party network or if they work against formal party organization.

SOSC A99
Less Money, More Problems: Evaluating Bail Reform in Harris County
Daisy Gray
Mentor: Dr. Robert Stein
This project intends to study the effect of unsecured release on subsequent reappearance in court for low-income individuals following arrest. Specifically, this project focuses on the July 30th implementation of Chief U.S. District Court Judge Lee H. Rosenthal's decision to release indigent arrestees on unsecured bonds. Judge Rosenthal's decision occurred in response to a system in Harris County that disproportionately impacted arrested individuals unable to pay bail; however, the policy had the unintended consequence of enabling release with little support for potentially high-risk populations. This study seeks to ascertain the efficacy of assigning personal recognizance bonds to offenders without factoring in risk propensity through examining the bond forfeiture rate in Harris County following implementation. Ultimately, this projects seeks to gain an understanding of factors that contribute to failures to appear for low-income defendants, and whether personal recognizance release is an effective intervention.

SOSC A100
Applying the Health Belief Model to College Students' Health Behaviors
Evan Reed, Matt Cho, Shannon Cui
Mentor: Chase Lesane-Brown
We examine how college students' nutrition and exercise beliefs affect their behavioral intentions. This study replicates the work of Kim, Ahn, & No (2012), and tests the validity of their results in a different college context. The Health Belief Model provides insight into an individual's likelihood of engaging in health behaviors based upon the individual's beliefs about the barriers and benefits of these behaviors. It is important to gain insight into college students' beliefs about nutrition and exercise as their health behaviors typically exhibit a decline throughout college. Using an online survey, we will collect data from Rice University undergraduate students regarding their beliefs about healthy eating and exercise and their intentions to engage in those behaviors, as well as their objective nutrition knowledge and nutrition confidence. We hypothesize that (1) beliefs about the benefits of and barriers to healthy eating and exercise, but not beliefs about susceptibility to and severity of lifestyle-related diseases, will significantly affect students' behavioral intentions; and (2) objective nutrition knowledge will be a strong predictor of students' nutrition confidence.

SOSC A101
Attitudes Towards Interracial Relationships at Rice University
Amanda Perozo, Charlotte Davis
Mentor: Dr. Chase Lesane-Brown
Past research has revealed racial differences in attitudes toward interracial relationships (Golebiowska, 2007; Todd et al., 1992). For example, Field, Kimuna, and Straus (2013)

demonstrated stark differences between students at predominantly white universities and students at historically black universities regarding their attitudes towards interracial relationships. We aim to replicate the Field et al (2013) study by examining racial differences in attitudes toward interracial relationships at Rice University, a university known for its racial diversity. Participants will complete an electronic survey in which they answer questions regarding their own and their parents' attitudes towards interracial dating and marriage. Based on previous research by Field et al (2013), we hypothesize that students will perceive that white parents are less open towards interracial relationships than parents of other races. Furthermore, we hypothesize that there will be no racial group difference in attitudes toward interracial relationships, but that Asian/Asian American students will be more likely to have dated or be willing to date interracially compared to black/African American students.

SOSC A102
The Role of the Cerebellum in Language and Memory
Sachi Paul
Mentor: Dr. Simon Fischer-Baum
The cerebellum is widely thought of for its critical role in fine motor skills, but there is increasing evidence that suggests its role in language and memory. In this single case study, we report a fifty-year-old college educated woman (G.P.) who suffered a stroke to the right cerebellum in 2014, leading to a lesion in lobule V and VI of the right cerebellum and a small left frontal hemi-white matter lesion. G.P. struggles to spell, providing a new hypothesis for the role of the cerebellum in language production. She is fluent in speech production and comprehension yet has difficulties with writing, notably longer words, and reading and recognizing written words presented in abnormal formats. In previous patients with cortical damage, this pattern of impairment has been argued to support the orthographic working memory system. Given these deficits and this lesion location, we conclude that the cerebellum plays a significant part of the writing system, especially the orthographic working memory system, affecting language production. Ultimately, these results increase understanding of the cerebellum's function, relationship to the brain, and role in speech production and perception.

SOSC A103
The Role of the Sublexical Route in Word Reading
Claire Ciampa
Mentor: Dr. Simon Fischer-Baum
This study examines how competition from the lexical and sublexical routes during word reading affects spoken word production. The lexical route pulls whole words from memory, while the sublexical route directly maps graphemes to phonemes in order to sound out a word. One account suggests that both lexical and sublexical routes are activated and information cascades through all processes of word reading. On the other hand, one route may be chosen early on and information from the non-chosen route

does not cascade. In this study, patient M.K., who has damage to the lexical route, was recorded while reading words out loud. Stimuli were quadruplets of heterographic homophones. For example, BRED and BREAD have the same phoneme but different graphemes, while BREAD and BEACH have the same grapheme but different phonemes. If the sublexical route is activated while reading BREAD, there should be an acoustic trace of the /i/ vowel (in the direction of the word BREED) that should not be present when reading the word BRED. On the other hand, if there is no activation of the sublexical route, the vowels in BREAD and BRED should be pronounced the same.

SOSC A104
"Yo, Banana Boy!": Palindrome Perception and Grouping Effects
Cassie Jennings, Katie Garcia
Mentor: Dr. Jim Pomerantz
A palindrome is normally defined as a word, number, or other sequence of characters that read the same backward as forward, as with the name ANNA. This study attempts to understand how the tendency to group elements in a display into larger configurations relates to palindromes. For many people, the sequence ()() reads as a palindrome, yet when typed backwards it reads)()(which is clearly a different sequence. We hypothesized that participants would demonstrate higher error rates when presented with stimuli that grouped together and stimuli containing mirror symmetry. Participants were given several sheets filled with sequences and asked to indicate which stimuli were palindromes and which stimuli were not palindromes. Each sheet comprised of 24 sequences and was analyzed for accuracy and speed. The findings of this work may contribute to the body of research studying how the human visual system recognizes various types of patterns.

SOSC A105
Access to Health Care in the Foster Care System
Salonee Shah
Mentor: Dr. Kimberly Lopez
The constant relocation of foster children has been shown to lead to social, educational, and developmental disruption in their lives. Focus groups with former foster children and interviews with stakeholders in the foster care system were conducted to understand foster children's access to healthcare. The focus group consisted of 7 female and 5 male participants from ages 18-24, and an additional 30 individual interviews were conducted with stakeholders. The study hypothesized that there would be disparities in both the mental health resources and foster parent trauma-informed training that lead to a sense of instability and isolation in foster children. These interviews were coded to find trends in met and unmet needs for children both in foster care and those who were aging out of care. The analysis revealed that there are many unmet needs relating to mental health care providers and assistance programs for aged-out foster children. The implications for this research are that the foster care system is overburdened and criminalized, over/mis-medicates children, and uproots foster children regularly due to the lack of resources and funds available for providers and institutions.

ENER A106
The Effects of Nitrogen in the Explosive Yield of Compound Explosives
Jack Kahanek (Energy Institute)
Mentor: Ms. Celeste Wilson
Ammonium nitrate explosives are the most common form of improvised explosive devices used in domestic terrorist attacks. Currently, there are no restrictions placed on the sale of ammonium nitrate or any other nitrogen-based compounds. However, the Department of Homeland Security has created a proposal for the regulation of the sale of ammonium nitrate. To compare the overall explosive yield of different nitrogen based compounds, four nitrogen-based compounds-ammonium nitrate, potassium nitrate, ferric nitrate, aluminum nitrate- will be individually combined with sugar and kerosene then ignited, with the sound produced from the explosion recorded in order to gauge the difference in strength. This experiment is still ongoing at the point of submission for the application. The results of this experiment would influence the current opinion on the regulation and distributing of nitrogen-based compounds.

ENER A108
Video Games For Parents
Elliot Salas (Energy Institute)
Mentor: Ms. Celeste Wilson
Despite previous research indicating that there is no correlation between children playing video games and violent behavior(Arkin, 2018)many parents still believe that video games do more harm than good to their children (Williams, 2006)In my study, I am trying to observe whether parents' opinions about video games would change after playing video games. In my study, I conducted 20-minute sessions, consisting of a pre-survey that assess the parents' perspective of video games, followed by a 15-minute guided session playing three video games, and finally a post survey that follows a similar format of the pre-survey. While this study is still ongoing, I expect a majority of positive response about their perspectives about video games in comparison to before the session.Conducting this experiment is very important, it helps bring and close the gap in knowledge of parents and video games.As said before, when it comes to video games and sociology, the only studies that submerge under that category is the topic of whether or not they affect children.Video games are never mentioned between elders or adults, and very few studies actually show any correlations between adults and video games

ENER A109
The Effects of Project Based Learning on SAT Scores Relative to Traditional Education.
Benjamin Negron (Energy Institute)
Mentor: Ms. Celeste Wilson
Project Based Learning (PBL) is a rapidly growing method of education. It involved bringing students face to face with real world topics through hands on projects. However, research on test scores among PBL students on exams like the SAT is

significantly lacking. A mock SAT exam, created from questions used on College Board's (The company which creates and distributes the SAT) practice exams, was given to students from PBL backgrounds and students from traditional backgrounds. This test was done to find out whether students from a traditionally educated background may perform better on exams than students who are in PBL. At the time of the submission, data is still being collected on this topic. Some of the limitations of the test were school's willingness to let the test occur during class-time, and student's unwillingness to take an exam that was not mandatory.

ENER A110
Effects of Privatization of Telecommunication Systems on Families of Prisoners
Max Hoffman (Energy Institute)
Mentor: Ms. Celeste Wilson
The War on Drugs caused an extreme increase in the volume of prisoners in the United States correctional system. An unfortunate consequence of this massive influx in prisoners is the privatization of prisons, and, more specifically, management of prison commodities. This study will focus selectively on the privatization of the communication systems in prison. Phone costs in prisons have skyrocketed in recent years. These rates often are too difficult for a jobless prisoner to pay for alone, forcing the responsibility onto their families. These unreasonable rates have sparked debates about the legitimacy of the prison communications industry. Those criticisms have materialized into legal actions. Originally regulations were implemented to protect companies from being under-compensated for their services. While the law was created with good intentions, it in fact facilitates the exploitation of consumers. Because it is so vaguely worded, companies have been able to abuse the system for their own excessive gain. Consequently, the operational costs for payphones in prison are often vastly inflated. This consistent manipulation allows companies to victimize prisoners and their families.

ENER A111
The Chemistry of Hip Hop
Brock Lewis (Energy Institute)
Mentor: Ms. Celeste Wilson
The hip-hop industry is known for its energetic upbeat sounds that have been bringing joy to its listeners since the late 1970s. While many studies have been done quantitatively analyzing other genres of music, hip hop has been consistently overlooked, so this study aims to analyze the traits of popular hip-hop songs. Utilizing the Spotify API through Tunebat.com and a python web scraper, I retrieved data on successful hip hop hit singles on Billboards Year-End Top 100 list from 2002 to 2018. Through Excel, I then analyzed this data by averaging out the tempo, BPM, duration, energy, danceability, loudness, acousticness, instrumentalness, liveness, and speechiness for the top 100 songs each year and then performed regressions on the data. I also compared the top 50 songs of each year to the bottom 50. The most interesting and significant results were that both the happiness and duration of the top 100 songs decreased linearly year by year. Lastly, this research would be most beneficial to hip hop producers, artists, and record labels.

ENER A112
Student Morale & School Performance
LeeAnna Villarreal (Energy Institute High School)
Mentor: Ms. Celeste Wilson
Measuring morale is often a task that's limited to the workplace; however, it has even greater implications in other settings, such as in a high school environment. In an effort to determine if high or low morale may be an associative factor contributing to school performance, student morale was researched in 4 HISD high schools, 2 considered low performing and 2 high performing. School selection was based on Texas standards of school performance, and online surveys were distributed among student bodies to measure morale. As of February, no conclusions have yet been drawn, but survey results will be finalized in March, at which point data will be analyzed. Although the study's sample size was small, and limited survey responses from selected schools may not fully represent the attitudes of a student body, this research offers significant insight into student morale, a subject with great implications for the future of education. Studying morale within school settings may help teachers and administrators create curricula or classroom environments that improve not only student morale, but perhaps student achievement and school performance.

ENER A113
The Effects of Phone Usage on High School Academic Performance
Josue Veloz (Energy Institute)
Mentor: Ms. Celeste Wilson
With the prevailing significance of technology in today's society and the dependence we have developed for it, the effects of electronics such as phones need to become more recognized and understood across the globe. Although many aspects of human life have become affected by technology, a growing impact would be the development of phone usage by high school students. In this study, the effect that increasing phone usage could have on the academic performance of high school juniors and seniors is surveyed at the Energy Insititute High School in Houston, Texas. Through a pre-survey that students completed, the study was able to determine the average dependence that these students have on their phone and how they believed they were performing in their academics. Furthermore, after having a portion of the students decrease their phone usage for one week, a post-survey was completed which would more accurately be able to determine a possible correlation in phone usage and high school academic performance. As of February, no conclusions have been drawn, but data will be finalized in March in an attempt to discover a potential link that could impact future academic performances.

ENER A114
Creativity on the Decline
Augie Giannoni (Energy Institute)
Mentor: Ms. Celeste Wilson
Project-based learning (PBL) is an emerging type of education that prepares students for a work environment and teaches soft skills like collaboration and creativity that are

otherwise not focused on in a traditional learning environment. Instead of taking notes and tests, students in PBL environments work in teams to solve real world problems through projects. In the study, creativity levels of students in PBL are compared to those of students learning in traditional learning environments. The survey asks how much the student's learning environment has prepared them for a career after graduation, and each participant records their creativity level from a creativity test given in the survey along with each participant's learning style. The study is aimed to find a correlation between learning environment and soft skills like creativity and preparedness for a career after graduation. PBL learning environment data has been collected from Energy Institute High School, but data for non-PBL schools still needs to be collected.

ENER A115
The Effects of a STEM Focused Learning Environment.
Michael Sanchez (Energy Institute)
Mentor: Ms. Celeste Wilson
The Energy Institute High School is the first high school in the nation with a focus in engineering based, energy focus. There, students take four full years of engineering based curriculum, are exposed to numerous industry opportunities within the energy capital of the world, Houston, as well as many engineering based extra curricular opportunities established within partnerships between the Energy Institute High School and external organizations. One of Energy Institute's primary goals is to inspire and create the next generation of leaders within the engineering and energy industry. This study measures the success and effectiveness of the Energy Institute's unique educational model, in terms of persuading and inspiring students to pursue future careers in science, technology, engineering, and math(STEM) fields. The experiment uses a survey to effectively gauge student interest and school success in persuasion. Over 300 responses were collected from students of all ethnicities, gender, and grade level were recorded, and the survey is still currently undergoing distribution. Through data analysis and breakdown, Energy was found to have profound impacts on the future's of students

ENER A116
Consumer Perception of GMOs
Camille Kaufman (Energy Institute)
Mentor: Ms. Celeste Wilson
This experiment is intended to address how Houston consumers perceive the use of GMOs, or the concept and application of genetic modification in consumer agriculture. Data is collected through surveys of shoppers over 18 years old sent to diverse families around the city. Participants ranged widely in race, religion, age, and occupation. Collected information compares elements such as income, level of education, and political affiliation to a scalar of how informed people feel about the topic of GMOs and how they believe it impacts consumer products (as in positively or negatively). At the time of submission, this experiment is still ongoing. Data so far indicates a fairly even split between support and opposition for GMOs, with an additional large portion of individuals who responded with indifference toward genetically modified foods. As data is analyzed, correlation may be implied between education, political affiliation, and

opinion on GMOs. While a larger sample size would be more encouraging and/or reliable to prove correlation if statistically significant data is found, the current (and growing) sample size is over 30, at approximately 100 respondents.

ENER A117
The Effects of PBL on Social Interaction
Jeremy Loss(Energy Institute)
Mentor: Ms. Celeste Wilson
High school environments and social structures can have a large impact in shaping personal lives. School environments are essential in establishing group dynamics through social interaction in between students and student groups. Traditional high schools typically do not encourage social interaction through in-class curriculum. However, Project Based Learning (PBL), a new type of curriculum focused on group projects, is starting to gain popularity in American schools. This brings up the question of whether students being encouraged to talk to each other increases outside social interaction and reduces personal loneliness. The purpose of this study is to see how PBL affects the social isolation of students involved. I constructed a survey to compare the social lives of PBL and non-PBL students and whether the PBL curriculum has helped them in their social endeavors. The realm of social psychology has had a large focus on student group dynamics and I'm hoping to add to that body of knowledge. Isolation is a defense mechanism and as school is a major stressor, it's possible a change in school environment could limit isolation among high schoolers.

SOSC A118
School Enrollment, Work Effort, and Poverty Status: A Comparison of Mexican Immigrant Children and American-born Children in Texas
Serena Tohme, Katie Lobodzinski, Amanda Perozo, Sunny Chen, Edgar Galdamez, Jacqueline Edmonds
Mentor: Dr. Gurncali Ozge
The rhetoric of the current American administration has caused a proliferation of myths about immigrants, many of which rely on false assertions about the work ethic and education of Mexican immigrants. In this demographic study, using the Urban Institute's open-science data tool, we investigate differences between children with parents from Mexico and children with American-born parents within Texas in 2015 on measures of school enrollment, work effort, and poverty status. Our results indicate that the two groups have the same level of school enrollment through grade 12 (each 94.8%) and show similar work effort (81.9% and 80.3% of families with high work effort, respectively). However, while 63% of Mexican immigrant families have low-income status, this number is 30% among American-born families. These results suggest that while Mexican immigrant children are just as educated and their families are just as hardworking as native-born families, the negative myths about this group may make it more difficult for Mexican immigrant families to escape poverty. This study has implications for further research on the Mexican immigrant experience in the United States.

NSCI A119
An ((in vitro)) Study on the Dynamics of Multi Stage Vector Uptakeby the Mononuclear Phagocyte System
Si Qi Tong
Mentor: Dr. Sara Nizzero
Macrophages are a key component of the liver's ability to filter out foreign substances in the bloodstream. In cancer treatments, systemically administered drugs may be prematurely removed from circulation by macrophages, preventing sufficient drug accumulation in tumors. Thus, a strategy to reduce macrophage sequestration holds great potential in increasing drug accumulation to tumors, and thus efficacy. This study investigates the kinetics of particle uptake by macrophages and the effect a macrophage depletion strategy would have on uptake capabilities. By first characterizing ((in vitro)) uptake and then pretreating macrophages with clodronate liposomes, the study shows that depletion strategies may be viable to enhance tumor drug delivery.

Session B

ENGI B1
Development of magnetic field sensing device for locating distal intramedullary rod fixation screw holes
Brian Kang, Taka Iida, Babs Ogunbanwo, Ian Frankel, Will Yarinsky, Hannah Jackson
Mentor: Dr. Sabia Abidi
Positioning the distal locking screw has been one of the greatest challenges of intramedullary rod fixation surgery. Despite the success in screw location assistive devices, x-ray exposure and procedure duration could be minimized and accuracy of screw placement improved. To address these needs, we have developed a prototype to locate the screw holes through magnetic field sensing, reducing the use of extensive fluoroscopy. Our device is composed of a magnetic wand, and a wearable magnetic sensor brace with LABVIEW visualization software. The magnetic wand consists of a metal wire to attach and detach a magnet to the distal hole of the intramedullary rod, ensuring that the maximum magnetic field is at the center of the hole. The wearable magnetic sensor brace contains a magnetic field sensor to find the position in three degrees of freedom: translational, rotational and angular. Our prototype testing results demonstrate high accuracy, reduced time to location, and ease of use, compared to conventional devices.

ENGI B2
Optimizing Sample Preparation and Speed of Low-Cost HPV DNA Cervical Cancer Screening Assay
Pujita Munnangi

Mentor: Dr. Chelsey Smith
Low-resource settings often lack infrastructure to implement advanced techniques to diagnose cervical cancer. To fulfill this need, the Richards-Kortum Lab has developed a paper enzyme-linked immunoassay (ELISA) to detect high-risk HPV DNA that accounts for 99.9% of cervical cancers. Results from clinical testing have shown the assay takes over an hour to run and produces false positives due to nonspecific DNA:RNA hybridization. Therefore, the goals are to optimize assay speed, model fluid flow with COMSOL, and optimize sample preparation. Methods included using food dye to visualize the flow of reagents, modeling assay format using a malaria PfHRP2 protein and measuring signal-to-background ratio, using COMSOL to model fluid flow, and optimizing sample preparation using DNA fragmentation. Results showed speed is optimized by increasing the area over which fluid expands, reducing travel length of fluids, and keeping sensitivity constant. COMSOL modeling showed pressure directly influences the concentration of fluid along the lateral flow assay. Sample preparation and binding specificity of the assay were optimized using fragmentase. Future work includes testing in clinical trials.

ENGI B3
Vignette
Robin Kim, Carl Henderson, Daniel Vadasz, Ayush Chapagain
Mentor: Dr. Gary Woods
In this current data-driven age, companies are seeking methods to gather customer information
regarding their products in hopes of replacing the traditional online survey approach. The purpose of this project is to build a video capture system to assist companies desiring information on how often the user interacts with certain products. To incentivize having this product in the customer's home, the company would fully cover the cost of the device as well as offer some form of financial compensation to the customer whether it be in cash or discounts on the company's products. To differentiate this product from other smart home devices, this device will allow the user to thoroughly control all data leaving the device. Any object recognition computation should be done locally on the device to give the user ease of mind that the customer's raw video data is not being sent to the company's remote server without the user’s consent. Additionally, any object recognition computation done on the device will be summarized as a text file and provided to the user directly allowing the customer to control what data is allowed to leave the device.

ENGI B4
Synthetic Gene Circuits with Tunable Expression Level and Dosage Compensation for Mammalian Cells
Jin Yang
Mentor: Dr. Francois St-Pierre

The most commonly used approach to express synthetic proteins via viral or chemical methods results in a broad distribution of DNA copy number, leading to large cell-to-cell variation in expression level. Synthetic proteins require sufficient expression to be functional in cells but above a threshold expression level, they cause cytotoxicity and may form intracellular aggregations. Under currently available expression methods, only a small portion of the cells are within the optimal expression level range. Chromosomal integration could give constant copy number across cells but is laborious, time-consuming, and not feasible for many applications. Therefore, there is a substantial need for a multi-copy DNA expression scheme that gives homogenous expression across cells. We developed a tunable gene circuit with dosage compensation that reduces the cell-to-cell variation in expression level under transient transfection close to that of chromosomally integrated cell lines and to as low as one-third of that of an open-loop circuit measured by the coefficient of variation.

ENGI B5
Derivation of fluorescent proteins with improved brightness and photostability via single-cell variant screening
John Ahrens
Mentor: Dr. James Lee
Fluorescent proteins (FPs) are used extensively as a tool for visualizing biological phenomena. They can serve many different purposes, allowing researchers to view cell organization, protein localization, cell death, enzymatic activity, voltage, and more. Many experiments require imaging over an extended period of time. However, FPs undergo rapid photobleaching when exposed to excitation light, greatly hindering the potential of continuous imaging. The dimness of many FPs can also make imaging difficult in vivo. To amend these issues, it is critical to derive new FPs that exhibit improved photostability and brightness. In this paper, I employ site-directed mutagenesis and a single-cell fluorescence screening system to derive, from existing FPs, novel FPs that show significant improvements in both of these characteristics. These new FPs will allow researchers to conduct biological imaging more effectively and for longer periods of time.

ENGI B6
Evaluating ((In Vitro)) Cytocompatibility of Encapsulated Mesenchymal Stem Cells in a Chondroitin Sulfate Crosslinked Poly(((N))-isopropylacrylamide)-Based Hydrogel
Athena Chien
Mentor: Dr. Antonios Mikos
Poly(((N))-isopropylacrylamide)-based macromers provide a promising platform for developing thermogelling injectable hydrogels. These injectable gels have the potential to deliver drugs and cells to defect sites in a minimally invasive manner. However, shrinking, or syneresis, of the gels remains the biggest challenge for their application to tissue engineering. We have recently developed a poly(((N))-isopropylacrylamide)-based thermogelling hydrogel crosslinked with chondroitin sulfate for cartilage tissue engineering. The crosslinking prevents syneresis, but has shown dose-dependent

cytotoxicity by increasing the acidity of the hydrogel environment. We investigated the impact of adjusting the pH and ionic concentration on the hydrogel's physicochemical properties as well as cell viability. Pending results will determine whether such adjustments will provide a better environment for encapsulated mesenchymal stem cells. Identification of aforementioned parameters have the potential to improve therapeutic properties of the Poly(((N))-isopropylacrylamide)-based hydrogel.

ENGI B7
Optimization of Carbon Nanotube Oxidative Purification to Minimize Effects of CNT Shortening and Residual Impurities
Jonathan Bloom
Mentor: Dr. Matteo Pasquali
Chemical vapor deposition is a promising method for scalable and efficient carbon nanotube (CNT) production. As-produced CNTs contain amorphous carbon and residual catalyst as impurities, inhibiting solubility in superacids for processing into macroscale materials. Oxidative purification in a furnace is a common method to remove amorphous carbon from CNTs, but the CNTs may be damaged or destroyed in the process, reducing product quality and yield. To determine the best oxidative purification conditions to optimize both CNT quality and yield, CNTs were purified at various temperatures and O2 concentrations for different lengths of time. Real-time analysis of the oxidative purification was provided by mass spectroscopy of the furnace effluent. The purified CNTs were characterized with Raman spectroscopy, scanning and transmission electron microscopy, and extensional rheometry to obtain information on the CNT's crystallinity, impurity content, and aspect ratio, which all affect the macroscale properties of CNT materials. These initial results indicate progress towards ideal furnace conditions to optimize CNT purification, which will help foster more CNT-based technology development.

ENGI B8
Click-Functionalized Hydrogels for Osteochondral Repair
Virginia Xie
Mentor: Dr. Antonios Mikos
Cartilage tissue cannot repair itself easily, so we are investigating the use of hydrogels as a superior alternative to graft surgery to produce functional tissue. Cartilage-specific biomolecules such as N-cadherin peptide and chondroitin sulfate are bound to hydrogels for in situ presentation of their tissue-specific cues. Our specific hydrogel system is composed of poly(NiPAAm) (poly(N-isopropylacrylamide)), a thermogelling macromer that solidifies at 37 oC, and PdBT, an alkyne-presenting crosslinker that stabilizes the hydrogel and can potentially be prefunctionalized with biomolecules. Our goal is to synthesize injectable, tissue-specific hydrogels to induce cartilage regeneration at a site of defect. Our research aims for this study were to determine the cytocompatibility of the synthesized hydrogels and maximize the viability of mesenchymal stem cells (MSCs) encapsulated within hydrogels. Using a leachables

cytotoxicity assay, we determined 100% cell viability of model fibroblasts when exposed to leached hydrogel components. We then performed a full factorial study using live/dead staining with confocal microscopy as well as PicoGreen for DNA content and determined that MSCs

ENGI B9
Size- and Shape-varied Immunomodulatory Alginate Biomaterials for Drug Delivery in Cancer Therapy
Lily Liang
Mentor: Dr. Sudip Mukherjee
Alginate-based biomaterials have been utilized as encapsulation devices for chemotherapeutic agents and other hydrophilic drugs. Utilizing anti-fibrotic small molecules, the aim of this project is to observe the enhanced effect of drug delivery and therapeutic efficacy of small molecule-modified alginate nanoparticles, microspheres, and millimeter blocks through morphology, off target cytotoxicity, drug encapsulation, degradation, and drug release profiles in both in vitro and in vivo cancer models.

ENGI B11
Cargo Capacity of Genomic Integration Techniques
Jack Wilson
Mentor: Dr. Ronan O'Connell
Over the past 20 years, advancements in large-scale plasmid assembly techniques and reductions in DNA synthesis costs have significantly increased the ability to design and build complex biological circuits. However, so far, the incorporation of more complex circuits into mammalian genomes has been limited. This is in part due to a dearth of information regarding the payload size-dependence of many integration methods. Therefore, we aim to test the cargo capacity of three non-viral genomic integration techniques: CRISPR-Cas9, PiggyBac transposase, and BxB1-catalyzed recombination. To evaluate the efficiency of each integration method, plasmids of varying sizes will be stably integrated into the genome of mammalian cells using the aforementioned techniques. As the size of the delivered payloads increases, a concomitant decrease in efficiency is expected. However, the rate of efficiency loss for each technique may vary, which will help us determine the best method to use for each corresponding circuit size. Overall, as genetic circuit designs become increasingly ambitious, effective integration strategies will be essential for ensuring their widespread use in biology and medicine.

ENGI B12
Three-Dimensional Printing of Protein-Loaded Microparticles in a Poly(Propylene Fumarate) Scaffold
Panayiotis Kontoyiannis
Mentor: Dr. Antonios Mikos

One of the challenges with bone regeneration is the attraction and guidance of local cells and cellular machinery to aid in osteogenesis and bone repair. Regeneration can be stimulated through the use of bioactive molecules and therapeutic proteins. However, in tissue engineering, there is an additional challenge in the creation of scaffolds that can both precisely and safely deliver these molecules to the body in order to stimulate regeneration and growth. Thus, a model was designed to incorporate and preserve bioactive molecules in a tunable and 3D printed bone scaffold. The design created involves the encapsulation of a model protein, bovine serum albumin (BSA), in Poly (DL-lactic-co-glycolic- acid) (PLGA) microparticle delivery vehicles within a synthetic poly(propylene fumarate) (PPF) polymer scaffold that can be printed with.

ENGI B13
Engineering a Biochemical Assay to Interrogate Coactivator-DNA Interaction
Bryant Colin
Mentor: Dr. Bert O'Malley
Regulatory T (Treg) cells play an in important role in the suppression of inflammatory immune responses to foreign agents in the body. The development and function of such Tregs are primarily controlled by forkhead box P3 (FOXP3) transcription factor, which is regulated by a promoter proximal sequence and several enhancers (CNS1, CNS2). In this ongoing project, biotin-labeled DNA "baits" were designed based on the FOXP3 promoter and enhancer DNA sequences, and Jurkat and M8166 T cell lines were harvested to manufacture nuclear extract. Streptavidin-coated magnetic beads were used to precipitate proteins in the nuclear extract that bind the enhancer and promoter DNAs and subsequently, detected by immunoblot. Interrogation of these proteins that interact with the FOXP3 promoter and enhancer sequences can be valuable in further understanding the FOXP3 regulatory pathway, which may be beneficial in combating mutations that cause autoimmune diseases and cancers.

ENGI B14
Development of Lensless Camera Algorithm for Production of Images with Bright Light Sources
Tammita Phongmekhin
Mentor: Dr. Jasper Tan
The aim of this project is to use ideas and techniques from signal processing and optimization to address the current inability of mask-based lensless cameras to produce accurate images of scenes containing objects with highly differing luminances. Many lens-based imaging applications impose rigid constraints on the size and cost of the imaging systems deployed. Mask-based lensless cameras provide a potential solution to these constraints in microscopy, endoscopy, and security by virtue of their naturally thin and inexpensive design. However, current designs of such cameras fail to capture accurate images of a scene (e.g. a room) containing a very bright light source (e.g. a bright lamp). As such, these cameras cannot be used to capture scenes containing the sun, reflective objects (such as eyewear or shiny metal), and other bright sources,

limiting their use in real-world situations. In this project, I will explore various ideas from signal processing and optimization to develop an algorithm that will allow mask-based lensless cameras to accurately produce images containing bright light sources, facilitating their application into real-world settings.

ENGI B15
Drone based Reidentification
Eduardo Berg,Xintong Liu,Matthew Mutammara, Ronaldo Sanchez, Varun Suriyanarayana
Mentor: Dr. Yingyan Lin
Person reidentification is a widely studied computer vision problem because of its complexity and broad scope. Most study in this field however, has revolved around the case when the camera itself is static. Performing this task on a mobile platform such as a drone is a relatively smaller but growing area of research. This task is complicated not only by the quality of captured data but also the power and computational resources available on a mobile platform. In our project we attempt to build a drone that can re-identify a target person with some known distinctive feature and perform a pre-determined task such as landing or pursuing this target.

ENGI B16
Modeling and Experimental Characterization of a Low-Profile Mass-Spring-Damper System for Minimizing Vibrations
Josh Holder, Kasia Kiela, Alex Berlaga, Orren Smith, Josh Brandel
Mentor: Dr. Matthew Brake
In high power rocketry, large aerodynamic loads and accelerations can lead to intense vibrations within a rocket's airframe. A vibration reducing system is a beneficial addition to minimize oscillations that may affect the structural integrity of payload avionics and other inner rocket structural components. The purpose of this research is to model and experimentally test a critically damped mass-spring-damper system that will lessen the axial vibrations experienced by a payload during flight. While many commercial solutions exist for vibration damping systems, most require a relatively large space to function. Due to the limited space available in a rocket, we developed a custom low-profile spring and damper system that will easily integrate into a constrained volume. A modal analysis of the airframe has been conducted to experimentally determine the natural frequencies and vibration modes of the rocket. The behavior of the mass-spring-damper payload system has been compared with the undamped response of the rocket during flights to characterize the effectiveness of the system in minimizing vibrations on the payload.

ENGI B17
Developing a Noninvasive Intracranial Pressure (ICP) Monitor
Tensae Assefa, Sammi Lu, Kiara Reyes Gamas, Brett Stern, Patricia Thai

Mentor: Dr. Sabia Abidi
Intracranial Pressure (ICP) is a measure of the pressure in the brain and cerebrospinal fluid surrounding the brain. ICP rises in cases such as traumatic brain injury and hydrocephalus, which causes swelling of the brain tissue. If left untreated, this can cause strokes, seizures, and even death. Current techniques of gauging ICP in clinical settings are either highly inaccurate or highly invasive. The goal of this project is to create a device that is able to accurately measure intracranial pressure noninvasively. The device is designed for use in infant patients younger than 18 months old. These populations have cranial soft spots known as fontanelles that bulge outwards due to high ICP levels.The presented technology uses a flex sensor to measure the bending angle of the anterior fontanelle and uses a mathematical model to obtain the values for the ICP causing the measured bending angle. An adhesive casing surrounds the flex sensor and allows for easy placement onto a patient following a user guided calibration. This device is entirely noninvasive and is accurate to within ± 6 cm H2O for ICP levels less than 50 cm H2O.

ENGI B18
Analyzing the Effect of Surface Roughness on Hydrodynamic Squeeze-Film Dampers
Raymond Lau
Mentor: Dr. C. Fred Higgs III
A squeeze-film flow refers to a thin layer of fluid separating two solid surfaces in relative normal motion. The squeezing motion of the surfaces generates a hydrodynamic force opposing the incident motion. This force is leveraged in turbo-jet aircraft systems, where squeeze-film dampers (SFDs) are implemented for vibration control. It is known that the surface roughness profiles can significantly affect the flow, which may lead to undesired damping properties. In this work, we take a computational approach to investigate the influence of surface roughness on SFD performance. Our model is based on the Reynolds equation – a PDE for the fluid pressure field that results from depth-averaging the Navier-Stokes equations. A novel, finite element approach is presented that incorporates the Reynolds equation implicitly within a nonlinear oscillator. Surface roughness profiles were numerically generated as model inputs using spectral methods, such as fractals and digital filters. Various time-domain simulations were conducted, and we analyzed the responses to extract a relation between damping performance and surface roughness structure.

ENGI B19
Naphthenic Acid Adsorption at the Water-Calcite Interface via Spectroscopic Ellipsometry
Nikhil Chellam
Mentor: Dr. Sibani Biswal
In this study, I demonstrate that ellipsometry is an effective technique to quantitatively study the adsorption of naphthenic acid in the conjugate-base form of sodium naphthenate (NaNA) at the calcite-water interface. The injection of “smart water”, which refers to brine with designed ionic composition, can significantly increase oil recovery in a low cost and effective way for carbonate reservoirs. The majority of carbonate

reservoirs are preferentially oil-wet because of the strong affinity between the carbonate rock and the crude oil originating from charge interactions. The current working hypothesis is that smart water alters the wettability of carbonate reservoirs to more hydrophilic conditions. Restoring the wettability of oil-wet carbonate rock to preferentially water-wet can significantly improve the oil recovery by eliminating the capillary entry pressure. I aim to understand the adsorption behavior of naphthenic acid under different environments due to the far-reaching implications it may have on enhanced oil recovery. Because naphthenic acid adsorption affects the wettability of calcite, our optical calcite system serves as a carbonate reservoir model.

ENGI B20
Semi-Automating the Design Process for 3D-Printing Customized Intraoral Stents for Patients with Oropharyngeal Cancer Undergoing Radiation Therapy using MATLAB
Anshuman Agrawal
Mentor: Dr. Eugene Koay
Intraoral stents are used in Radiation Therapy for patients with Oropharyngeal Cancer to immobilize the jaws and maximize the therapeutic index to help ensure that the radiation is delivered accurately and consistently throughout the many-months long treatment course. However, the production of the current clinical standard is time consuming and costly. Hence, we at the Koay Lab are working on using 3D printing to easily and quickly produce cheaper and better custom intraoral stents for patients. The goal of my project is to reduce the time taken to design the patient-specific 3D stent model by semi-automating the process using MATLAB algorithms, hence reducing the technical knowledge required to design and manufacture the stents, enabling easier adoption of the device as the standard of care across hospitals in the United States and abroad.

ENGI B21
Optimization of Caspase-Activatable Adeno Associated Virus Vectors
Cooper Lueck
Mentor: Dr. Junghae Suh
Viral vectors have shown themselves to be viable methods of gene delivery in recent years with Adeno-Associated virus (AAV) showing promise due to its low immunogenicity when compared to similar vectors and its is safety in handling and manipulating. In previous studies, researchers have created protease-activatable viruses, or provectors, that are “unlocked” in the presence of specific proteases, namely matrix metalloproteinases (MMP)-2 and -9 in order to create vectors that “unlock” in specific conditions in vivo. To that end, this study focuses on the optimization of a vector that is unlocked in the presence of Caspase-3, -6, and -7 to better target disease sites at which these proteases are upregulated, namely heart failure and neurodegenerative diseases. Through manipulating “scar” residues to minimize net charge in the “unlocked” state, optimizing lock size and repulsion, and introducing wild-type subunits to the provector capsid, this study builds upon the findings from previous vectors to

have increased switchability between “on” and “off” and wild-type levels of transduction when “unlocked.”

ENGI B22
A Machine Learning Approach to Predicting Occurrence of Sharp-Wave Ripple Complexes
Ariel Feldman
Mentor: Dr. Caleb Kemere
Within the hippocampal circuit, electrophysiological activity in one region leads activation within another. In this vein, there exists in vitro and in vivo evidence supporting the possibility of activation in one region leading sharp-wave ripple complexes (SWRs), which are typically viewed as indicators of memory consolidation and recall. We propose the integration of prediction of SWRs into current realtime detection and disruption algorithms to improve accuracy and broaden the scope of interrogation of these hippocampal events. To do so, we train statistical models and neural networks to predict SWRs, as well as classify pre-SWR events. This would enable full interrogation of a SWR event, which has not yet been achieved as state-of-the-art algorithms only achieve interrogation of 40-60% of SWR events.

ENGI B23
A Distributed Wireless System of Water-Level Sensors for Real-time Measurement of Street-level Flooding
Nicholas Lester, Jerry Lin, Justin Bryant
Mentor: Dr. Gary Woods
Preparing coastal cities for future hurricanes like Harvey or for chronic intense rainfall, requires accurate modeling of flood-water flow over large areas covered by urban streets, buildings, parking lots, and other rapidly evolving environment features. However, accurate real-time modeling at a city scale is infeasible computationally, and requires a large data set of empirical flood-water measurements over a large urban area for model calibration and validation. In order to obtain this data, Houston Solutions Lab is supporting our development of a scalable network of wireless water-level sensors that can be deployed around coastal cities like Houston. Each sensor node can be placed at or near a street, reports wirelessly to the cloud, does not require power from the grid, and will cost at most a few hundred dollars. Our proof of concept system, comprised of four nodes around the Rice campus, measures street flooding on campus roads. The system has a web-based interface that can be read out in real time from any browser. When deployed at scale, our system can be used to support decision making for traffic routing and evacuation, both for citizens as well as emergency officials.

ENGI B24
Fluid Flow in a Y-shaped Lateral Flow Assay
Rithika Proddutoor

Mentor: Dr. Sai Paul
"In low-resource settings, a need for rapid, inexpensive, and portable healthcare diagnostic tests exists. One such test is a lateral flow assay (LFA), a paper-based Enzyme-Linked Immunosorbent Assay (ELISA) test that parallels the sensitivity of conventional tests. We are developing a semi-quantitative LFA to predict progression of patients with malaria to cerebral malaria, a deadly form of malaria that primarily affects children under five years of age in Sub-Saharan Africa. A threshold for differentiating risk is optimized with a one-stream, sandwich LFA using antibody-conjugated gold nanoparticles. Since the LFA detects high levels of a biomarker, we use an excess of reagents to deplete the antigen and improve quantitative detection. Modifying the LFA to a y-shape uses less gold nanoparticles, decreasing cost. However, fluid velocity and reagent timing affect binding kinetics and the signal. Thus, we measure fluid flow between these assays using colored fluids to differentiate between the components (sample, nanoparticles, wash buffer). Exploring the differences in velocity allows us to determine if the y-shape is feasible for implementation."

ENGI B25
Quantitative Control of Protein Senor Localization in Mammalian Cells
Leonardo Sanchez Solis, Syed Shams
Mentor: Dr. Michael Diehl
This project will develop a novel probe technology for multiplexed quantification of dilute, easily perturbed, transiently-active, and compartmentalized signaling lipid markers. These probes will employ engineered phosphorylation reactions to sense, amplify, and integrate lipid signaling events at the plasma membrane or within subcellular compartments. They will be designed to produce whole-cell reporting outputs that are amenable to high-throughput single-cell analysis and phenotyping, and PIP3 will be used as a model lipid target to demonstrate detection and amplification. The improved fidelity of our circuits will open opportunities to evaluate potential crosstalk or coordination among signaling lipid species. We will validate their utility by generating whole cell outputs that are amenable to high-throughput wide-field-of-view imaging. Rapid whole-cell readout of lipid synthesis will be used to delineate how lipid turnover depends on different dynamic processes to quantify inter-lipid communication and functional connections to reporters of oncogenic signaling. Overall, our circuits will enable new quantitative metrics for resolving crosstalk among lipid species.

ENGI B26
Fuel Cells as Engines for Soft Robotics
Kalen Ziegler
Mentor: Dr. Fathi Ghorbel
Swimming robots are important in many applications, such as the safe inspection of large liquid-containing tanks. One method to effectively and continuously control the bouncy of these robots is the use of balloon actuators filled with air or mass to cause stationary, upward, or downward movement in the robot. Reversible electrolysis reactions, producing water in one direction and gases in the other, can be used to

accomplish this. A nonlinear model of the electrolysis reaction is proposed. The model considers an input of hydrogen and oxygen gas and an output of water. It relies both physical and electrochemical principles. The model will be linearized and simulated in order to be able to control the electrolysis reactions. This will allow desired buoyancy changes in the robot by inputting electrical current to the cell.

ENGI B27
Design and Fabrication of an Omnidirectional Mobile Robotic Platform Based on a LIDAR Scanner
Joshua Holder
Mentor: Dr. Fathi Ghorbel
When using scanners for the inspection of aboveground storage tanks, it is necessary to be able to control the location of the scanner remotely and to a high degree of accuracy. This careful control allows the sensor to obtain the most accurate possible measurements. The sensor mount must be able to traverse surfaces with protrusions up to 1” tall—current solutions fail to handle surfaces this rough while satisfying the dimensional requirements necessary for the sensor. The purpose of this research is to model and experimentally test a control scheme to control this omnidirectional motion over rough surfaces, and then implement it on a robotic platform. Several simulations of control schemes have been developed and then compared to their experimental results to characterize the validity of the control scheme and the success of the implementation.

NSCI B28
Water Retention Benefits and Cost Savings from Biochar Soil Amendment: A Spatial Analysis
Jennifer Kroeger
Mentor: Dr. Caroline Masiello
While a large body of literature exists on the ability of biochar to retain water and nutrients, little research exists regarding where biochar soil amendment could produce the greatest water retention. Biochar benefits depend strongly on the type of soil in question, which vary across the United States. Therefore, geographic biochar research can indicate where biochar usage is most efficient, and guide stakeholders to study and invest in the product accordingly. Using government databases and existing published data, we conducted a meta-analysis in which we created a statistical model to estimates potential water retention benefits and conducted a partial cost-benefit analysis, considering predicted biochar application costs versus avoided water costs. We then mapped these analyses to create visual displays of where in the United States biochar application, and thus advertising and production, would be most profitable and practical. The results of our meta-analysis will be useful for scholars, agricultural extensions, and policymakers in formulating field experiments, targeting land-owners, and proposing incentives for biochar use in the future.

NSCI B29

Effect of Caffeine on Zebrafish Intestinal Transit
Ashley Tsang
Mentor: Rosa Uribe
The enteric nervous system (ENS) , a vast array of intrinsic nervous tissue in the gut, regulates hormone balance and gut motility during digestion. Between 3- 7 days post fertilization, the zebrafish ENS grows in neuronal complexity and matures from exhibiting erratic contraction waves to more organized motility, suggesting a correlation between gut motility development and neuronal control (Holmberg). Because caffeine has been known to affect neuronal development, I have assayed neuron function using an intestinal transit assay (Field 2008) and video recordings to detect differences in motility between fish treated with or without caffeine. I will use immunohistochemistry to test if the basis for these intestinal motility differences may result from changes in neuron content. Zebrafish serve as a model organism for this experiment because they are transparent, allowing observation of their intestinal motility. The transit assay and gut motility video experiments have shown a significant increase in intestinal motility in caffeinated zebrafish. Together, these experiments provide new visual data on how caffeine affects the ENS and/or the gut's smooth muscle in zebrafish.

NSCI B30
Sleep Disturbance in School Age Children with PTHS, SMS, and MAND Mirrors Sleep Abnormalities in Autism Spectrum Disorder
Anusha Gandhi
Mentor: Dr. Sarah Elsea
Sleep disturbance in school aged children with neurodevelopmental disorders such as Pitt-Hopkins Syndrome (PTHS), Smith-Magenis Syndrome (SMS), and ((MDB5))-Associated Neurodevelopmental Disorder (MAND) are not well characterized in the existing literature. We conducted surveys of caregivers of children with these 3 disorders and compared the extent and focus of sleep disturbance in each cohort to examine what aspects are most problematic in each disorder. We also compared our data to existing data regarding sleep disturbance in school aged children with Autism Spectrum Disorders (ASD). The data indicate that sleep disturbance in PTHS is less severe than that in SMS and MAND and focuses on sleep duration. Sleep disturbance in SMS and MAND do not significantly differ from each other based on scores on the Children's Sleep Health Questionnaire (CSHQ). Scores on CSHQ sleep subscales in PTHS and SMS mirrored sleep disturbance in a population with ASD from Hodge et al. (2014), and sleep duration in MAND mirrored that in the ASD population, suggesting that different aspects of each disorder mirror the wide range of sleep disturbance found in ASD.

NSCI B31
Distance Dependence of Transcriptional Responses following CNS Axonal Injury
Allison Melton
Mentor: Dr. Trent Watkins
A key contributor to the permanence of central nervous system (CNS) injuries such as spinal cord injury may be the lack of pro-regenerative transcriptional responses of the type that enable axon regeneration in the peripheral nervous system (PNS). We are

investigating the possibility that transcriptional injury responses in the CNS, unlike those of the PNS, are limited only to injuries to segments of axons close to the neuronal cell body. Previous work has demonstrated that such proximal injuries to the optic nerve engage a pro-regenerative response through the activation of the dual leucine zipper kinase (DLK). To test whether DLK is similarly activated by more distal injuries, we have developed an ((in vivo)) mouse intracranial optic nerve crush (IC-ONC) model, in which the optic nerve is injured near the optic chiasm, far from the neuronal cell bodies. Markers of DLK activation are reduced in this model. Ongoing expression profiling using qRT-PCR will determine if this is associated with reduced transcriptional responses. Our findings suggest that reduced DLK-mediated transcriptional responses contribute to the failure of axon regeneration following distal CNS axonal injuries.

NSCI B32
Understanding the Atoh1 Interaction Network
Alexandra Boufarah, Amna Ali
Mentor: Dr. Tiemo Klisch
Atoh1, the mouse homolog of Drosophila atonal, is a basic helix-loop-helix transcriptional factor that regulates the differentiation of key cell populations of the nervous system and of non-neuronal cell types. Atoh1 has a wide variety of functions, two of which seem to oppose each other—the promotion of cellular proliferation (some of which can become malignant) in the cerebellum and the promotion of cell cycle exit. Exactly how Atoh1 can be manipulated in an effort to control its influence on tumor expression remains unknown. That being said, researchers have long understood that Atoh1 heterodimerizes with its obligate binding partners to promote gene expression. Interestingly, some studies have applied this principle and identified kinases and phosphatases as interactors with Atoh1.
With this new web of interactors, there are many ways in which we can begin to understand Atoh1's interaction network. Consequently, my research focused on validating the kinase and phosphatase interactors found through past studies via a Bimolecular fluorescence complementation (BiFC) assay. Through my work, I identified kinases VRK1 and VRK3 as well as phosphatase PBK as potential interactors.

NSCI B33
Knockdown of rib in the Tracheal Region of Drosophila Melanogaster and its Effect on Burrowing, Tunneling, and Maturation
Antonia Jordan-Millet, Ken Nguyen, Jordyn Williams.
Mentor: Dr. Carrie McNeil
"In previous research from the Beckingham Lab, it has been observed that the knockdown of the gene jim lovell (lov) using the Gal4-UAS system inhibits lov's ability as a transcription factor. This was specifically revealed by the fact that flies with lov knockdown failed to burrow into their food during their growth which is indicative of tracheal fluid filling and subsequent
development of hypoxia. In our study, the gene Ribbon (rib) was knocked down in a cut-Gal 4 - rib cross at 22℃, 26℃, and at 30℃. The cut-Gal4 UAS driver that was used is temperature dependent and has the highest RNAi knockdown of rib at 26℃. There was

a greater lack of burrowing, less tunneling, less pupation, and a smaller number of larvae reached adulthood when there was a greater knockdown of rib RNAi. These results suggest that rib plays an integral role in tracheal development in the larval stage and that because these manifested behavioral phenotypes are similar to the effect of knockdown of the gene lov, which can be used as evidence to suggest that rib is a co regulator of lov."

NSCI B34
Elucidating the Functional and Molecular Consequences of IDH Alterations in Gliomagenesis Using Crispr/Cas9 Technology
Hannah Roberts
Mentor: Dr. Jason Huse
Gliomas account for more than 70% of all primary brain tumors. Yet, their prognosis remains poor, necessitating the further study of molecular drivers of tumor growth. Isocitrate dehydrogenase (IDH) mutations are early, foundational events in low glioma biology. In vitro studies have revealed IDH mutants create the oncometabolite R-2-hydroxyglurate (2-HG) which leads to increased methylation of DNA and histones. To understand the in vivo effects of IDH mutation, we have utilized in utero electroporation to deliver combinations of plasmids overexpressing IDH mutants in conjunction with Crispr technology to knockout either p53/Pten (2x Crispr) or p53/Nf1/Pten (3x Crispr) in the embryonic mouse brain. We tracked glioma development in vivo via luciferase bioimaging and performed GFP-guided harvest of tumor tissue. Metabolic analysis of resulting glioma has confirmed the presence of 2-HG, functionally validating our IDH constructs. IDH status does not influence survival of 3x Crispr mice. In contrast, IDH mutations increase survival of 2x Crispr mice. We will next sequence resulting glioma to determine the molecular underpinnings of differential growth and predominance of IDH mutations.

NSCI B35
Appropriate balance of bone morphogenetic protein signaling is essential for keratinocyte differentiation in skin development
Serra Sozen
Mentor: Dr. Yoshihiro Komatsu
Growth factor signaling including bone morphogenetic proteins (BMPs) is critical for normal skin development. Still, it remains elusive how SMAD-dependent BMP signaling specifically controls keratinocyte differentiation ((in vivo)). We used a genetic system to enhance BMP signaling in a skin-tissue specific manner in mice. These BMP mutants were perinatally lethal, characterized by a hairless phenotype with an undifferentiated epidermis. Though cell survival and proliferation activity were similar between WTs and mutants, production of keratin 1 and loricrin was reduced in mutants, suggesting that keratinocyte differentiation was attenuated. A global screening revealed that cell cycle regulatory machinery was severely impacted, particularly by Cyclin-dependent kinase inhibitors (CDKis). mRNA and protein levels of CDKi p21 were increased in mutants, demonstrating that SMAD-dependent BMP signaling positively regulates p21, and that an appropriate range of signaling is indispensable in keratinocyte differentiation. Our

study unveils the mechanisms behind how BMP signaling networks orchestrate skin homeostasis, aiding our understanding of skin diseases like psoriasis or hypotrichosis.

NSCI B36
Immunofluorescence Staining of H3K9me3 and Lamin B1 to explore the role of ATRX loss of function mutations in chromatin architecture of gliomas cells of origin
Pavan Pinnamaneni
Mentor: Dr. Carla Danussi
The eukaryotic genome is organized into a three-dimensional structure which is crucial to the regulation of gene transcription. Specific architectural proteins coded by genes characterize the building of this structure. ATRX is one of these genes and specifically functions as a chromatin regulator. Recently, the role of ATRX inactivation in regards to genomic stability has been explored. Previous studies have shown that ATRX deficiency causes significant differences in chromatin access, histone composition, and genomic transcription. ATRX inactivation occurs frequently in gliomas, the most common primary brain tumors. This project used immunofluorescence techniques to explore the epigenetic discrepancies between glioma cells with ATRX inactivation compared to glioma cells with ATRX wild type. Results indicated a reduced colocalization between H3K9me3 and Lamin B1 in the ATRX-deficient context, suggesting that an increase in gene expression that may have unintended consequences.

NSCI B37
Spatial integral projection models predict slow and steady encroachment of creosotebush
Trevor Drees
Mentor: Dr. Thomas Miller
The encroachment of creosotebush ((Larrea tridentata)) into grasslands in the southwestern United States significantly alters local ecosystems and has become a management concern in recent decades. However, few studies have sought to quantify the processes occurring at the front line of this expansion. Our work fills this knowledge gap by combining density dependence data with dispersal kernels to model encroachment of creosotebush as a moving wavefront. Results indicate that a slow but steady encroachment speed may be attributed to low chances of both long-distance dispersal and recruitment from dispersed seeds as well as high mortality of seedlings. Negative and monotonic density dependence in most demographic rates show that the wave is pulled forward by shrubs at the front rather than pushed by shrubs at the back. Individuals at the low-density front of the wave tend to have higher reproduction and dispersal capabilities and therefore greatly drive encroachment. These results conservatively estimate creosotebush encroachment speed and give insight into the types of individuals that contribute the most to this expansion, both of which are useful in a management context.

NSCI B38
Exploring the Utility of Oxidative Stress to Monitor Autophagy of Peroxisomes
Melinda Wang

Mentor: Dr. Bonnie Bartel
Peroxisomes are essential membrane-bound organelles conserved across eukaryotes that sequester key metabolic reactions and detoxify reactive oxygen byproducts. One of these byproducts, hydrogen peroxide (H2O2), induces the autophagy of peroxisomes, or pexophagy. We aim to identify peroxisomal proteins necessary for H2O2-induced pexophagy in ((Arabidopsis)) plants. Our first step is to identify H2O2 treatments that impact peroxisome function and degradation. To measure peroxisome function, we monitored root responsiveness to the auxin precursor indole-3-butyric acid (IBA) in wild type and various mutant backgrounds treated with H2O2. Additionally, we used immunoblotting to evaluate the impact of H2O2 on the levels of peroxisomal proteins. A genotype that hastens or impairs pexophagy is expected to demonstrate corresponding changes in IBA sensitivity and peroxisomal protein levels. Completion of this project will provide insight into the regulation of pexophagy, a process that is critical to plant homeostasis. Our findings may contribute to understanding defects in human peroxisomal biogenesis, which are linked to often fatal diseases.

NSCI B39
S-MiRAGE: A Quantitative, Secreted RNA-Based Reporter of Gene Expression and Cell Persistence
William N Feist
Mentor: Dr. Aryeh Warmflash
Tracking cell persistence and gene expression without sample destruction is crucial for longitudinal research studies and prognostic monitoring of cell therapies ((in vivo)). To this end we describe S-MiRAGE, a system that employs secreted and multiplexable synthetic small RNA molecules detected through RT-qPCR as sensitive and quantitatively accurate reporters for cellular transcription. We demonstrate the utility of S-MiRAGE by reporting on a key pluripotency gene (SOX2), allowing us to monitor the differentiation status of human embryonic stem cells ((in vitro)) by detecting our marker in culture media. We also use our system to track SOX2 expression in human embryonic stem cells throughout the process of differentiation into fibroblasts and subsequence viral reprogramming into induced pluripotent stem cells. ((In vivo)), we use S-MiRAGE signal in plasma to track cancer cell persistence in a mouse model over four weeks. In conclusion, we believe that our S-MiRAGE system can act as a faithful reporter for cell processes and persistence ((in vitro)) and ((in vivo)).

NSCI B40
Effects of Genotype and Social Group Structure on ((Drosophila simulans)) Emergence Behavior
Allison Jaffe
Mentor: Dr. Julia Saltz
How does an individual’s genotype interact with their social group structure to determine their emergence behavior? ((Drosophila simulans)), a species of generalist fruit fly, was used in this experiment as preliminary data reveled that for females only different genotypes of ((D. simulans)) had different emergence behavior in a novel environment. To investigate this intriguing pattern further in this experiment two genotypes that

showed fast emergence behavior and two genotypes that showed slow emergence behavior were selected to study the effects of social group structure versus genotype on emergence behavior. Social groups were made up of six individuals, three of genotype A and three of genotype B. Given the four genotypes used all possible social grouping combinations were tested. Groups were placed in a tube leading to a novel environment. The emergence behavior in terms of time and number of times an individual moved between the tube and the novel environment was calculated for each individual in a social group. The effects of social group structure versus genotype were then analyzed providing insights into the the interaction of these factors on emergence behavior.

NSCI B41
Surveillance of ((Borrelia turicatae)) in Lackland Air Force Base ((Ornithodoros)) ticks
Melody Xiao
Mentor: Dr. Job Lopez
Ornithodoros turicata is a fast-feeding argasid (soft-shelled) tick that transmits the blood-borne relapsing fever spirochete Borrelia turicatae, a bacterium that causes recurring bouts of fever. O. turicatae has been recorded in the southern United States and typically resides in nests and burrows. Despite its medical importance its geographic distribution is not well-understood. More importantly for public health, the infectivity status of O. turicata at different localities is unknown. O. turicata ticks were collected from the Lackland Air Force Base; DNA was extracted from the ticks and polymerase chain reaction (PCR) was performed to determine infectivity status by B. turicatae. The results indicated that O. turicata by the Lackland AFB were infected by B. turicatae and pose an infection risk to those on the Air Force Base and in San Antonio. B. turicatae is relatively rare, but there have been recent outbreaks of relapsing fever in Austin, indicating that it may be emerging. To limit infection risk and exposure to relapsing fever, more surveillance needs to be implemented and more research must be done to target prevention efforts in areas of high B. turicatae presence.

NSCI B42
((Ophyrocystis elektroscirrha)) in Houston's resident monarch population: rates of infection and testing safe rearing protocols
Cindy Ryoo
Mentor: Dr. Amy Dunham
Monarch populations in the U.S. have significantly decreased in the past few years because of habitat degradation. Prevalence of a protozoan parasite called ((Ophryocystis elektroscirrha)) (OE) has gained attention because it is responsible for increased mortality and decreased fecundity in monarchs. Past studies have compared infection rates in different monarch populations, and results support that overwintering monarchs have higher infection rates than migratory ones. However, little work has studied non-migratory populations in Texas. Our study explores the prevalence of OE in Houston's overwintering monarchs and tests the success of a sterilization method to reduce infection in captive reared populations. We use two experimental populations of

Houston monarchs to determine the effect of sterilization on OE prevalence in adult butterflies. We also compare OE prevalence between migrating and overwintering populations. The results of this study contribute to the lack of information surrounding OE rates in Houston's overwintering monarchs and has implications for safe rearing protocols for captive rearing facilities and hobbyists in reducing their impact on disease prevalence.

NSCI B43
Improving Drug Efficacy in Osteosarcoma through RNAi-Mediated Repression of RPS19 and RPL5
Lon Kai Pang
Mentor: Dr. Dung-Fang Lee
Osteosarcoma (OS) is the most common type of bone cancer. BRCA1/2-deficient breast cancer cells are highly sensitive to PARP inhibitor drugs such as Olaparib. Suppression of the BRCA1/2-associated DNA repair pathway is synthetic lethal with the impairment of the PARP DNA repair pathway. DNA repair genes have generally shorter 5'-untranslated regions (UTRs), a characteristic also observed in genes downregulated in ribosomal protein haploinsufficiency. Hence, we hypothesize that suppressing ribosomal protein genes in OS cells may impair DNA repair pathways and consequently increase the efficacy of PARP inhibitor drugs. Lentiviral particles expressing short hairpin RNAs that inhibit RPS19 and RPL5 expression were produced. OS cell lines were infected and then treated with Olaparib, and cell viability was assessed with MTT assays. Infected 143B ($p\neg < 0.001$) and HOS ($p < 0.004$) exhibited reduced cell viability six days after 5 μM Olaparib treatment. These promising results motivate continued work to gather more data, and potentially expand to experimentation on other OS cell lines.

NSCI B44
iDREADDS: Rapidly Inducible Astrocytes Under Chemogenetic Control of Designer Receptors Activated by Designer Drugs
Arya J Shetty
Mentor: Dr. Robert Krencik
Astrocytes are a glial subtype that are integral in the maintenance of health and homeostatic conditions in the central nervous system. The synaptogenic properties of astrocytes are well established and a topic of interest for their potential for neuroregenerative therapies. However, methods to induce astrocytes' synaptogenic function following injury or disease in the nervous system remain unclear. DREADDs (Designer Receptors Activated by Designer Drugs) are a series of synthetic receptors that can be engineered into cells allowing for chemogenetic control of downstream pathways. The DREADDs receptor hM3dq may allow us to trigger release of intracellular calcium (via a synthetic GPCR pathway responsive to the drug clozapine-n-oxide) and thus stimulate astrocytes to secrete synaptogenic proteins. Here we outline the engineering of a human pluripotent stem cell line that is readily differentiable into astrocytes expressing the hM3dq receptor. We expect that this cell line, termed iDREADDs, will serve as breakthrough technology for the investigation of the

mechanisms underlying astrocytes' synaptogenic properties and their role in the development and maturation of neural circuits.

NSCI B45
Rapid Adaptation of Wing Morphology in Texas Populations of Red-shouldered Soapberry Bug ((Jadera haematoloma))
Zachary Verne
Mentor: Dr. Scott P. Egan
Examining rapid adaptation of an organism to a new environment can help illuminate the mechanisms by which intraspecies divergence occurs. Often, such adaptations only occur when geographic distance reduces gene flow between diverging populations. Due to a recent shift in host plants, novel populations of the red-shouldered soapberry bug (RSSB) Jadera haematoloma in Florida exhibit rapid ecological adaptation. However, it is unknown if such adaptations could manifest in the face of gene flow. Here we test for phenotypic differences in geographically proximate (or sympatric) populations of RSSB in Texas. In doing so, we examine variation in the adaptive traits beak, body, and wing length of RSSB on three different host plants. We found that there was a greater proportion of long-wing morphs in populations on the introduced novel host plants compared to that of the ancestral host plant. When RSSBs shifted to the novel host both the proportion of long wing morphs and the mean beak length increased. Thus, RSSBs appear to be an example of divergent rapid adaptation despite the potential for gene flow ultimately informing our greater understanding of adaptation at its earliest stages.

NSCI B46
Investigating the role of PEX26 in ((Arabidopsis thaliana))
Claire Stevens
Mentor: Dr. Bonnie Bartel
Peroxisomes are essential for activating plant hormones and catabolizing fatty acids through beta-oxidation. Peroxisomal deficiencies can lead to reduced growth or embryonic lethality. Peroxisomal transport proteins such as PEX5 are essential for beta-oxidation, and PEX5 recycling facilitates sustained peroxisome function. One of the proteins implicated in this recycling step is the peroxisomal membrane protein PEX26. Interestingly, a ((pex26)) null allele causes embryonic lethality in the model plant ((Arabidopsis thaliana)), whereas the splice-site mutant ((pex26-1)) is viable but displays deficient beta-oxidation. We are characterizing the ((pex26-1)) mutant and the relationship between PEX26 and peroxisomal transport through a forward-genetic suppressor screen. We grew mutagenized ((Arabidopsis pex26-1)) plants in conditions that require beta-oxidation for growth, and isolated seedlings with improved growth. Candidate suppressors are being retested and prioritized for whole-genome sequencing to identify mutations that ameliorate the ((pex26-1)) phenotype. Identified mutations will provide insight into the functions of PEX26 and its role in PEX5 recycling.

NSCI B47
Biophysical Subtypes of Pancreatic Ductal Adenocarcinoma: Differences in Plasma IL-6 Levels
Newsha Nikzad

Mentor: Dr. Eugene Koay
Pancreatic ductal adenocarcinoma (PDAC) is a cancer with a poor prognosis due to a lack of clinical signs and biomarkers for early detection, resulting in late diagnosis, rapid disease progression, and resistance to chemotherapy and radiation therapy. We have identified quantifiable differences of PDAC tumors based on their computed tomography (CT) imaging properties, allowing for tumor categorization: high delta (less stroma, worse prognosis) or low delta (more stroma, better prognosis). Differences in prognoses, stromal properties, and platelet levels throughout disease progression between the tumor subtypes were hypothesized to be associated with the levels of pro-inflammatory cytokines such as IL-6. Following analysis of CT scans and measurement of IL-6 levels from baseline blood draws, we found a significant difference in the plasma concentrations of IL-6 between patients with low delta and high delta tumors. The results support our previous findings that the biology of PDAC tumors can be differentiated based on CT scan analyses. Ongoing work will determine how IL-6 levels change during therapy and may lead to personalized therapeutic strategies for PDAC that target IL-6.

NSCI B48
Manipulation of DNA Copy Number as a Novel Method of Increasing Dynamic Range of Synthetic Gene Circuits
Stephanie Ponce, Anshul Bhatnagar
Mentor: Dr. James Chappell
Although it is known that DNA copy number is a critical factor in controlling gene expression, it is not typically considered as a point of control when designing synthetic genetic circuits. DNA copy number can act as an intrinsic mechanism to control the network dynamics underlying cell fate decisions and levels of gene expression. Given many synthetic gene switches or circuits suffer from low dynamic range, we propose to manipulate DNA copy number as a novel method to increase dynamic range. To demonstrate this, we will construct six genetic amplifier design variants that use direct copy control or indirect copy control through an RNA regulatory system. Our initial designs will seek to control the expression of GFP from a library of inducible promoters and test the effects of DNA copy number on the dynamic range. The findings will allow modular construction of more effective genetic amplifiers. Applications include tuning the dynamic range of biological sensors and optimizing performance of genetic circuits.

NSCI B49
Assessing the Potential for Seed-Predator/Pollinator Mutualisms in the Red-Shouldered Soapberry Bug ((Jadera haematoloma)) and Its Sapindaceous Hosts
Steven Pappas
Mentor: Dr. Scott Egan
Abstract: Pollination involves the interaction between an angiosperm species and an animal in which the angiosperm provides a reward to the animal (i.e., nectar), and in exchange, animals fertilize female flowers by depositing pollen during feeding. Our research indicates the presence of a poorly understood variation of pollinator

mutualism. Here, we report the observation that the red-shouldered soapberry bug ((Jadera haematoloma)), a seed-predator, nectars on the flowers of two of its host plants: ((Cardiospermum halicacabum)) and ((Koelreuteria elegans)). We conducted field and greenhouse experiments where we used mesh bags and cages to exclude pollinators from both plant species. In one treatment, we excluded all potential sources of pollination, and in another, we excluded all sources except ((J. haematoloma)). Our results show that the nectaring behavior of ((J. haematoloma)) directly caused the production of seeds in both host species. These seeds make the bulk of ((J. haematoloma))'s normal diet. These results indicate the presence of a "seed-predator/pollinator mutualism" in which an obligate seed-predator pollinates and later consumes the offspring of its host plants.

NSCI B50
Dynamical Fermionization of Ultracold Bosons with Spin Degree of Freedom
Timothy Skaras
Mentor: Dr. Han Pu
One dimensional systems are known for exhibiting peculiar quantum phenomena in the ultracold regime: when strongly-interacting, spinless bosons are confined in a harmonic trap and the trap is suddenly turned off, it has been shown that the gas will expand and that its single-particle momentum distribution will asymptotically approach that of fermions. This phenomenon is known as dynamical fermionization. Previous studies of this phenomenon have focused only on spinless particles. We extend previous work on spinless particles and show that for particles with spin the momentum distribution of each spin component will asymptotically approach the initial real space distribution. Using the bose-fermi mapping and a scaling transformation, we study the dynamics of the single-particle momentum distribution for each spin component of a spin-½ boson system, and show that dynamical fermionization will occur. These results are intriguing because they demonstrate that dynamical fermionization is more ubiquitous than was once thought and that systems with spin contain richer dynamics. Previous results on dynamical fermionization in spinless systems are a special case of our more general work.

NSCI B51
Development of Cell-Based Methods to Investigate Transcription Regulation by Nuclear Receptor TLX
NamTip Phongmekhin
Mentor: Dr. Mirjana Maletic-Savatic
Nuclear receptors are a class of ligand-dependent transcriptions factors involved in a broad range of biological and disease pathways. Nuclear receptor TLX (NR2E1) is primarily expressed in the brain and regulates neural stem cell proliferation and differentiation. Similarly, recent findings have provided evidence for oncogenic role of TLX in cancer stem cells and established TLX as a potential target for prostate cancer and gliomas. TLX functions as a transcriptional regulator through the recruitment of chromatin-modifying factors, but its regulatory role in specific cancer contexts remains

largely unexplored. To better understand TLX's function in cancer, we are developing cell-based methodologies for probing TLX-dependent transcriptional activity and chromatin occupancy of TLX on target genes. Defining the direct target genes of TLX in various cancer contexts will help us better define therapeutic outcome. Specifically, we can test potential therapeutic agents that alter specific gene expression and mechanistically reduce disease progression thru TLX. We hope to use such agents in mechanism-based and combined drug therapies to improve prognosis of cancer patients.

NSCI B52
Identifying the Interactions between ((Pseudomonas aeruginosa)) and ((Candida albicans)) using a ((Caenorhabditis elegans)) model
Alex Deyanov
Mentor: Dr. Natasha Kirienko
"((Candida albicans)) and ((Pseudomonas aeruginosa)) are two pathogenic microorganisms that can cause lethal infections; for example, patients with cystic fibrosis often have simultaneous ((C. albicans and P. aeruginosa)) infections in their lung tissues. Previous research into the polymicrobial interactions between the two pathogens has suggested that their relationship ((in vitro)) is antagonistic. The aim of this project is to characterize the interactions between these two pathogens ((in vivo)) using a ((Caenorhabditis elegans)) infection model.

To test the impact of co-culture on virulence, we performed an agar-based killing assay. In all replicates, the bacteria outcompeted the fungus, even when the inoculation volume ratio was tripled in favor of the fungus. Furthermore, co-cultured plates physically resembled the bacterial control and exhibited similar virulence. CFU assays of both pathogens showed that ((P. aeruginosa)) outnumbers ((C. albicans in vitro)) by roughly 30x. Further aims of this project are to assay for virulence using a 1:1 CFU competition ratio and to identify the virulence factors involved in the pathogens' polymicrobial interactions."

NSCI B53
The Role of BRCA1 Mutation on Cellular Response to X-ray and Proton Radiotherapy
Joycelyn Yiu
Mentor: Dr. David Grosshans
Proton therapy is a growing form of radiation therapy. Proton radiation results in a differential biological effect compared to x-rays accounted for by the relative biological effectiveness (RBE) factor. The main biological effector of radiation therapy is DNA damage with double strand breaks (DSBs) being considered the most lethal DNA lesion. BRCA1 is a well-studied protein involved in homologous recombination (HR), an error-free type of DNA repair. The mutation of BRCA1 frequently results in breast or gynecological cancers. Given the key role of BRCA1 as a DSB repair mediator, we sought to determine radiation delivery strategies exploiting defective HR. This study analyzes the effects of underlying radiation interactions and subsequent DNA damage repair (DDR) for cancer cells harboring a BRCA1 mutation. We hypothesize that cancers with reduced BRCA1 function will be increasingly sensitive to larger biologically effective doses of radiation. Developing an understanding of BRCA1's role in DDR

could improve the therapeutic efficacy of radiation therapy for patient's harboring BRCA1 mutations.

NSCI B54
A test of dispersal polymorphism facilitating reproductive isolation in the incipient stages of speciation
Claire Boschert
Mentor: Dr. Scott Egan
Despite recent advances in the study of sympatric speciation, there are few examples clearly demonstrating speciation events in sympatry. Here we test two early mechanisms that may give rise to reproductive isolation (RI) between geographically overlapping populations of Jadera haematoloma that have formed ecologically divergent populations on different host plants. We will test dispersal ability and host preference as drivers of spatial structuring that may give rise to RI within sympatric populations. J. haematoloma has recently expanded its host range through rapid ecological adaptation of its beak length to plant species with different sized fruits. Due to a dispersal polymorphism, a proportion of the population is unable to move from their natal host, which could facilitate the development of RI between dispersers and non-dispersers. We will perform a mark-recapture experiment, releasing individuals in the vicinity of multiple potential host plants. We will measure the movement of individuals across time, while simultaneously assessing host plant preference. This work will help to inform our understanding of how RI establishes despite the homogenizing effect of gene flow.

NSCI B55
Understanding the Effect of IL-15 on the Tumor Microenvironment to Enhance Cell-based Therapies for Solid Tumors
Anna Cole
Mentor: Dr. Robin Parihar
Immunotherapy using antigen-redirected lymphocytes in patients with solid tumors has shown poor efficacy. Cell therapies are hindered in solid tumors by immune-suppressive cells such as inhibitory macrophages (M2s) and myeloid-derived suppressive cells (MDSCs) that contribute to a highly suppressive tumor microenvironment (TME). Researchers have armed redirected lymphocytes with cytokines such as IL-15 to self-promote their own proliferation and survival in suppressive TMEs. However, the effect of IL-15 on MDSCs and M2s within the TME is unknown. To determine how IL-15 affects their function, we exposed MDSCs and M2s to IL-15 and assessed their phenotype and suppressive capacity. While IL-15 had no effect on M2 phenotype, it decreased the ability of M2 to suppress T-cell proliferation. Conversely, IL-15 altered MDSC phenotype, while having a donor-dependent variable effect on suppression. These results suggest that IL-15 could potentially reverse the suppressive nature of the TME. Ongoing experiments will define the mechanisms by which IL 15 affects MDSCs and M2s and will expand the scope to other cytokines commonly used in cellular therapies like IL-2, IL-7, and IL-21.

NSCI B56

Role of fungal cell types of ((Candida albicans)) during infection of ((Danio rerio)) embryos
Annie Yang
Mentor: Dr. Michael Gustin
Candida albicans is one of the leading causes of hospital-acquired infection. An opportunistic, commensal fungus living in human mucosal membranes, C. albicans can cause candidiasis in immunodeficient hosts. During infection, two morphologies predominate – budding yeast and invasive hyphae. Current methods of tracking infection by colony-forming units may not fully account for the multinucleated hyphae present, thus underestimating the extent of infection. To better assess infection severity, I aim to use quantitative PCR to measure C. albicans genome equivalents per fungus-injected zebrafish (Danio rerio) embryo at different time points of infection, from initial rise in Candida to host-mediated fall. Thus far, my current method allows detection of upwards of ~750 C. albicans nuclei per infected host. Additionally, I developed fluorescent reporter strains of Candida that allow microscopic assessment of Candida localization in transparent D. rerio embryos and visualization of morphological distribution in host tissues over time. A double reporter strain of C. albicans is being generated for simultaneous visualization of either cell morphology in single strain-injected embryos. Using these methods, I propose to increase our understanding of the cellular basis of disease-causing mechanisms of Candida, host response to infection, and dynamics of candidiasis progression.

NSCI B57
Total Synthesis of Novel ENO2 Inhibitor Prodrug for the Treatment of ENO1-Deleted Glioblastoma
Elliot Ballato
Mentor: Dr. Florian Muller
Glioblastoma (GBM) is the most aggressive form of brain cancer, with a median survival time of 15 months. Previous work has shown that homozygous deletion of the 1p36 locus frequently incurs passenger deletion of ENO1, the dominant (~90%) isoform of Enolase. We have identified a lead compound, HEX, which shows preference for ENO2 over ENO1, and cytotoxicity towards D423 ENO1-deleted cells while sparing ENO1-rescued. HEX's major shortcoming, though, is in pharmacokinetics; its high TPSA and low logP values make it poorly cell-permeable. Our lab has hence focused on prodrugging HEX. Our current synthetic effort focuses on benzylamine and S-acyl-2-thioethyl (SATE) prodrugs which are sequentially cleaved ((in vivo)) by thioesterases and phosphoramidases. The total synthesis described here begins with two starting materials: methyl hydroxypivalate and Bn-HEX. The former is protected, hydrolyzed, and coupled with 2-mercaptoethanol. The latter is coupled with benzylamine, hydrogenated, and acetylated. The two products are then reacted to generate a promising prodrug for GBM precision oncology.

NSCI B58
Reduced Immigrant Fecundity Promotes Reproductive Isolation Between Host Associated Populations of the Gall Wasp ((Belonocnema treatae))

Amy Roush
Mentor: Dr. Scott Egan
Ecological speciation is the evolutionary process where reproductive barriers develop between populations due to divergent natural selection between environments. Reduced fitness of immigrants could contribute to this reproductive isolation. Many studies have tested the impact of reduced fitness of immigrants via reduced viability, but not reduced immigrant fecundity. This study bridges that gap by exploring the magnitude of reduced immigrant fecundity and its relative contribution to the total reproductive isolation using host-associated populations of the gall-forming wasp ((Belonocnema treatae)). We allowed two host-associated populations to colonize sapling trees of the native and of the alternative host. We measured the right hind tibias of individuals from each of the four subgroups created, as previous studies have established the linear relationship between body size and the number of eggs in ((B. treatae)). We can infer reduced fecundity with body size through this linear relationship. We found evidence of a significantly decreased tibia lengths of ((B. treatae)) on alternative hosts, supporting reduced immigrant fecundity in ((B. treatae)).

NSCI B59
Utilizing Mitochondrial Dysfunction and Hyperactive Mitophagy as a Novel Cancer Therapy
Emily Pepperl, George Liu
Mentor: Dr. Natasha Kirienko
As cancer continues to be a prominent issue within the medical community, more specialized treatments have become necessary. Our research focuses on mitotoxins as a potential treatment option as the metabolic shift undergone by cancer cells can result in the buildup of maladaptive mitochondria that may be subjected to lethal levels of mitophagy, conceivably hindering tumor survival. Strains of the model organism, C. elegans, have been sustained by RNAi bacteria, resulting in targeted knockdowns of genes found to be mutations in various cancers. Our recent focus has been to optimize the efficiency of our secondary assay. This assay utilizes the mitocan, phenanthroline, to identify knockdowns that exhibit increased sensitivity to this class of drug. Previously, the phenanthroline exposure lasted seven days, with scorings of dead worms occurring every day. In order to expedite the screenings and increase throughput, we aimed to select a single day in which a one-day scoring would yield data similar to the week-long scoring. We have retested hits of varying strength and discerned, upon analysis, that the fourth day fit these criteria.

NSCI B60
Location and Expression of ((Hoxd4a)) in Zebrafish Embryos at 24 and 36 Hours Post Fertilization
Andrea Doan, Grayson Kotzur, Teja Paturu
Mentor: Dr. Caroline McNeil
Homeobox (Hox) genes are conserved amongst all animals and control the axial development of developing embryos. However, there is limited data on how the expression of Hoxd4a changes at different points in development. The aim of this study

was to determine the location and magnitude of the expression of the Hoxd4a gene in zebrafish embryos at 24 hours post fertilization (hpf) and 36 hours post fertilization utilizing in situ hybridization. We hypothesized that Hoxd4a would be expressed in the caudal region of the neural crest and in the hindbrain, and its expression would be greater at 36 hpf than 24 hpf. Our results show that Hoxd4a is expressed in the cardiac neural crest and the caudal region of the neural tube and that the expression decreased from 24 hpf to 36 hpf. A potential reason for this is that prior studies have discovered that the expression of one Hox gene inhibits the expression of the previous Hox gene linearly from the anterior to posterior direction in embryos. Therefore, the parts of embryonic development that need Hoxd4a expression may have been completed by 24 hpf and the Hox gene expressed by 36 hpf began to downregulate the expression of Hoxd4a.

NSCI B61
Immunohistochemical Analysis of Platelet Distribution in Cancer and Colitis Tissue
Rachel Lisker
Mentor: Dr. Lenard Lichtenberger
In 1865, Armand Trousseau made the pioneering observation that late-stage cancer patients are in a hypercoagulable state and run the risk of developing thrombosis (blood clots). Since then it has been established that cancer patients often suffer from thrombocytosis, or abnormally high circulating platelets. The evidence is consistent: solid are often associated with increased platelet count. However, some of the mechanisms remain uncertain. It is known that platelet increase can directly influence an increase in metastasis, but more research is needed in order to draw conclusions about the many complex mechanisms involved in the interactions between platelets and cancer cells, so that treatments to block them can be proposed. Working with the lab of Dr. Lichtenberger at the University of Texas Health Science Center, I am using immunohistochemistry in order to analyze platelet distribution in breast cancer. colon cancer, and ulcerative colitis tissue in order to better understand these connections.

NSCI B62
Examining the Safety and Activity of SXC-2023 to Improve Behavioral Dynamics in Non-Treatment Seeking Adults Undergoing Acute Nicotine Withdrawal
Sam Shuman
Mentor: Dr. Richard De La Garza, II
Previous studies in non-treatment-seeking nicotine addicts show that subjects undergoing acute nicotine withdrawal exhibit deficits in inhibitory control, executive functioning, and mood. Alterations in glutamate neurotransmission and/or oxidative imbalances in the central nervous system have been proposed to contribute to the pathogenesis and maintenance of these deficits. SXC-2023, a novel molecule, activates the system xc- increasing the cystine-glutamate exchange in the brain. Its mechanism of activation may represent an important pathway to restore control over various pathological behaviors. This study is evaluating SXC-2023 on measures of abstinence-induced impulsivity, inhibitory control, and mood in tobacco dependent subjects. Using a double-blinded, placebo-controlled study design, 24 subjects maintain nicotine abstinence over two 5-day treatment periods. Subjects are randomized to one of two

doses of SXC-2023 and matching placebo with a ~9-day washout between regimens. Study sessions include assessments of neurocognitive control, urge, and mood. Levels of GSH in whole blood are also collected. This study is currently ongoing and data are not yet available for analyses.

NSCI B63
Heat stress alters coral photosymbiont health and viral abundance
Rebekah Bryant
Mentor: Dr. Adrienne Correa
Coral reefs are the most diverse marine ecosystems on Earth. Rising ocean temperatures threaten reefs by causing scleractinian corals to lose their dinoflagellate photosymbionts (Family: Symbiodiniaceae) in a process called coral bleaching, which often kills the coral host. While stressors that induce bleaching are relatively well documented, the physiological mechanism(s) underlying the bleaching process remains disputed. Viruses in the family Alvernaviridae potentially cause bleaching signs by lysing coral photosymbionts. This study tracks the abundance of Alvernaviridae strains in five colonies of the stony coral Pocillopora verrucosa exposed to heat stress for five days. We paired major capsid protein gene amplicon sequencing data with transmission electron microscopy images of photosymbiont cells to correlate viral abundance with photosymbiont health over time. Virus-like particles appeared in photosymbionts after 24 hours of heat stress, concurrent with photosymbiont degradation signs. Additionally, the relative abundance of certain Alvernaviridae strains changed over time. Our findings help clarify the role of Alvernaviridae in coral bleaching.

NSCI B64
Post-settlement Movement of an Obligate Sponge Dwelling Goby ((Elacatinus horsti))
Megan Siemann
Mentor: Dr. Scott Solomon
As space-occupiers and filter-feeders sponges impact reef species directly and indirectly. Sponge-dwelling gobies utilize sponge microhabitat as shelter. Obligate sponge-dwelling goby larvae preferentially settle on larger sponge tubes. It is not known whether the goby distribution patterns persist through post-settlement movement and/or mortality after the larval phase. Post-settler phase distribution is hypothesized to be maintained through movements toward preferential habitat and through persistent occupation of preferential habitat through territory holding. Here, (Elacatinus horsti)), yellowline goby, distribution and movement within sponge tube clumps of ((Aplysina archeri)) (stove pipe sponge) was investigated in Bonaire, Dutch Caribbean. Using SCUBA, presence of ((E. horsti)) in ((A. archeri)) tube clumps was visually assessed and clumps were filmed for thirty minutes to allow for analysis of goby movement post-dive. Within clumps, the majority of movements were between tubes of similar sizes, with large tubes mostly occupied by sedentary gobies. Although higher densities of gobies in larger tubes do not persist post-settlement, larger tubes are maintained as territories.

NSCI B65

How Drones can Enhance Visualization of Geological Data and Understanding of Environmental Processes
Jessica Sheldon
Mentor: Dr. Kirsten Siebach
Drone technology and the high resolution datasets it enables stand to revolutionize our understanding of the Earth's surface. A better understanding of the Earth's surface will both help us visualize and interpret the geological formations that contain the story of Earth's past and help us see the active geological and environmental changes that are happening today. Our research aims to see how drones can be implemented to improve and expand data collected in the field and apply that to understanding local environmental changes in the Houston area.
In particular, we are working to undergo a two year long project of collecting images over the Katy Prairie to detect change over time. This area, while currently largely undeveloped, is expected to be developed into subdivisions. The Katy Prairie currently acts as a natural source of flood mitigation and prevention for the larger Houston area. This large wetland absorbs water that would otherwise runoff into the lower Houston metropolis. Our goal with the drone is to collect before, during, and after images of potential development to see how the change effects properties such as absorption and retention.

NSCI B66
Analyzing Cytotoxicity of Dual C43SC43F CD96-specific CAR T Cells against AML Tumor Cell Lines in Co-Culture
Roma Nayyar
Mentor: Dr. Cliona Rooney
Acute Myeloid Leukemia (AML) is a common form of leukemia and has poor prognosis due to high relapse rates. CAR T cell therapy, which uses bioengineered T Cells to target & kill cells which display specific antigens, is a novel treatment option. CD96 is highly expressed on leukemic stem cells, has low expression on normal hematopoietic stem cells, and thus, is an ideal antigen target for CAR T cell immunotherapy. CD96 specific CAR constructs C34 & C43 are effective against AML in vitro, and thus a dual C34SC43F CD96 specific CAR T cell was created in hope of making a more effective & applicable CD96 specific CAR T cell. My project tested cytotoxicity of these CAR T cells, and compared them to their single CAR T cell counterparts (C34S/C43F) and the original CD96 specific CAR T cells (C34/C43). The growth and relative percentages of tumor and CAR T cells in co-culture were measured, using two different tumor cell lines- IMSM-2 and Molm-13- with 1:1 and 1:4 effector to target cell ratios. Results showed that C34S43F CAR T cells didn't show improved cytotoxicity or CAR T cell growth. However, CAR T cell behavior did have a correlation with the tumor cell line used.

NSCI B67
Visuospatial attention modulates motor cortex excitability
Snigdha Banda
Mentor: Dr. Jeffrey Yau
Sensory processing guides our motor behaviors. To prime actions, visuospatial attention may automatically engage the motor cortical system. Here we characterized

the effects of visuospatial attention on motor cortex (M1) excitability. In two experiments, we delivered transcranial magnetic stimulation (TMS) over left M1 while measuring motor evoked potentials (MEPs) from the right hand. We manipulated participants' visuospatial attention using a visual detection task performed on targets near the left and right hands. In Experiment 1, spatial attention directed near participants' right hand, even in the absence of visual cues, resulted in increased left M1 excitability. This result reveals the effects of endogenous visuospatial attention on M1 excitability. In Experiment 2, we replicated the effects of endogenous visuospatial attention and characterized the effects of exogenous visuospatial attention and the temporal profile of visual influences on M1 excitability. Our results imply that visuospatial attention automatically modulates M1 excitability. The automatic engagement of the motor system by visuospatial attention circuits results in faster and more precise motor behaviors.

NSCI B68
Evaluating Autophagy in ER Stress Clearance with Resveratrol
Juliana Wu
Mentor: Dr. Karen Posey
Pseudoachondroplasia (PSACH) is a dwarfing condition associated with severe early onset osteoarthritis and joint pain. Mutations in cartilage oligomeric matrix proteins cause PSACH by affecting protein folding and export pathway to the extracellular matrix, causing intracellular retention and increased ER stress in chondrocytes. To keep chondrocytes functional, mTORC1 signaling increases protein synthesis but consequently represses autophagy, one mechanism to clear the misfolded proteins causing the ER stress; however, suppressing this clearing pathway will worsen protein accumulation. We have shown that resveratrol reduces PSACH chondrocyte pathology and reduces the amount of mis-folded COMP in the ER. The purpose of this study was to evaluate if autophagy is the mechanism which clears the ER with resveratrol treatment. In this study, MT-COMP expression was induced in a rat chondrosarcoma (RCS) cell line and autophagy was tracked using the autophagosome marker, LC3, and chloroquine treatment. Immunostaining was used to determine if autophagy was responsible for resveratrol clearance of MT-COMP from the ER of chondrocytes.

NSCI B69
Analyzing ((Solenopsis invicta)) Venom Proteins For The Presence of DEAD-Box Helicases
Rhea Cholia, Anu Dwarumpudi, Trevor Egerton, Ryan Vu
Mentor: Dr. Collin Thomas
((Solenopsis invicta)) is an invasive fire ant species whose venom has been characterized as a mix of proteins and alkaloids. The published fire ant venom proteome indicates presence of at least one RNA modifying enzyme in venom. This observation combined with a growing literature which shows that reptile venoms contain all of the mRNA species present in the venom glands, have prompted our group to directly test for the presence of RNA and RNA modifying proteins in venom. In this study we present a novel device for harvesting ant venom, the venom ejection

electrostimulator or VEE. When ants encounter the activated VEE they engage in gaster flagging and release detectable droplets of alkalinized venom spray onto the VEE. We present biochemical data which demonstrate that the electrically treated ants have a lower concentration of venom proteins than the untreated ants. It is our hope that this device will aid other researchers in their study of fire ant venom and provide a new method for commercial venom isolation.

NSCI B70
Abiotic and Biotic Factors in the Decomposition of Invasive Plant Litter
Clay Musial
Mentor: Dr. Evan Siemann
Decomposition rates may depend on the chemical characteristics of plant litter and the soils in which they decompose. In addition, soil communities may reflect long-term litter inputs, so novel plant litter may decompose more slowly. Here we investigated how characteristics of recipient soils (in which litter decomposes) interact with those of source soils (in which a plant grew) to determine litter decomposition rates. We conducted factorial greenhouse and lab experiments with Chinese tallow tree ((Triadica sebifera)) litter from various populations grown or decomposed in soils collected from 6 sites in LA and TX under tallow trees or native vegetation (66 soils). We grew plants for 3 months, removed and dried their leaves, added them to different soils (500 trials), and estimated decomposition as litter mass loss after 30 and 60 days. We will use ANOVAs and ordination to examine individual and combined effects of differences in soil elements between source and recipient soils. Through ANOVA we will also examine the importance of dominant vegetation on decomposition rates. Together, this will advance our understanding of abiotic and biotic factors controlling litter decomposition.

NSCI B71
"The Expression of ((hoxb7a)) in wild type Zebrafish Embryos"
Akshaya Venkatesh, Maia Helterbrand
Mentor: Dr. Carrie McNeil
The gene ((hoxb7a)) regulates the growth of the body axis and central nervous system through activation, particularly during the stage of development for zebrafish embryos. It is predicted that ((hoxb7a)) gene will be expressed in the hindbrain region at 24 hours post-fertilization (hpf) and there will be higher expression in the same region at 36 hpf. Therefore, the expression of hoxb7a gene in zebrafish embryos at 24 hpf and 36 hpf was investigated using in situ hybridization. The ((tgfb1a)) gene was used as a positive control as it is understood that ((tgfb1a)) regulates cell growth, proliferation, differentiation and is expressed throughout the caudal region of the zebrafish embryo. The expression of ((hoxb7a)) at 36 hpf differs from the expression at 24 hpf as evidenced by more signal seen throughout both the neural crest region and caudal region, while ((tgfb1a)) expression remained in the caudal areas. Understanding the expression patterns of ((hoxb7a)) will provide insight to the embryonic development of high level organisms such as mice or humans as this family of genes is conserved amongst all species mentioned.

NSCI B72

Electrophysiological Recordings in ((Hydra vulgaris))
Jared Beshai
Mentor: Dr. Guillaume Duret
Hydra vulgaris has emerged as a promising model organism to study neural plasticity and understand the relationship between behaviors and neuronal networks. Neurobiologist are in need of such new models, but meaningful advances in understanding the neural net require a thorough comprehension of the individual neurons' electrical activity. While whole-body recordings and extracellular traces from Hydra have been observed in the past, we aim to record the electrophysiological activity of single neurons to better understand the mechanisms of neural signal transduction. Specifically, we want to determine whether the neurons have action potentials and what type of voltage gated channels are implicated in signal transmission. Understanding the ionic mechanisms of signal transduction will generate a more robust foundation of knowledge to use Hydra as a model for more complex neural circuits in the future. To reach this end, we are developing protocols to 1) separate single, living neurons from Hydra bodies and 2) use perforated patching to clamp these neurons and monitor their internal electrophysiology.

NSCI B73
Proximity Induced Site-Specific Antibody Modification
Ruchi Gupta
Mentor: Dr. Han Xiao
Monoclonal antibodies with high specificity and homogeneity have useful applications in research, diagnosis, and immunotherapy. Most antibody labeling techniques, however, include non-specific reactions that result in heterogeneous antibody conjugations, or employ site-specific conjugation methods by antibody engineering, which can be costly, time-consuming, and reduce conjugation efficiency. To site-specifically label native antibodies without antibody engineering or UV/chemical treatment, the Xiao lab has developed a method of proximity-induced conjugation technology (pClick) that uses non-canonical amino acids (ncAAs) that enable proximity-induced covalent attachment to a nearby lysine reside. Using solid phase synthesis, we modified a Fc-(III) peptide to bind to anti-PDL1 antibodies as a possible chemotherapeutic target. In addition, we also developed a traceless antibody modification method by incorporating tyrosine derivatives into the structure of the B domain from Staphylococcus protein A (FB). This novel method can be used to site specifically modify residues on antibodies without any antibody engineering, which has important implications in research and therapy.

NSCI B74
Substrate Stiffness Influences The TLR7/8 driven Immune Response in Dendritic Cells, Regulating The Expression of Exogenous Messenger RNA
Maishara Muquith
Mentor: Dr. Jeroen Pollet
Recent innovations have enabled ((in vitro)) transcribed messenger RNA (mRNA) to become a promising platform for vaccine development. Unfortunately, ((in vitro)) data of mRNA transfections has often proven to be a poor indicator of in vivo data. This discrepancy prevents the use of the cell culture model as a high-throughput screening

tool. We believe that by reducing the stiffness of culture plates, a more natural extracellular environment can be reproduced. Our hypothesis is that in standard cell culture plates, the innate immunity of the cell is downregulated, leading to inconsistent results between ((in vivo)) and ((in vitro)) testing. Our data indicates a possible important role of the toll-like receptors (TLR) 7/8. While RNA can trigger the cell`s TLR7/8, 5-methoxyuridine mRNA cannot. Using standard mRNA, we measured a 50% reduced transfection efficiency in dendritic cells grown in culture plates with reduced stiffness compared to the standard culture plates. Using 5-methoxyuridine mRNA, the overall protein expression increased and the difference between the plates was only 15%. RT PCR and western blot analysis will be applied to further prove the role of these TLRs.

NSCI B75
Rehabilitation Robotic Unloading System: Effects of Unloading on Electromyography and Joint Kinematics during Overground Walking in Able-Bodied Individuals
Concepcion Chinwe Appio-Riley
Mentor: Dr. Shuo-Hsiu Chang
Neurological imparities developed as a result of disorders such as a stroke, spinal cord injury, multiple sclerosis, etc. may cause gait impairment. Body weight unloading (BWU) can be used for gait training, but efficacy remains unclear. BWU has been commonly used with treadmills as a method of gait rehabilitation. However, studies have shown that treadmills modify gait biomedical parameters and thus confound the effects of BWU. By utilizing an overground BWU system we were able to assess the unique effects of BWU on healthy subjects' kinetics during overground gait. Ten healthy subjects walked overground in a control (no suspension) and four (10%, 20%, 30%, 40%) BWU experimental conditions. The kinematic measures and EMG activity of the tibialis anterior, soleus, gastrocnemius lateral head, vastus medialis, rectus femoris, semitendinosus, biceps femoris (long head), and gluteus medius were recorded. It is important to investigate the effects of BWU on healthy individuals' gait kinematics and muscle activity to better implement rehabilitation protocols for individuals with gait impairments.

NSCI B76
Differentiation of Symptoms of MBD5-Associated Neurodevelopmental Disorders from Those of Cerebral Palsy and Ataxia.
Nithya Gillipelli
Mentor: Dr. Sarah Elsea
To approach the treatment of rare genetic disorders, the underlying pathophysiological mechanisms must be well understood. Our project focused on MBD5-Associated Neurodevelopmental Disorder (MAND), a rare condition associated with either a 2q23.1 microdeletion including MBD5 or a mutation in MBD5. Intellectual disability, seizures, and hypotonia are common features associated with this genetic syndrome; however, because of the recent identification of this disorder, the extent of the phenotype is not fully known. Thus, this study was focused on understanding ambulation to determine if this patient population has an underlying movement disorder. We surveyed primary

caregivers of children with a diagnosis of MAND (n=59) to determine primary concerns regarding movement for this population. Approximately 41% of respondents mentioned that their child reached a developmental milestone and then lost that ability. We conclude that MAND could have neurodegenerative elements. By seeking out the individualistic characteristics of MAND, we will be able to have a better understanding of the effects of 2q23.1 deletion syndrome, allowing us to find solutions to treat this rare genetic disorder.

NSCI B77
Characterization of apoptotic body biogenesis in human breast cancer cells after chemotherapeutic treatment (James Chen, Jovany Franco, Safia Essien, and George T. Eisenhoffer)
James Chen
Mentor: Dr. George Eisenhoffer
Tumor repopulation is a major challenge in cancer therapy, yet the pathways that mediate this process remain poorly understood. Previous studies on apoptosis suggest that activation of caspase-3 and production of WNT proteins play a major role in apoptosis-induced proliferation. However, little is known about how these proteins are delivered to surrounding cells to induce proliferation. The Eisenhoffer lab recently discovered that small extracellular vesicles containing mitogenic cues, termed apoptotic bodies, are released from dying cells. I hypothesize that cancer cells may hijack this mechanism to stimulate proliferation after chemotherapeutic treatment. Caspase-3 activation and Wnt3a production were quantified in MDA-MB231 human breast cancer cells after chemotherapeutic treatment or UV damage. Time-lapse high-resolution imaging revealed the packaging of RNA and DNA during apoptotic body biogenesis. Future experiments will determine the identity of the packaged RNAs and if they contribute to proliferative pathways. Overall, our study shows that cancer cell derived apoptotic bodies contain proliferative cues and may provide a novel signaling mechanism for tumor repopulation.

NSCI B78
Dinoflagellate Endosymbiont (Family ((Symbiodiniaceae))) Community Dynamics During Coral Bleaching
Jordan Sims
Mentor: Dr. Adrienne Correa
Stony corals form obligate mutualisms with endosymbiotic algae (Family Symbiodiniaceae). During environmental stress, this mutualism is disrupted, and corals lose mass quantities of symbionts through “bleaching”. The Adaptive Bleaching Hypothesis posits that different symbiont species confer different physiological traits to the host, and hosts may preferentially expel and reuptake symbionts to acclimatize to environmental conditions. To investigate this, colonies of ((Acropora hyacinthus)) were subjected to heat or control temperature treatments over 78 hours. Samples of retained and expelled symbionts were isolated from both treatments during the experiment. Symbiont communities were characterized through amplicon sequencing of the Internal Transcribed Spacer-2 region of Symbiodiniaceae rDNA, and I present results of the retained and expelled symbiont assemblages during the bleaching process. All

assemblages were dominated by genus ((Cladocopium)), but diversity of low abundance background symbionts was decreased in heat treatments. This work provides insight into coral-symbiont dynamics and the role of symbionts in coral acclimatization to changing environmental conditions.

NSCI B79
Roles of Genes 45 and 46 during Infection of ((Bacillus subtilis)) by Bacteriophage SPO1
Alexis Williams, Gabriel Gomide
Mentor: Dr. Charles Stewart
When bacteriophage SPO1 infects B. subtilis, it converts the cell from a factory for making new bacteria into a factory for making new phage. A cluster of 24 SPO1 genes is primarily responsible for this host-takeover process, and we are studying the mechanisms by which they function. Genes 45 and 46 are a 2-gene operon within that cluster. When expressed in uninfected cells, they inhibit cell-division and cause cell death (suggesting that elucidating their mechanisms may provide a basis for development of new antibiotics). By comparing rates of macromolecular syntheses during infection by phage mutant for genes 45 and 46, with those during infection by wild type phage, we have determined that the double mutant shuts off host DNA and RNA synthesis as effectively as the wild-type, but is significantly deficient in shutting off host protein synthesis, suggesting that gene products 45 and 46 are specifically inhibitory to host protein synthesis, which may be how they inhibit cell division and viability. Fluorescence microscopy during infection by mutant phage shows subtle changes in nucleoid division, cell division, and cell length compared with infection by wild type phage.

NSCI B80
Effects of Blood Flow Restriction on Rotator Cuff Muscles
Christine Wang
Mentor: Dr. Bradley Lambert
Blood flow restriction (BFR) therapy has been observed to be efficacious for preventing post-operative atrophy in the limbs when combined with low intensity resistance exercise (LIX). BFR therapy research is underdeveloped for rehabilitation and injury prevention protocols in the upper body. Based on previous literature and clinical observations, we hypothesized that a combination of BFR and low intensity rotator cuff training (BFR-Rx) would elicit greater increases in rotator cuff strength and endurance compared to standard low intensity resistance training alone (noBFR-Rx). Additionally, we hypothesized that BFR would elicit greater activation of shoulder musculature during acute exercise. Combined BFR-Rx using common RC exercises may yield greater increases in shoulder/arm lean mass as well as maximal RC and deltoid strength. BFR also appears to improve muscular endurance, as the BFR-Rx group was able to achieve greater increases in weekly exercise volume due to greater activation of shoulder musculature.

NSCI B81

The Effect of COMT and DAT1 Genetic Polymorphisms on Resting EEG Activity in Healthy Individuals
Ananya Venkat
Mentor: Dr. Raymond Cho
Common psychiatric disorders such as schizophrenia and bipolar disorder can be chronic and severe, greatly affecting thought, emotion, and behavior. In many of these disorders, the dopamine circuits and gamma oscillations involved in the brain's cognitive processes are disturbed. Previous research has yet to identify the variability of the interactions between the neurotransmitter/chemical messenger dopamine (DA) and gamma activity in normal and pathological conditions. This investigation is part of a larger study on the genetic basis of variability in gamma responses within the brain's cortex. This part of the study is focused on single nucleotide polymorphisms of the catechol-O-methyltransferase (COMT) gene and the DA transporter gene (DAT1) and their associations with variations in Gamma and Alpha activity during rest in healthy human controls. Although the subjects of the study were healthy controls, the results may provide preliminary evidence for certain genetic, chemical, and electrical mechanisms that contribute to some psychiatric disorders. The information gained from this research may help in the development of treatments targeting the identified mechanisms.

SOSC B82
Acknowledging Impostor Phenomenon: How Does It Affect an Individual's Likeability?
Miranda Cole, Jennifer Lee, Arjun Peddireddy, Jerry Wu
Mentor: Dr. Sandra Parsons
The impostor phenomenon (IP) refers to a sense of intellectual fakeness that exists in a variety of groups, including college students. The current study addresses a gap in the literature and investigates how the impostor phenomenon influences the social interaction among students. The participants read a paragraph that described a typical Rice student, who either disclosed (N=148) or did not disclose impostor feelings (N=144), and rated the likeability of the student. As it turned out, there was no main effect of disclosure status on likeability ratings, and the participants' own impostor levels had no influence, either. However, gender differences were present in the data, as female subjects had severer impostor feelings and gave higher likeability ratings; we think that these are potential results of gender norms. In addition, the data reflected the prevalence of impostor phenomenon on campus, because the average survey score of participants fell to a medium level of IP, and very few subjects qualified for absence of IP. In this way, the impostor phenomenon is a paramount mental health issue that warrants attention.

SOSC B83
Priming Effects on Situational Evaluations of Binge Drinking
Michelle Fokam, Daphne Campo, Anh Tran, Aubrey Lewis
Mentor: Dr. Sandra Parsons
The administration at Rice University has banned certain words and themes in Beer Bike theme names due to their potential influence on student behavior during Beer Bike.

To examine this efficacy of the word ban, this study will look at how these banned words influence students' evaluations of situations relating to drinking and Beer Bike. A group of participants will be primed with Beer Bike themes containing these banned words and the other will not. The subjects' potential behavior will be assessed by hypothetical Beer Bike scenarios derived from the ((Arnett Inventory of Sensation Seeking)) questionnaire. We expect subjects that are primed with Beer Bike themes containing banned words will exhibit higher sensation seeking responses. If the results show there is a difference in responses, then the ban is effective and valid, and if not, the ban may need revision.

SOSC B84
The Effect of Active Shooter Training on Employee Stress and Stigma
Claire Sandman
Mentor: Dr. Mikki Hebl
Despite the prevalence of mass shootings covered by the media, no research has examined the effect of the seemingly ever-growing threat of mass shootings on people's daily stress in the workplace. Study one of the current research was an exploratory study to discover the experiences and perceptions workers have related to mass shootings in the workplace. Overall, people seem to not experience stress about the possibility of mass shootings in the workplace; however, people are making a connection between mass shootings and mental illness. Study two experimentally measured the how current active shooter training are affecting employee stress and mental health stigma. Participants were given the active shooter training, or a control training, and then measured on their perceived stress about mass shootings, mental health stigma, personality, and content knowledge. I predict that the training will increase stress and stigma against mental illness, while not increasing content knowledge. Such findings would have implications for organizations deciding the type of training they should implement.

SOSC B85
Identity Management in the Workplace: Strategies for Individuals with De-Legitimized Disabilities
Rebecca Godard
Mentor: Dr. Mikki Hebl
Many employees with disabilities withhold requests for workplace accommodations, often due to anticipated negative social consequences. Ethnographic research suggests that people with socially de-legitimized disabilities (that is, disabilities that are popularly associated with malingering, oversensitivity, or unfair pursuit of performance advantage) have a particularly hard time receiving appropriate accommodations. This study uses both surveys and laboratory situations to examine the efficacy of various identity management strategies that individuals with de-legitimized disabilities might use when requesting academic or workplace accommodations. Results indicate that differentiating strategies are the most effective at increasing the perceived fairness of an accommodation request from an employee with a de-legitimized disability. The results of this study will contribute to existing theories, as well as provide insight into organizational best practices for ensuring that employees with de-legitimized or invisible disabilities receive appropriate accommodation.

SOSC B86
Phonetic Correlates of Sublexical Contributions to Reading Aloud Familiar Words
Anne Turney
Mentor: Dr. Simon Fischer-Baum
In order to perform the task of reading words aloud, two cognitive systems must work together – the system responsible for visual word recognition and the system responsible for speech production. The dual-route connectionist (DRC) model of reading (Coltheart et al., 2001) proposes that activation cascades through the whole path, starting from the initial orthographic analysis of the letter identities in word, extending through the lexical and sublexical processes, and terminating in a level of representation that has been argued to correspond to the post-lexical phonological level in theories of spoken production (Goldrick & Rapp, 2007). These distinct routes can generate different phonological plans for certain kinds of words, such as irregular inconsistent words. This study uses phonetic measurement during reading aloud to examine the assumptions that the DRC model makes. We investigated if phonetic traces of the sublexical route are present in words read aloud after being primed for the sublexical route with nonwords or irregular words.

SOSC B87
Relationship between Child Language Learning and Socioeconomic Status of Immigrant Families in Houston, TX and Minneapolis, MN: A Descriptive Demographic Study
Jacob Bhoi, Jane Clinger, Sai Lammata, Sachi Paul
Mentor: Dr. Özge Gürcanlı
When immigrating to a new country, children of immigrants face many unique developmental challenges. One of the most salient is the pressure to learn and maintain multiple languages, often with limited resources and support. In this demographic study using the open-science data tool by Urban Institute, we examine the relationship between children of immigrants' socioeconomic status (SES) and their English language development, comparing 2015 data from Minneapolis and Houston. In Minneapolis, 8.79% of high income children are bilingual, whereas in Houston, this number is 21.49%. When ethnic background of the immigrant families is considered, Minneapolis has a higher percentage of children of African immigrants than Houston (26.27% vs. 5.66%) and lower percentage of Mexican immigrants (18.11% vs. 54.34%). We discuss the role of SES of immigrant families in relation to their ethnic background. We argue that the high number of bilinguals in Houston can be explained by the prevalence of Spanish speakers in Houston compared to the relative lack of those who speak African languages in Minneapolis and hypothesize a relationship between language community and socioeconomic mobility.

SOSC B88
Stereotypes Across Party Lines: The Effects of Political Attitudes on Perceived Party Membership
Sofia Russo, Natalie Sanchez, Viola Yu

Mentor: Dr. Sandra Parsons
After the 2016 presidential election, political identification has become even more polarized. Past research has shown that political ideology can decrease cooperation and trust with others if they are from political outgroups. Given that Rice University, a largely Democratic campus, is located in Texas, a historically Republican state, it is of particular interest to us to learn about political stereotypes and their impact on co-partisan relationships in the student populace. Participants (n=187) were randomly assigned to one of four scenario conditions (Republican/Democrat man/woman) and completed an adapted Reyson Likability Scale, a set of demographic likelihoods that the individual in the scenario characterized, and a Political Implicit Attitude Test. Our results showed that while Rice students do not have different attitudes (i.e. likability ratings) towards members of their political ingroup compared to their political outgroup, they do assess other characteristics differently based on group membership. For example, Democrats attributed minority status more to fellow Democrats rather than to Republicans. Thus, future work should further explore cross-party stereotyping.

SOSC B89
Homesickness and Help-Seeking Behavior: Exploring the Impact of Social Stigma
Anna Seballos, Sierra Jenkins, Sean Olsen
Mentor: Dr. Sandra Parsons
Current experimental designs studying university student homesickness are limited. Additionally, little is known about the impact of the social stigma of homesickness on homesick individuals. This study investigated the effect of triggering feelings of social stigma and of first-year status on an individual's admittance of homesickness and their expressed willingness to seek help from a friend or professional for feelings of homesickness. Rice University undergraduate students' level of admittance was not shown to significantly differ based on the manipulation of social stigma or first-year status. The present study also performed exploratory analyses that showed an association between level of homesickness and the likelihood of admitting homesickness. Analysis of results and suggestions for future research are discussed.

SOSC B90
Analyzing Student Choices between Experiential and Material Purchases
Anna Croyle, Kathleen Bradbury, Rohan Bhardwaj
Mentor: Dr. Sandra Parsons
Many consumers spend money in pursuit of happiness or as a way of expressing a sense of self. Previous research indicates that people will preferentially choose material goods over experiential goods, even though purchasing material goods has been shown to be associated with less happiness and life satisfaction. This study focuses on this tendency to mis-forecast purchases within the population of college students. We created a survey in which one group was primed with the finding that experiential purchases lead to more happiness. Both groups answered questions about which purchase (experiential or material) people in hypothetical spending scenarios should make, depending on whether the money was earned or given. While we found no difference in purchase type based on the prime, a chi-squared analysis showed a significant difference based on money source. Looking at the data, when money was

earned, material purchases were chosen more, and when the money was given, experiential purchases were chosen more. This implies that purchasing decisions differ based on money sources. However, further research is still needed as our study only replicates existing work in a student population.

SOSC B91
Employment-Based Opportunity Improves Quality of Living for Adults on the Autism Spectrum
Lauren Palladino, Lindsay Josephs
Mentor: Dr. Lawrence Hampton
Spectrum Fusion is a Houston-based, non-profit organization that seeks to expand educational and occupational opportunities for young adults on the autism spectrum. Furthermore, Spectrum Fusion hopes to provide their participants with a sense of belonging and purpose, particularly through its Reactor Room program, which connects participants with prominent community members to turn their talents and passions into internships, jobs, and other interest-based opportunities. Using Spectrum Fusion as a case study, we seek to ask whether the quality of life of these adults has been significantly improved through the programming. To measure this, we have implemented six psychological measures: the Beck Anxiety Inventory, Beck Depression Inventory, Beck Hopelessness Scale, Mood and Depression Assessment Questionnaire, Sense of Belonging Scale, and Suicide Behavioral Questionnaire. We found that when participants were matched for their scores on the Beck Depression Inventory, Beck Hopelessness Scale, and Sense of Belonging Scale, there was a statistically significant difference between their scores before and after participating in the Reactor Room ($p=.016$, $p=.012$, $p=.024$ respectively).

SOSC B92
Consumer-Z: An Assessment of Consumer Bankruptcy Risk
Elizabeth Rasich
Mentor: Dr. Alex Butler
Accurately estimating the probability that a given consumer will go bankrupt is of critical importance to lenders. Although corporate bankruptcy and corporate financial distress have received a great deal of attention in the literature, starting with Altman (1968), consumer bankruptcy has remained a less well-understood area. In addition, much of the existing literature on consumer bankruptcy uses either survey data of individuals, which may be biased due to its inherent reliance on self-reporting of financial information, or aggregates data across states or nations, losing granularity on an individual level. This paper aims to fill those gaps. I utilize a large 1% sample of Experian credit reports that provide a thorough financial history of individuals over the course of 2004-2017 to analyze the risk factors for consumer bankruptcy filings. I also develop an analog to the Altman Z-Score which quantifies the risk of an individual filing for bankruptcy in the next year.

SOSC B93
Narrative Framing and Portrayal of Immigrants in German Print Media

Erika Schumacher
Mentor: Dr. Keith Hamm
In 2017, a report (Georgiou & Zaborowski) traced the media portrayal of the 2015 refugee crisis and of immigrants in European countries. The authors reported a general negative portrayal of immigrants in the news. Additionally, they showed a shift: the refugee crisis was initially described as a humanitarian issue that transcended boundaries; by the end of 2015, each country viewed migrants as an issue of national security. My research revisits the media narrative around the migrant crisis in 2018, specifically in Germany, which accepted an exceptionally large number of refugees. My research categorizes newspaper articles written on the topic of immigration over the course of 2018, finding that the issue of immigration has shifted narratives once again. While not necessarily making value statements on immigrants themselves, German print media presents positive images of immigrants in an economic context and negative images of immigrants in a societal context. Further, immigration is overwhelmingly an issue of politics and policy. In this way, the print media talks ((around)) immigrants, showing them as an issue of electoral politics instead of societal participants.

SOSC B94
Gender, Physical Activity, and Social-Cognitive Motivations
Rose Click, Erin Krusleski, Vineel Mallepalli
Mentor: Dr. Chase Lesane-Brown
This study investigated gender differences in physical activity and underlying social-cognitive theory (SCT) variables among Rice University undergraduates. A previous study examined these variables specifically among Hispanic college students (Magoc et al. 2016); we are replicating their methods in the diverse Rice University undergraduate population. Participants responded to several measures of their regular physical activity habits as well as self-efficacy, outcome expectations, goal-setting and planning, and social support for exercise. The previous study found that men report engaging in significantly more physical activity and score significantly higher on measures of SCT variables, compared to women. They found gender to be a significant moderator of the relationships between SCT variables and physical activity. Specifically, self-efficacy and self-regulation are the strongest predictors of physical activity for women, whereas body image is the strongest predictor of physical activity among men. We expect to find similar results in this study, which could be practically significant in promoting physical activity among college students.

SOSC B95
The Effectiveness of Governmental Reforms on Preventing Civil War Recurrence
Maurice Frediere
Mentor: Dr. Mark Jones
The post-Cold War world saw more civil wars than at any other point in human history. While the prevalence of intranational conflict has abated in the last two decades, the transition from a wartime to post-conflict society is of the utmost importance as a matter of both academic research and policy implementation. Through this project I hope to identify what kind of governmental systems are most effective at preventing civil war

recurrence and how much of an effect those institutions have on actually preventing recurrence. There's rather expansive research on the reality that weak institutions and failed states are highly likely to experience civil wars and that democracies are less likely to experience civil war than autocracies. There are many causal mechanisms when predicting whether or not a civil war is likely to occur in a nation, however, in this study I hope to isolate what types of reforms and institutions have proven most effective in preventing relapse into conflict in countries that have already proven susceptible to civil war.

SOSC B96
Understanding Reproductive Health Needs Among Refugee Populations in Lesvos, Greece
Annum Sadana
Mentor: Dr. Marwa Shalaby
More than 68.5 million people are either internally displaced, have refugee status, or are currently seeking asylum. The public health consequences of displacement include—high death rates and a need for treatment of non-communicable diseases, vaccination, mental health activities, maternal and obstetric care, trauma care, and provision of hygiene facilities. Female migrants are often at risk of sexual and gender-based violence. This study builds on observational and qualitative interview data conducted in Lesvos, Greece in the Summer of 2018 to investigate reproductive and maternal health as well as general safety of asylum-seeking women. I have researched women's health and well-being in the camp, including access and frequency of visits to health professionals, access to bathroom facilities and family planning methods, and feelings of safety and wellness in general. Preliminary findings highlight the cultural barriers and other obstacles women face in obtaining medical care for necessary issues and how their health is inherently tied into their asylum process.

SOSC B97
Social Resources during Emergency Department Discharges: The Impact of a Volunteer Patient Discharge Initiative on Emergency Department Revisits
Daniel Wang
Mentor: Dr. Michael Jaung
Emergency Department (ED) visits have outpaced rates expected from population growth. Limited studies examine ED discharge interventions to improve outcomes. The Patient Discharge Initiative (PDI) is a volunteer organization providing educational interventions to discharged ED patients through counseling, connection to social resources, and post-ED follow-up telephone calls.
The goal of this study is to examine the rates of ED revisits and outpatient follow-up of patients receiving the PDI intervention.
We reviewed written records of interventions between September 1, 2017 and May 1, 2018. We examined electronic medical records to obtain demographics, chief complaint, and follow-up and ED revisit rates.
494 patients were included in data analysis. Patients who received follow-up calls and used one resource had significantly lower ED revisit rates within 90 days of the initial ED discharge compared to those who did not receive a follow-up call (13.5% vs 25%; p

= 0.028); however, they had no significant difference in follow-up appointment attendance.
These data show potential for an ED discharge intervention focused on providing underserved patients with social resources.

SOSC B98
Parental Decision-Making for High-Risk Neonates
Shweta Sridhar
Mentor: Dr. Frank Placencia
The Placencia Lab at Texas Children's Hospital aims to survey parents of high-risk neonates to determine what information they would have wanted while their child was on life support. By conducting interviews with a refined set of queries, we intend to qualitatively assess how parents make medical decisions for their critically ill newborns. Parents must take into account factors such as their child's quality of life, treatment options and their feasibility, how decision-making would impact other family members, and socioeconomic constraints. We hypothesize that parents will consider long-term effects on all family members and will want to work with physicians to ensure the best outcome for everyone while adhering to the Best Interests Standard. By applying linguistic coding techniques on transcriptions of parent interviews, we will isolate common themes that arise in parental decision-making. Using this knowledge, we plan to standardize the education provided to prospective parents of high-risk infants. Our long-term goal is to take parents' experiences and feedback and construct a cohesive understanding of how parents conceptualize the Best Interests Standard.

SOSC B99
3D Printed General, Non-Patient Specific, Bleeding Human Airway Model as a Teaching Method for Emergency Surgical Cricothyrotomy
Smeet Madhani
Mentor: Dr. Shane Jenks
Due to the limitations of current teaching models of surgical cricothyrotomy, a 3D printed model mimicking human anatomy was designed and tested with a group of Emergency Medicine (EM) residents. The purpose of the new model was to assess its viability as a more accurate teaching model in comparison to one of the current teaching methods, a sheep trachea. The 3D printed model has more human anatomic realism while the sheep trachea is solely comprised of the laryngeal anatomy with no tissue or blood simulation. EM residents practiced the surgical procedure on both the 3D printed model and the sheep trachea and then completed surveys assessing each model's similarity to a real human. 13 of the 17 responses stated that the 3D printed model offered a more accurate representation of the real-life procedure on a human patient than did the sheep trachea. Thus, the results support that practicing with the 3D printed model has the potential to better prepare EM residents for a live cricothyrotomy. This data provides enough evidence for the continued use and measurement of the effectiveness of this 3D printed model as an improved alternative to current methods in emergency surgical practice.

SOSC B100

Early Voting and the Contingency Model of Voter Turnout in the 2018 Texas State Senate District 6 Special Election

Chloe Wilson
Mentor: Dr. Robert Stein

The creation of early in person (EIP) voting periods has been a popular policy implemented by state legislatures seeking to increase voter turnout through decreasing the costs of going to the polls. The efficacy of EIP voting has been questioned in the literature. EIP voting has, however, changed the way in which campaigns are run (Burden et al 2014; Hamel et al 2018). Using individual level paid phone bank call data from the Ana Hernandez campaign for the Texas State Senate District 6 special election held on December 11, 2018 and district wide voter history data I examine the efficacy of campaign contact under early voting conditions. I find this contact to be on the whole ineffective when accounting for vote history. Notably, I also find that contrary to Arceneaux and Nickerson's (2009) contingency model of campaign contact, in this low salience election, voters with lower propensity scores responded to campaign contact more than those with higher scores. These findings have important implications regarding the status quo model of campaign contact currently implemented and how it can be modified to be both more effective in turning out voters in low salience elections.

ENGI B101

Incorporation and Characterization of Coiled Coil Tags in Adeno-Associated Virus

Joanna Yang
Mentor: Dr. Junghae Suh

Adeno-associated virus (AAV) has been established as an efficient gene therapy vector due to its low immunogenicity. Previous research has demonstrated that small peptide motifs can be inserted in the virus capsid sequence to modify virus targeting while preserving functionality. However, insertion of larger proteins, such as antibodies, may disrupt the formation of the virus. We sought to develop a method of attaching larger proteins to AAV using coiled-coil domains (CCDs). Pairs of complementary coiled-coil domains dimerize through hydrophobic and electrostatic interactions. By introducing a CCD into the viral capsid, the virus may bind to large proteins with a complementary CCD tag. We introduced CCDs into the AAV capsid using genetic modification of the capsid protein. Western blotting and QPCR assays confirm that the CCD has been successfully incorporated, and transduction assays indicate that CCD-AAV are infectious. Preliminary data also indicate that the CCD-AAV successfully binds to a complementary coiled coil domain. We plan to continue testing the functionality of these CCD-AAVs in mammalian cells.

ENGI B102

Synbiotron: Affordable liquid-handling robots for synthetic biology

Aurnab Baidya, Peter Suzuki, Constantine Tzouanas, Harvey Yang
Mentor: Sabia Abidi

Research into synthetic biology, the engineering of biological systems, requires time-intensive protocols to build and test biological parts. These protocols are tedious and repetitive, and take time away from researchers that could otherwise be spent doing science. Thus, research is aided tremendously by automated machinery capable of running experiments and/or constructing biological systems with minimal human intervention. Synbiotron provides researchers with a powerful tool in the automation of research protocols. The device focuses on automatic liquid handling and features: (1) high throughput capability — less than 20 second automatic pipetting of a 96-well plate, (2) high spatial precision — less than 1mm standard deviation, (3) high pipetting accuracy — less than 5% average residuals, (4) tissue culture hood compatibility — less than 60cm in each dimension. This device can be later expanded to a more versatile portfolio of tasks such as colony picking.

Oral Presentations

A: Herring 224
B: Huma 116
C: Huma 315
D: NSCI Dean's Conference Room GRB

12-1PM
12A1 - HUMA
The Role of Mysticism in Prosocial and Pro-Environmental Behavior
Isaac Carroo
Mentor: Dr. Niki Clements
This research analyzes the role of religious experience as a catalyst for positive social and environmental interactions through mystical experiences, group rituals, and cultural practices. Religious experience has immense power in shaping individual and group perspectives on how to build ethical relationships with other beings, human or otherwise, and influence how practitioners view their obligations to the world around them. This research comparatively analyzes traditions such as Native American religions, Buddhism, Shamanism, and Transcendentalism to highlight aspects of

spiritual practice that encourage participants to act conscientiously towards the human and natural communities in their lives. Characteristics of religious experience that can influence practitioners prosocially and pro-environmentally include encounters with supernatural that implore ethical conduct, feelings of unity in group ritual practice, characterization of nature as sacred, or interpretation of doctrine as a call for social action. These views work synergistically to promote a worldview where individuals do not exist and act alone, but inhabit a lively universe with sacred species, spirits, and humans.

12A2 - SOSC
Examining Semantic Errors for Phonetic Distortions
Kathleen Bradbury
Mentor: Dr. Simon Fischer-Baum
Cascading activation describes a type of processing through cognition where processing at one level of representation is not fully complete before processing at the subsequent level of representation begins (see Rapp & Goldrick, 2000 for review). Evidence for cascading activation in models of speech production have been drawn from speech errors (Dell et al., 1997) and phonetic measurement (Goldrick & Blumstien, 2006). However, studies of cascading activation have not examined if semantic representations cascade through the speech production system and have consequences for articulation. These consequences, known as phonetic distortion effects, are traces of activated but unselected phonemes reflecting semantic representations activated during lexical selection. The present study examines phonetic measurements (voice onset time and formant frequencies) of semantic errors made by a stroke patient (O.C.). If semantic representations cascade to articulation, errorful productions will have phonetic features that reflect the target words. However, if no evidence of phonetic distortion is found, it is implied that activated semantic representations do not cascade to articulation.

12A3 - HUMA
Diverse Utility Perspectives in Clinical Applications of Genomic Sequencing
Mackenzie Kubik
Mentor: Dr. John Mulligan
In recent years, the use of clinical genomic sequencing has risen dramatically and sparked discussion over the ethics and utility of testing within the realm of medical diagnostics and treatment. This year, I have worked with Baylor College of Medicine's Center for Medical Ethics and Health Policy to analyze reported perspectives on utility and concerns regarding clinical genomic sequencing from a diverse group of stakeholders, in order to inform standards of sequencing usage in these settings and direct further research. I will present my scoping literature review, which aims to synthesize evidence on clinical sequencing perspectives from the viewpoints of patients, parents, physicians and other medical professionals, payers, and ethicists. A narrative synthesis of the findings reveals (1) that (dis)utility perspectives vary widely across stakeholders, and (2) that these perspectives have grown in their complexity and diversity over time as clinical sequencing gained popularity, and its clinical utility became a focal topic of biomedical research.

12A4 - HUMA
Okinawan-Bolivians: Their Identity and Transnational Mobility
Gennifer Geer
Mentor: Dr. Sonia Ryang
Okinawan Studies has focused on subjects of Okinawa, Japan, as objects of American and Japanese imperial policy. Yet, in the 1950s, Okinawans were able to use the power of the state to minimize its impact on their lives. In an effort to solve population problems of postwar Okinawa, the U.S. military coordinated a migration program from Okinawa to a colony in Bolivia. While it may appear that the program is restricting, I propose that Okinawan-Bolivians, due to a sense of transnational mobility, saw their ethnic identities and state connection as malleable facets that they directly manipulated based on situation and need. The migrants exercised maximum choice in a limited, oppressive environment. Prior scholars have noted Okinawan-Bolivians' identities and state relationships appear in flux, but I aim to give both migrants and their descendants more agency. Their histories and sense of mobility have empowered them to directly and purposefully alter their positions, a powerful tool for a historically oppressed population.

12D1 - ENGI
Oxidation of Iron Oxide Nanoparticles Improves Magnetic Fluid Heating
Kaiyi Jiang
Mentor: Dr. Gang Bao
Magnetic iron oxide nanoparticle (MION) heating under an alternating magnetic field has many biomedical applications, including cancer hyperthermia therapy and organ warming after cryopreservation. The ability to generate a high level of heating with a low dose of MIONs delivered is crucial for most of the applications. Yet, the specific absorption rates (SAR) obtained by different groups for similar MIONs are very different. SAR values can vary significantly even for the same MIONs but measured at different time points. To address this issue, we have performed systematic measurements of SAR as a function of oxidative state of MIONs. We found that SAR values due to magnetic fluid heating (MFH) increases linearly with oxidation of MIONs in water. Our MION characterization and numerical simulation suggest that the effect of oxidation on SAR is due to the increase in anisotropy energy barrier during MION's transition from magnetite to magnetite. Therefore, it is possible to increase the MFH of MIONs by controlled oxidation.

12D2 - NSCI
Quantitative Top Down Proteomic Determination of Proteoform-Level Substrate Specificity of the Acetyltransferase P300 and Underlying Mechanisms of Specificity
Nikit Venishetty
Mentor: Dr. Nicolas Young
Top down proteomics distinguishes proteoforms, the true physiological molecular form of proteins. Proteoforms are chemically defined molecular species that account for all sources of variation, including the single molecule combinations of PTMs. Combinations of PTMs influence protein-protein interactions, direct subcellular location and transduce

a variety of internal/external generated signals into cellular/phenotypic outcomes. We have recently developed the capacity to reproducibly quantitate proteoforms. Here we apply this analytical capacity to measure how the enzymatic activity of the crucial histone acetyltransferase p300 is modulated suppressed by preexisting PTMs on the other residues of its substrate. We measure the effective relative rates of enzymatic activity for all substrates in a complex mixture of proteoform substrates representative of physiological relative concentrations and reveal mechanism. We demonstrate that p300 alone, in vitro, is sufficient to direct a single-molecule acetylation progressive hierarchy mechanism. Furthermore, we show that this high proteoform specificity is due to the acetyllysine recognizing bromodomain of p300.

12D3 - ENGI
Facet-Defining Inequalities for the Stochastic Single Node Fixed Charge Network Flow Polytope
Victor Gonzalez
Mentor: Dr. Andrew Schaefer
For our project, we use linear algebra techniques to explore facet-defining inequalities for the stochastic single node fixed charge network flow polytope. We show conditions under which facet-defining inequalities for the single-scenario polytope are facet-defining for the extensive form polytope. We then show sufficient conditions under which a valid inequality will be facet-defining and compare them to necessary conditions. These sufficient conditions can be verified with less computation than with traditional methods of finding facet-defining inequalities. We aim to improve optimization over these polytopes within the branch-and-bound framework.

12D4 - NSCI
When a rat smells a cat: neural basis of innate fear and reward-seeking conflict
Leah Olivo
Mentor: Dr. Douglas Senna Engelke
Survival in nature depends on balancing foraging with the risk of predation. Although the brain mechanisms modulating food seeking and fear have been extensively studied apart, few studies have investigated which neural circuits integrate both behaviors. Our lab has developed a conflict task in which rats must overcome fear induced by predator odor (PO) in order to obtain a sucrose reward. PO induced strong defensive behaviors and abolished reward-seeking. Immunohistochemistry analysis showed that PO activates several brain areas related with fear, including the paraventricular nucleus of the thalamus (PVT). PVT densely projects to the nucleus accumbens (NAc); both structures are also known to modulate reward seeking, suggesting that the PVT-NAc projections could participate in the conflict between fear and reward.
Electrophysiological recordings confirmed that the PVT is activated during the reward vs. fear conflict situation. Chemogenetic inhibition of the PVT-NAc pathway reduced defensive behaviors and rescued reward seeking. Studying this pathway in humans could help our understanding of stress-related psychiatric disorders such as phobias, eating disorders, and anxiety.

12D5 - NSCI

Kinetic Studies Elucidate Underpinnings of Antibiotic Resistance in Tuberculosis
Hector A. Chaires
Mentor: Dr. George Phillips
The widespread use of antibiotics in a clinical setting led to the propagation of bacteria with resistance to previously neutralizing antibiotics. β-lactams, such as penicillin, are antibiotics commonly used to treat bacterial infections like tuberculosis. β-lactamases are enzymes that grant bacterial pathogens a resistance to β-lactams. Circulating bacterial strains of Mycobacterium tuberculosis encode BlaC, a β-lactamase that grants resistance to most β-lactams. This poses a huge challenge as it requires next-generation antibiotics that are reserved as a last defense-line against infections. Static structures of the enzyme have been obtained using X-ray crystallography. Time-resolved (TR) studies reveal possible intermediates of the reaction but lack sufficient detail for accurate interpretations. In this study we use kinetic measurements under the experimental conditions used in TR studies to expand our current understanding of BlaC and facilitate drug design.
Work supported by NSF STC BioXFEL center No. 1231306 and R3E821.

1-2PM
1A1 - SOSC
Impact of Business Oriented Neoliberal Policies on the Gentrification Process: A Houston Case Study
Thresa Skeslien-Jenkins
Mentor: Dr. Sergio Chavez
This study examines the gentrification process in Harris County, Texas by analyzing population changes between 2000 and 2016 and the simultaneous introduction of development oriented policies in various Houston neighborhoods. Gentrification is defined as “the process of renewal and rebuilding accompanying the influx of affluent people” into previously deteriorating areas, resulting in demographic change for the neighborhood. I seek to understand whether these development policies spurred gentrification and displacement when they were implemented in lower income, minority communities.To begin, tracts that have undergone significant change were identified. Next, boundaries of business districts and tax increment reinvestment zones were overlaid with the Census tract boundaries. Lastly, we were able to identify the impact these policies had on the gentrification process in Harris County between 2000 and 2016. The study seeks to understand the impact business oriented policies have on previously low income, minority community in the hope that these findings can better inform policymakers and stakeholders as they continue to develop these policies.

1A2 - NSCI
Molecular validation of a ((Tsc2))-null mouse model of tuberous sclerosis
Raymond Tjhia
Mentor: Dr. Sirena Soriano

Tuberous Sclerosis (TS) is a neurodevelopmental disorder that commonly presents impaired learning and autism features. It is caused by mutation of ((TSC1)) or ((TSC2)), whose protein products regulate the mTOR pathway, key for cell signaling and growth. While targeting this pathway shows promise in improving TS symptoms, it alone may be insufficient for full therapeutic benefit.
To investigate alternative targets, we first aimed to identify robust preclinical outcome measures in heterozygous ((Tsc2)) mice (HET). Yet, behavioral assays with HET adults did not reproduce abnormal sociability and learning phenotypes described historically. To explain this, we proceeded to molecularly validate the mouse model. We first confirmed that homozygous ((Tsc2)) mice exhibit expected embryonic lethality. Transcriptional analysis shows ((Tsc2)) RNA levels are expectedly decreased in HET adult brain. However, TSC2 protein levels are unchanged in HET adult brain and embryo.
These results may indicate post-transcriptional compensatory effects in HET, resulting in adults with normal protein levels and behavior. This supports reexamining this ((TSC2)) model in future and past studies.

1A3 - SOSC
Oncologists' Perspectives on Whole-Exome Sequencing and its Utility in Pediatric Cancer: A Typology of Perceived Utility
Rishab Ramapriyan
Mentor: Dr. John Mulligan
In this study, we explore how oncologists perceived the utility of clinical tumor and germline whole-exome sequencing (WES) in pediatric cancer care. We conducted follow-up interviews with oncologists caring for patients who underwent WES at a large academic children's hospital. We applied a qualitative approach on the transcripts from the interviews of 11 oncologists and identified a broad range of perceived utilities. Most oncologists reported that they did not find much direct clinical utility (where the results would affect immediate treatment) in the WES results. However, they all reported that parents found psychological utility in different forms (e.g. peace of mind, relief of guilt) as well as pragmatic utility (e.g. future planning), which they considered beneficial for both patients and their families. We compare our findings with previous reports on parents' perceived utility of WES in the same study. Our findings are crucial in determining whether WES should be incorporated into the standard of care for pediatric oncology patients. Our findings can also inform how clinicians might explain WES to a parent when asking for consent, and prevent therapeutic misconception.

1A4 - SOSC
Operational Performance Measures: In-Mission Monitoring of Astronaut Cognitive-Behavioral Functions
Karen Qi
Mentor: Dr. Pete Roma
According to current space medicine research, isolation and confinement are major risk factors for decline of astronauts' cognitive and behavioral health. Because traditional brain imaging, psychological assessments, and communication with mission control

may be unfeasible and inefficient during missions, I propose a method of behavioral health measurement based on astronauts' execution of core mission tasks; this strategy corresponds to NASA's performance-based approach to health. Effective translation of these mission tasks into health monitoring tools requires 1) identifying the various behavioral pathways underlying each mission task and 2) incorporating quantitative and qualitative criteria to measure behavioral health. I have determined the major behavioral pathways using the National Institute of Mental Health's Research Domain Criteria, and the Behavioral Health and Performance Lab will design assessment criteria according to the data collected during a simulated mission. The development of performance-based indicators for astronauts' behavioral health can further advance the conversation about health management, even outside the field of space exploration.

1A5 - SOSC
Lessons learned from a pilot partner-based lifestyle intervention for African American and Hispanic prostate cancer survivors on active surveillance
Munachimso Uzodike
Mentor: Dr. Dalnim Cho
Prostate cancer (PCa) has the highest disparities among all cancers in men and women in the US. Specifically, African American (AA) men have 1.7 and 2.4 times higher PCa incidence and mortality rates than non-Hispanic white (NHW) men. Additionally, poorer quality of life has been reported by AA and Hispanic PCa survivors compared to their NHW counterparts. Active surveillance (AS) is a safe treatment option for low risk PCa survivors in which survivors' conditions are closely monitored until treatment is deemed necessary. Preliminary studies have shown that lifestyle interventions targeting diet and exercise are promising for reducing disease progression and improving quality of life. However, none of the interventions in the literature have specifically targeted AA or Hispanic men on AS. Also, none of them have included partners, who are likely to be a main source of support for PCa survivors. The aim of the study is to pilot test a lifestyle, diet, and exercise intervention, Watchful Living, for AA and Hispanic men on AS and their partners. We will determine the feasibility of recruiting the target participants and evaluate the intervention for efficacy in disease management.

2-3PM
2A1 - HUMA
The Right to Exist: Trans Activism and the Involvement of LGBTQI+ Organizations in the Public Sphere in San Carlos de Bariloche
Angelo Ragan
Mentor: Dr. Gustavo Ariel Marin
The current LGBTQI+ liberation movement in Argentina has found itself in a philosophical debate about the politicization of the trans body and the right to self-determination and a life free from discrimination. In this investigation, I will attempt to better understand the function of LGBTQI+ political organizations through the lens of trans activism and the formation of public policy that affect these communities. Through interviews with trans activists, government officials, and trans sex workers, I will attempt to outline and link the trans perspective and the policies that govern their bodies and livelihoods. By understanding the role of active trans participation in the formation of

policies, particularly Ordenanza 568-17 (cupo laboral trans) and the Encuesta de la Población Trans e Identidades Disidentes, I hope to better understand the intersection of gender identity, community organization, and human rights.

2A2 - HUMA
A Thousand Eyes: The Personal Journals of an American Doctor in Post-War Hiroshima
Rachel Lisker
Mentor: Dr. John Mulligan
The ABCC (Atomic Bomb Casualty Commission), a US government organization made to do medical research on Japanese victims of the atomic bomb, has been the focus of much analysis in regards to its no-treatment policy. This policy dictated that American doctors were prohibited from treating patients, limiting them to diagnosing and handing care to Japanese doctors. One underutilized source in this area is the journal of ABCC physician Dr. William C. Moloney. This journal includes his account of his treatment of a 9-year-old Japanese boy with leukemia, one of the rare instances in which the ABCC received positive attention from the press and the public. For this project I am working with the journals at the Texas Medical Center Library archives in order to analyze how Dr. Moloney's journals illustrate the tensions between his roles as a scientist, a doctor, and a human being, as well as how the contents illuminate his decision to treat a Japanese boy in seeming contradiction to the ABCC's standard policy.

2A3 - HUMA
Right-to-Try: A Fake Solution to a Real Problem
Hannah Bablak
Mentor: Dr. John Mulligan
This paper examines the recently-passed Right-to-Try law and its role in revealing the ethical failings of the current system of access to unapproved drugs outside of a clinical trial. Right-to-Try's political momentum culminated in the 2018 State of the Union Address, promising desperate patients increased access to experimental treatments. Despite its political popularity, the law fails to address the systematic barrier to access: the drug companies are under no obligation to accept patient requests, publish data on requests, or provide a rationale for denial. Instead of addressing this, the Right-to-Try Act removes FDA oversight from the process and deprives patients of critical safety information and a powerful ally in negotiation with the drug companies. The Act also highlights and contributes to the issue of unequal access, with well-connected patients gaining greater access than the general population. The lack of transparency, threats to patient safety, and inherently inequitable access highlighted by Right-to-Try ultimately raise the question of whether a system in which companies act as the gatekeeper to emergency use of unapproved treatments can be an ethical system.

2A4 - HUMA
The Role of Opium in Chinese-Filipino Community Formation during the Late-Spanish Colonial Era (1800–1898)
Darren Pomida
Mentor: Dr. Sayuri Shimizu

Today, the over two million people that comprise the Chinese-Filipino community are important members of the greater Philippine nation-state. The ascendance of the Chinese is quite remarkable, given that in the first three centuries of Spanish colonial rule (1565–1898), the Chinese existence was marked sometimes near-genocidal oppression by the Spanish. This thesis analyzes the origins and development of this complex yet powerful group in the Philippines that had hitherto not been accorded enough representation in the Philippine national historiography. I examined Spanish and Philippine legal documents to construct the role of the Chinese-Filipinos in the domestic and international opium economy by looking at the interactions the Chinese-Filipinos had with the state and with each other in the nineteenth century. Through these documents, I utilized a transnational framework of analysis to problematize and add to the previous works on Chinese-Filipino community development by using the opium trade as a lens through which I clarify the emerging class and social structures that developed during the last half-century of Spanish rule in the Philippines.

2A5 - HUMA
VADventure: The Development of an Interactive Educational Tool
Rachita Pandya, Jessica Hartz
Mentor: Dr. Kirsten Ostherr
Children and adolescents affected by heart disease are a high risk population, and some of the most complex patients are those with ventricular assist devices (VADs). Texas Children's Hospital (TCH) strives to help pediatric patients with this device's implementation, management, and ultimate removal. Proper training of VAD maintenance for patients and caregivers plays a key role in these childrens' survival. Although some training is provided, it is not standardized. To address this challenge, we developed VADventure, an educational game website to interactively inform caregivers and patients. VADventure allows the users to choose their own "adventures," which are required training modules with the intent to reinforce knowledge and information shared while in the hospital. Once they complete each module's quiz and the comprehensive final exam, they can continue to access the site and the information as needed. This platform will also help TCH staff and administration with their management of all their patients and caregivers. Since the project's inception, we have developed a working prototype designed by current computer science seniors.

3-4PM
3A1 - HUMA
To Control and To Educate: Didactic Italian Museography, 1920-1960
Clair Hopper
Mentor: Fabiola López-Durán
From 1920 to 1942, Italians were determined to use museums as social educators. Party-affiliated museum professionals pioneered an effective modus operandi: by utilizing the arts to appeal to visitors' emotions, museums could create a feeling of transcendent unity and reinforce the popular appeal of fascism. Government officials

provided direction and funding; strategic publicity provided freedom and notoriety. The fascist exhibition was immersive, didactic, and innovative.
After the trauma of World War II, postwar museographers moved beyond the fascist modus operandi. While they were strictly antifascist, this “new generation” of museum professionals utilized the same tools for new ends. Building on the success of the experimental fascist exhibitions, the new shows were also conceived as innovative-immersive experiences, but they were committed to the production of knowledge rather than to the arousal of emotions and propaganda. Museums began to offer rich programming to educate the public and promote visual literacy. Recognizing both the efficacy of the fascist museum and its moral failings, postwar museographers appropriated its strategies in service of a more democratic, educational museum.

3A2 - HUMA
Treating the Symptoms, Not the Cause: An Investigation Into Burnout Policies
Taylor Phillips
Mentor: Dr. John Mulligan
Medical education administrators have demonstrated interest in the issue of burnout in residents as research has revealed its negative effects such as increased rates of suicidal ideation and medical errors. I first evaluate policies made to address burnout in residents, such as duty hours, that yielded underwhelming results using previous literature and data from resident focus groups among various specialties and program evaluations from Dr. Childress’ research in our study of burnout. I highlight that these policies may also exacerbate the problem by creating further divide in the clinical team, leading to the mistreatment of residents and undervaluing them as resources. I go on to argue that these policies are inadequate for residents’ needs because they only address the symptoms of the burnout issue while leaving the cause – the systemic power inequality and labor disparity –untreated. Finally, I suggest a framework for future policies that address the power imbalance and the clinical team divide that can aid researchers and policy makers to decreasing burnout in physician residents.

3A3 - HUMA
Miracle Babies in the Media and Miracle Workers in the NICU:
The Responsibility of Neo-Natal Nurses in Mitigating Miracle Discourse
Emma Reford
Mentor: Dr. Trevor Bibler
The language of miracles is common in media accounts of pediatric medicine. Through a qualitative content analysis of media depictions of miracle babies, this paper contributes to the growing body of literature illuminating the relationship between miracle discourse and medicine. We analyzed the rhetoric of over 200 Google News stories (2017-18). I show that while this miracle discourse affords joy, confidence, and hope, neo-natal nurses are portrayed as acting in complex, dichotomous roles. In the context of this miracle rhetoric, nurses are cast as both clinical caretakers and emotional solaces. I argue that this language places an unequal responsibility on neo-natal nurses in confrontation of the expectations engendered from these pieces. Then, I show that moral distress increases for these nurses in decision making in the NICU, as they must address heightened expectations for the treatment of the baby and their own

behavior. However, I find that this unique position of nurses can be utilized for the benefit of families and the clinical care team in addressing this miracle discourse to better make decisions which are in the best interest of the baby.

3A4 - HUMA
Innovating Within the Tradition: Feminist Reconstructions of Agency in the Jewish Mikveh
Chloe Wilson
Mentor: Dr. Niki Clements
My research analyzes the modes of agency and power in the context of ritual adoption and innovation in the Jewish ritual of mikveh immersion. By utilizing the theoretical frameworks of Saba Mahmood and Amy Hollywood, I seek to first examine the gendered conceptions of agency that develop in the history of the mikveh as a deeply vulnerable practice, as well as the way that contemporary American usage contests and reforms the practice. Through qualitative interviews, I then utilize a case study of the Mayyim Hayyim mikveh in Newton, MA to examine how Western liberal feminist critique of the ritual can be complicated by the work of mikveh ritual innovators.

3A5 - HUMA
Competing Claims: State and Church Uses of the Past in the Debate over the Ownership of the Mosque-Cathedral of Córdoba, Spain
Abigail Panitz
Mentor: Dr. Lora Wildenthal
Competing claims of ownership to the Mosque-Cathedral of Córdoba, a popular tourist site, have emerged in the twenty-first century. The Cordoban Chapter of the Catholic Church was permitted to register the space as its formal property in 2006. Some politicians, particularly members of Spain's Socialist party, the PSOE, dispute the law that allowed this registration. In their view, the law was passed as part of the conservative People's Party's strategy to protect privileges afforded to the Church. The essay analyzes two reports to demonstrate how two groups, the state and the Church, relied on distinct episodes of Spanish history to support their claims. A 2014 local Church report used nineteenth- and twentieth-century property laws to defend its claims to ownership. A 2018 local government report used the medieval legal code Las Siete Partidas to argue for restoring the space to state control. The dispute in Córdoba is a microcosm of the challenges affecting church-state relations in the post-dictatorship era of secular democracy in modern Spain.

3B1 - SOSC
Boundaries, Toxicities, Literacies: Understanding Community Success in Cleanup of a Houston Superfund Site
Amy Kuritzky

Mentor: Dr. Andrea Ballestero
My research asks what enables an activist community to attain government-mandated environmental cleanup. I look specifically at a Superfund site in Houston where paper mill companies buried their toxic waste in a riverbank decades ago. This site has advanced to the “remedial design and action” phase of the Superfund process in a matter of years – a nearly unprecedented rate of government action. Much anthropological scholarship focuses on the complex entanglement of bodies and exposures to understand environmental harm. Drawing upon my own ethnographic work, I argue that, in this case, reductive practices which might otherwise be criticized for how they delimit complexity and ignore larger structural conditions work towards an activist agenda. These practices, such as enforcing boundaries and privileging scientific forms of understanding toxicity, enable effective activism and government intervention even as they fail to comprehensively describe the experiences of local residents. The success of community activism in this case raises questions about who has access to scientific knowledge and how people navigate bureaucratic systems as particular gendered and racialized subjects.

3B2 - SOSC
Teamwork Makes the Dream Work: A Systematic Strategy Analysis to Improve Team Dynamics of NASA's Mission Teams
Anika Agrawal
Mentor: Dr. Pete Roma
In this paper, I will assess specific ways in which improving team cognition might improve mission success at NASA. Recently, NASA has begun to conduct research into discovering the most beneficial strategies that create effective teams to have the most mission success. The goal of my research is to analyze proposed strategies on creating premier teams comprised of individuals who are independently successful at mission tasks and are also capable of cognitively working together as a cohesive team to enhance efficiency. Specifically, my paper assesses team dynamics in the context of cognition, and it compares and contrasts two strategies to improve cognition: interactive team cognition and cognitive diversity. Both are strategies focused on maximizing team cognition through recruitment of diverse individuals, though each strategy has a unique definition of diversity, leading to different compositions of teams. My paper suggests a method for conducting systematic strategic analyses, and similar approaches can be applied to factors including and beyond team dynamics to discover the most effective ways to optimize mission success.

3B3 - SOCI
Education as a Means to Improve Policy Solutions for Children of Incarcerated Parents
Siddharth Gorantla
Mentor: Dr. John Mulligan
This paper delves into the policy implications of the suffering of children with incarcerated parents. There is a knowledge deficiency among key stakeholders that, when reduced, could create new policy solutions. Relevant literature has been substantial in the last decade but has not been put to practical use. For example, many case studies connect flashbulb memories and subsequent trauma-driven issues with the

use of excessive force. A majority of law enforcement procedures do not incorporate any measures to protect children when executing search warrants. This paper argues that filling in these knowledge gaps will improve how persons with authority treat children of incarcerated parents. Groundwork has been established: some jail facilities have implemented policies that mitigate these adverse childhood experiences (ACEs) by, for example, teaching incarcerated individuals best parenting practices. Policy implications are also explored to evaluate the feasibility of implementation. Legislative bills across the nation are analyzed to determine factors that indicate feasibility and success.

3B4 - SOSC

Approaches to Improving Discharge Planning for Patients with Chronic Diseases
Shivani Raman
Mentor: Dr. Molly Horstman

This paper explores existing approaches for improving discharge planning for patients with chronic diseases. The literature reveals that existing approaches focus on three principle actors: healthcare professionals, patients and their caregivers, and the healthcare system. First, education and training for healthcare professionals is critical to establishing a clear delineation of roles and responsibilities and promoting appropriate responses to language, culture, and literacy differences. Second, educating patients and their caregivers throughout the discharge process through clear, culturally-appropriate instructions facilitates optimal understanding and retention. Third, health system improvements such as sending a summary of care to the patient's primary care provider and following up with patients and their caregivers after discharge allows for more coordinated, patient-centered care. After reviewing these approaches and making the case that discharge planning is integral to improving patients' health experiences and outcomes and increasing the efficiency of the healthcare system, I close by outlining the major limitations of these approaches in the American healthcare system.

3B5 - SOSC

Houston 311: An Analysis of Citizen Satisfaction and Engagement
Akin Bruce
Mentor: Dr. Meng Li

Houston, like any other metropolitan area, has thousands of public issues that affect its economy and citizens each year. In 2001, a program named Houston 311 was developed to aid the city's customer service. It allows Houston citizens to report non-emergency issues easily via telephone, email, smart phone app, or the 311 website. Most importantly, citizens have the ability to rate the manner in which their complaints were addressed and give feedback to hold the city accountable. In this project, that feedback is analyzed critically. What factors of the City's efforts have been successful? What are the drivers of negative and positive feedback? And how can these factors help improve the efforts set forth in the city? Taking into account survey, geographical, and census information to give as descriptive results as possible, it was discovered that the

area of Houston the request takes place in, the type of service requested, and even some personal demographic information, such as the requestor's age, could have a significant impact on the ultimate level of satisfaction that a citizen reports. And as Houston 311 gains popularity, this becomes all the more essential to the City.

4-5PM

4B1 - NSCI

Measuring Stellar Rotation Periods from TESS Light Curves to Discover Fossil Star Forming Regions in the Milky Way

Rae Holcomb

Mentor: Dr. Patrick Hartigan

As stars age, they lose angular momentum and their rotation slows. Since fast-rotating stars must be young, it is possible to discover regions of recent star formation in our galaxy by mapping the locations of fast-rotators. However, measuring stellar rotation rates requires either high-resolution spectroscopy or high-cadence time series data, both of which are difficult to obtain across large regions of the sky. My project utilizes data from the recently launched Terrestrial Exoplanet Survey Satellite (TESS) to design a semi-automated algorithm to calculate stellar rotation rates for thousands of stars. During its groundbreaking two-year mission, TESS will measure the brightness fluctuations of over 200,000 stars covering 90% of the sky, allowing us to measure stellar rotation rates on a scale never before possible. My algorithm calculates the autocorrelation of the light curve to detect periodic dips in brightness associated with the transit of sunspots across a star's surface as it rotates. Ultimately, this project has to potential to add hundreds of new stellar rotation measurements to the scientific literature and open up study of a new chapter of star formation history.

4B2 - ENGI

EasyScope Laparoscopic Grasper for Low-Income Countries

Ria Sur, Ami Sheth, Safina Hsu, Rohan Bhardwaj

Mentor: Dr. Devika Varma

Laparoscopic surgery, also known as minimally invasive surgery, is a surgical procedure in which small incisions are made on the abdomen to examine and operate on organ systems. Laparoscopic surgery has revolutionized medical surgery by reducing the recovery time and the risk of infection that usually comes from conventional surgical techniques. In developing countries, however, access to laparoscopic tools is limited; these tools are extremely expensive, misalign frequently, and cauterize poorly. Thus, laparoscopic surgery cannot be performed effectively.
Our overall goal is to create low-cost laparoscopic devices appropriate for low-resource settings that are durable, easily sterilized, and repairable in the low-middle income countries where they will be utilized.
Currently, our prototype can successfully complete 1 Simulab session at the Baylor College of Medicine. This session consists of two tasks: transferring blocks from one peg to another and grabbing 12-inch string at specific locations. Our tool has demonstrated strong grasping power, lifting more than 3.5 oz and all the subcomponents of our device can be removed, replaced, and sterilized.

4B3 - NSCI
The Role of Anti-nutrients in Microbiome Composition and Gut Health
Vivekanudeep Karri
Mentor: Dr. Kendal Hirschi
Oxalates and phytates, sometimes called anti-nutrients, reduce absorption of calcium, iron and other minerals. Oxalates are highest in leafy greens such as spinach while kale has less. We hypothesize that these antinutrients also impact the gut microbiome and gut health. Ascribing these difference to oxalates by comparing microbiome differences in animals fed spinach vs kale would be problematic given the vast genetic differences between these plant based diets. We could only form associations and not attribute the differences specifically to calcium oxalate crystals. A model forage legume M. truncatula and the cod5 (calcium oxalate deficient) mutant allow us to use precision agriculture to specifically assess the impact of calcium oxalate crystals on gut microbiomes. Previous work has shown that cod5 is isogenic to M. truncatula with the exception of a single gene mutation altering calcium oxalate crystal formation. Using these diets +/- antinutrients in mouse feeding studies, we can directly address how anti-nutrients alter microbial composition. Additional work will be directed at ex-vivo experiments to assess how dietary antinutrients alter bacterial growth.

4B4 - NSCI
Cosmic Ray Muon Detector Project
Jaanita Mehrani, Junzhe Bao, Artun Bayer
Mentor: Dr. Frank Geurts
Our currently ongoing project is primarily focused on the study and research of particle physics and detection. Over the course of the spring semester, Dr. Geurts, professor in physics and astronomy, mentored and guided our group through the VIP (Vertically Integrated Project) program. We started off by learning some of the basics of elementary particles, including the history and makeup of the standard model. In addition, we were taught the fundamentals of particle detection and data analysis, such as how momentum and the origin of a collision were calculated and how events were detected in the detectors at CERN and BNL. As of this point, we have worked with a 3-scintillator muon detector and calibrated the input voltage and threshold voltage of each counter to make sure we are efficiently detecting the cosmic rays. As the project is ongoing, the next step will be to implement a low power device (Raspberry Pi) to allow for the counters to run and send data continuously to a computer for broader analysis of large-scale events, such as muon showers, by combining our data to other muon detectors across the country and checking for coincidences.

4B5 - ENGI
Treatment Quality and the Fate of Antibiotic Resistance Genes in an Anaerobic Membrane Bioreactor
Laney Baker
Mentor: Dr. Lauren Stadler
Anaerobic membrane bioreactor (AnMBR) is an emerging treatment technology that can be used to recover energy (biogas) and water from wastewater and other organic wastes such as livestock manure. However, antibiotic resistance is a concern in treated

wastewater and manure, especially when the effluents are reused in agricultural applications. Little is known about the fate of antibiotic resistance genes or bacteria during AnMBR treatment. Here, we operate a bench-scale AnMBR to treat domestic wastewater (DWW) and DWW with cattle manure. Experiments are underway to grasp the relative contributions of DWW and manure to the performance of the AnMBR in terms of energy recovery, effluent quality, and antibiotic resistance gene removal. The accumulation of volatile fatty acids, production of methane, and rate of COD removal are tested to monitor the performance of the AnMBR. Additionally, samples of influent and effluent are collected to monitor fate of antibiotic resistant bacteria and antibiotic resistance genes. We hope to understand the feasibility of reusing AnMBR effluent for irrigation, considering EPA COD standards and potential health risks associated with antibiotic resistance.

4C1 - SOSC
Application of “MINDSPACE” Behavior Change Principles in the Implementation of Decisional Support Tools at U.S. LVAD Implantation Sites
Sarah Smati
Mentor: Dr. Jennifer Blumenthal-Barby
This paper contributes to the emerging body of literature proposing choice architecture as a key strategy for behavior change. I examine nine principles by which choice architecture seeks to change behavior, abbreviated as MINDSPACE, and their utility in motivating busy clinicians to use decisional support tools with their patients in eight U.S. Left Ventricular Assist-Device (LVAD) implantation sites. LVAD therapy is an option for advanced heart failure patients whose disease is no longer responding to medication. The American Heart Association published a Scientific Statement revealing inadequate understanding of the LVAD treatment among the patients and cited a crucial need for improved decision support processes. In response, my P.I. and her team developed a patient-centered decision aid (DA) aimed to fill this gap in decision support. However, studies have shown that it is difficult to get busy clinicians to use decision support tools. Drawing from formative research identifying factors that optimize engagement with DAs at the patient, practitioner, and managerial levels, we aim to show how integration of DAs into clinical practice can be improved using MINDSPACE principles.

4C2 - SOSC
Does Providing Structured Feedback Forms Produce More Accurate Feedback for People with Disabilities?
Felix Wu
Mentor: Dr. Mikki Hebl
People with Disabilities (PWD) face disparities in job outcomes, which results from inaccurate feedback. Such feedback is often overly positive, which hinders PWD’s development. Therefore, in the current project, we investigate how to reduce the positive bias in scores given by participants and the amount of discomfort with interactions through structured feedback forms. To this end, we conducted a 2 (disability) x 2 (feedback form) study. This study was then completed by 141 college students at a small southern university. In each trial, the participant assessed the confederate with or without a disability on their performance on a test that included

multiple choice, short answer questions, and an interview. Additionally, they completed scales to rate their overall discomfort. Specifically, people gave less accurate scores and rated more discomfort when given the intervention form compared to when given the control form. Contrary to expectations, the intervention feedback form did not do well in reducing discomfort and producing more accurate feedback. Nonetheless, future studies should investigate if other forms can be effective and ameliorate some of the disparities PWD face.

4C3 - SOSC
Texas H.B. 810: Increased Access to Stem Cell Interventions or Unproven Medicine?
Bhavana Kunisetty
Mentor: Dr. Kirsten Matthews
There are now numerous clinics around the world selling stem cell-based interventions (SCBI) that have yet to be proven effective, with little to no accounting of outcomes. In the United States, SCBI are overseen by the Food and Drug Administration, but clinics and patients have been pushing for policies to expand access and circumvent FDA oversight. In 2017, Texas passed a bill, H.B. 810, which allows clinics to provide "investigational stem cell treatments to patients with certain severe chronic diseases or terminal illnesses." The new law is a well-intentioned first step to providing patients with access to SCBIs. However, there are serious concerns about the unintended consequences of the law within safety, clarity, and data reporting requirements. In this project, we analyze HB810 content and legislators' intent, outline critical concerns within the bill, and provide policy suggestions to bridge these gaps. While HB 810 increases patients access, it also increases significant safety and cost risks for treatments that potentially have no positive impact. To truly understand the impact of SCBIs, the public will require scientifically rigorous and accurate outcome reporting.

4C4 - SOSC
Wellness For Warriors: Developing A Veterans Self-Guided Behavioral Health Workbook With Stakeholders
Moushumi Sahu
Mentor: Dr. Jennifer Bryan
The objective of this study was to construct a self-guided workbook with evidence-based positive psychology interventions for the Veteran population, in conjunction with Veteran stakeholders. Positive psychology aims to complement traditional psychology by enhancing well-being rather than focusing on ameliorating symptoms. There is limited self-guided material with these interventions for the Veteran population as emphasis is placed on treating mental and substance use disorders. Due to a culture of self-reliance, Veterans wanting to improve their overall well-being may not seek professional help. Our workbook was presented to a diverse focus group of Veteran stakeholders (n=8) for feedback on cultural appropriateness, usability, and acceptability. They reported need in their underserved community and were supportive of the idea of improving wellness through the use of a workbook. Stakeholders thought the content would be well received in the community after changes in images and phrasing were made. Ultimately, this is the first step in creating appropriate self-help specifically for the Veteran population. Veterans have the potential to benefit greatly from such resources.

4C5 - SOSC

Palliative Care as a Cost-Saving Solution to Medical Spending: A Theoretical Economic Exploration

Autumn Engebretson
Mentor: Dr. John Mulligan

Outpatient palliative care within a coordinated system is an effective way to improve hospital efficiency; however, it is underutilized in existing healthcare structures. In this paper, I design an economic analysis of outpatient palliative care through a literature review and the development of a series of theoretical equations based on marginal analysis, total cost accounting, and investment decision points. These economic tools can evaluate outpatient palliative care systems for pure monetary benefit, even without considering palliative care's proven health outcome improvements. Monetary benefits are supported by existing research that has shown the reduction of total patient costs in outpatient palliative care, particularly within bundled payment coordinated care systems like the VA. The lack of current implementation of outpatient palliative care can be traced to structural educational barriers that must be addressed to realize the total gains of outpatient palliative care for the healthcare system that this paper helps to underscore.