2022 Rice Undergraduate Research Symposium:

BUILDING ON OUR LEGACY

ABSTRACT BOOK

20th Anniversary

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Welcome Letter from the Co-Chairs

Dear Symposium Attendees,

Welcome to the Rice Undergraduate Research Symposium!

This year marks the twentieth anniversary of the event, which showcases our commitment to promoting inquiry-based learning through course-based undergraduate research experiences, research assistantships, and independent projects. The theme for this year, "Building on our Legacy," reflects on the founding of the Rice Undergraduate Research Symposium (RURS) and its growth into the premiere event for Rice undergraduates across all disciplines to showcase their work.

As an undergraduate in 2002, Dr. Jenessa Shapiro founded RURS to give Rice student researchers an opportunity to share their diverse work. Twenty years later, we honor Dr. Shapiro's legacy with the Shapiro Showcase, a competition featuring 16 students across the disciplines who have been nominated and selected by faculty in their respective schools. We also celebrate this anniversary with additional ways for students to showcase their work through exhibitions and poster sessions.

We are thrilled to present the abstract book for the 2022 Rice Undergraduate Research Symposium. Today, 321 students will present 263 projects that highlight the diversity of scholarship across the schools. 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.

We would like to thank all of the faculty, students, alumni, and staff who make RURS possible. This celebration of scholarship would not be possible without mentors from within Rice and beyond who are dedicated to supporting student scholarship, promoting undergraduate research, and providing opportunities for inquiry.

Sincerely,
Aman Eujayl
Brittney Espinoza
RURS 2022 Co-Chairs

Rice Undergraduate Research Symposium Schedule

Exhibitions – 30-minute Multiple Presenter Exhibitions

Session A1: 9:00 a.m.
It's About Dignity & Justice - SEW 133

Session A2: 9:00 a.m.
It's About Dignity & Justice - SEW 305

Session B: 11:15 a.m.
Health of the Mind and Body – Farnsworth Pavilion

Session C1: 12:00 p.m.
It's About Dignity & Justice – SEW133

Session C2: 12:00 p.m.
Health of the Mind and Body – Farnsworth Pavilion

Session C3: 12:00 p.m.
Climate & the Environment – Humanities Building 117

Session C4: 12:00 p.m.
Building Networks: How We Connect – Meyer Conference Room

Session C5: 12:00 p.m.
Multidisciplinary– Minor Lounge

Session D: 1:15 p.m.
Frames & Borders – Meyer Conference Room

Poster Presentation - One-hour Judged Sessions

Location: RMC, Grand Hall
Session A: 12:00 – 1:00 p.m.
Session B: 1:30 – 2:30 p.m.

Shapiro Showcase – Invited Research Presentation Competitions

Engineering (4)/Natural Sciences (4)
10-minute oral presentations with slides or any other medium Location: Duncan Hall, McMurtry Auditorium
3:00 – 4:30 p.m.

Humanities (3)/Social Sciences (3)/Architecture(1)/Music(1)
10-minute oral presentations with slides or any other medium Location: Kraft Hall, 101
3:00 – 4:30 p.m.

Closing Reception and Award Presentation

Location: Grand Hall
5:00 - 6:00 p.m.

Shapiro Showcase

Session A: Duncan Hall, McMurtry Auditorium
3:00 – 4:30 p.m.

School of Engineering

Colter Decker - *Digital and Analog Control of Soft Devices*
Aasha Zinke - *Bionanocomposite Coating to Improve the Quality of Eggs and Reduce Waste*
Savannah Tiemann - *Enhanced Stability of Halide Perovskite Solar Cells with Removable Barrier*
Bohan Wu - *Semiparametric Count Data Regression for Self-Reported Mental Health*

School of Natural Sciences

Jim Lu Zhang - *Structural and Functional Studies of a Viral Spike Protein*
Jack Sheehan - *Machine-Learning Detection of P-Waves in Laboratory Acoustic Emission Events*
Casley Matthews - *Dietary Behaviors and Food Insecurity Among Houston College Students During the COVID-19 Pandemic*
Jaanita Mehrani - *Hydrodynamic Simulations of Au-Au Collisions*

Session B: Kraft Hall, Room 101
3:00 – 4:30 p.m.

School of Humanities

Kierstin Wilkins - *The Effects of Federal Legislation on Sex Work/Sex Trafficking in the Digital Age*
Saumya Jhaveri and George Huang - *The CCP's Authoritarian Toolkit*
Katelyn Landry, Victoria Zabarte, and Ben Schachter - *Reconstructing the Coastwise Trade in Enslaved African Americans to Texas in the Nineteenth Century*

School of Social Sciences

Charlotte Hirsch - *Generic-You as a Linguistic Mechanism of Psychological Distancing*
Dylan Nguyen - *Like a Good Neighbor, Nonprofits Are (Sometimes) There: Neighborhood Transformation and Nonprofit Organizations*
Ashley Fitzpatrick –*Student Experiences with Egg Donation: A Qualitative Study on Agency, Mental Health, and Financial Circumstance*

School of Architecture

Bay Fujimoto and Charlotte Cohen - *Material Optimization for the Mahama Refugee Camp*

School of Music

Connor Chaikowsky - *Explorations into Brazilian Music Culture and Folk Violin Performance Practice*

Engineering Poster Presentations

Investigating PAPSS1 Inhibition as Chemotherapy Vulnerability

Katherine Chen – Poster Session B 201

My research project focuses on the discovery and validation of gene targets for improving chemotherapeutics in prostate adenocarcinoma. Previous research has identified that the shRNA knockdown (KD) of 3′-phosphoadenosine 5′-phosphosulfate (PAPS) synthase 1 (PAPSS1), an enzyme that catalyzes the synthesis of biologically active PAPS, has sensitizing effects to chemotherapy drug cisplatin in lung cancer cell lines, but such chemo-sensitization was not observed in normal epithelial cells. We intended to build on the previous discovery by elucidating the inhibition of the PAPSS1 chemo-sensitization effect in prostate cancer cell lines. We hypothesized that CRISPR-Cas9-mediated knockout (KO) of PAPSS1 in the PAPSS2-deleted prostate cancer cell line could have a better sensitization effect as it is more complete inhibition than KD.

Power Savings in USB Hub Through A Proactive Scheduling Strategy

Bikrant Das Sharma – Poster Session B 202

USB has been the predominant I/O in computing systems over the past two decades. With the increased adoption of USB-C with high data rates, USB hubs are becoming more popular. Existing power-saving mechanisms do not save much power in USB hubs when there is a steady bandwidth demand from devices. In this paper, we demonstrate significant power savings with a proactive scheduling policy for hubs. Our approach includes the introduction of a shallow U1/CL1 low-power state, resulting in better overall power savings due to the reduced entry and exit times to U1/CL1. Our results demonstrate greater power savings (in the order of tens of watts) by increasing the scheduling interval up to the minimum latency tolerance across all downstream devices. As USB moves to USB4 and hubs are used to connect to higher bandwidth devices, these power savings will become even more pronounced.

Digital and analog control of soft devices

Colter Decker - ***Shapiro Showcase Presenter***

In soft devices, complex actuation sequences and precise force control typically require hard electronic valves and microcontrollers. Existing designs for entirely soft pneumatic control systems are capable of either digital or analog operation, but not both, and are limited by speed of actuation, range of pressure, time required for fabrication, or loss of power through pull-down resistors. Using the nonlinear mechanics intrinsic to structures composed of soft materials – in this case, by leveraging membrane inversion and tube kinking – we designed two modular soft components: a piston actuator and a bistable pneumatic switch. These two components can be combined to create valves capable of digital computer logic, controlled oscillation, analog pressure regulation, nonvolatile memory storage, linear actuation, and interfacing with human users. A demonstration showcases valves being employed for analog control of an actuator based on individual inputs from each of a human user's five fingers. Additionally, we use these valves to control a cushion matrix designed for use in medical care; the matrix supports patient comfort and transport and is powered by a single pressure input line.

Engineering Mesenchymal Stem Cells with a Synthetic AND-Gate Genetic Circuit to Improve their Therapeutic Utility in Treating Solid Tumors

Shonik Ganjoo - Poster Session A 101

We are investigating mesenchymal stem cells (MSCs) as delivery vehicles for cancer therapeutics due to their homing properties and engineerability, but prior efforts have been stymied by deleterious off-target effects arising from complex signaling in the tumor microenvironment (TME). To create a safer and more effective MSC-based cancer therapy, we designed a synthetic AND-gate genetic circuit that processes two inputs: solid tumor stiffness and TGF-β (a key cytokine in the TME). MSCs engineered with this circuit will home to solid tumors and express a therapeutic only when both inputs are sensed, improving specificity and reducing off-target toxicity. HEK-293T cells transfected with a stiffness-sensing construct and plated on stiff plastic showed a 3.4-fold activation over the negative control, marking the first key finding that validates the construction of our AND-gate circuit. We will ultimately combine the stiffness-sensing construct with a synthetic TGF-β receptor to complete the AND-gate circuit and implement it in MSCs. In future work, we will deploy MSCs engineered with this construct in tumor models to investigate their therapeutic utility in treating solid tumors.

Investigation of Precipitation Patterns on Particulate Matter Composition in Houston, TX

Marina Karki – Poster Session B 204

Particulate Matter are fine particles found in the air that can negatively impact vital bodily functions if inhaled. This makes it critical to understand the processes that impact the formation of PM. In Houston, a metropolitan city near the Gulf of Mexico, precipitation is an important factor to consider for creation of PM. This study focused on measuring and comparing PM and precipitation levels near Rice University during July 2021. The precipitation data was collected in five-minute intervals by the Harris County FWS Site 400. Overall PM data and species concentrations for Organics, SO_4, NH_4, NO_3, and Chlorine were collected in five-minute intervals by the Aerodyne AMS machine at Rice University. From these datasets, the total rain and average species concentrations for each day were calculated. The days were then split in three categories based on rain totals: no rain, total rain under median total rain (0.16 in), and total rain equal/above median total rain. The final analysis was to look at the average species composition percentages in each category which did vary between the categories with the largest difference being in the percentage of sulfate and organics.

Non-Hermitian Metasurfaces with Non-Trivial Technology

Rosemary Lach - Poster Session B 205

Both non-Hermitian physics and topology are very promising frameworks that can be used in nanophotonics to treat losses as a design parameter and provide robustness against defects. Naturally, combining non-Hermiticity with topology has great potential for the future of optical devices, but past demonstrations of topological non-Hermiticity have been limited to super-wavelength scales or in topological edge states. Through the design of a plasmonic-dielectric non-Hermitian metasurface at visible wavelengths, we show that non-trivial topological effects can also manifest in bulk states. The metasurface is based on a fourth order passive parity-time symmetric system, which unlocks its topological effects by coupling horizontal and vertical modes. It exhibits an exceptional concentric ring in its momentum space indicating a Z3 topological invariant of V=-1. Experimental results obtained through Fourier-space imaging for single-shot k-space measurements are consistent with full-wave electromagnetic simulations and the analytical model. These findings provide a foundation for future optical devices to combine topology and non-Hermiticity and exhibit topological effects in bulk states.

High-throughput Screening of the Human Gut Microbiome for Two-Component System Diagnostic Biosensors

Hannah Li - Poster Session A 102

The human gut microbiome hosts a diverse community of bacteria that help regulate human health. Two-component systems (TCSs) are the largest family of signal transduction systems in bacteria and are the primary means by which bacteria sense and respond to environmental stimuli. However, the majority of TCSs in the human gut microbiome are uncharacterized, with unknown inputs and outputs. We aim to characterize potential bacterial biosensors that could be engineered into minimally invasive diagnostic and therapeutic devices for a wide range of diseases.

The Tabor lab has developed a technique to rewire TCSs to well-characterized output promoters, enabling high throughput screening of uncharacterized TCSs. Through Next-Generation Sequencing (NGS), we have identified a multitude of TCS-input hits and we aim to further elucidate input stimuli for TCSs in the gut TCS library through flow cytometry. We prioritized TCSs with strong responses in NGS data for follow-up screening. We used the set of prioritized hits to screen TCSs by flow cytometry to confirm that TCS activation is reproducible. Finally, we will characterize potential hits by measuring ligand-TCS transfer functions.

Proximity of start and stop codons affects gene expression in bicistronic ribosome binding sites

Matan Lieber-Kotz, Andrew Li, Sophie Reilly – Poster Session A 103

Ribosome binding sites (RBS) regulate translation initiation rates and are important tools for tuning protein expression. However, they are strongly influenced by the local sequence. One method to reduce these effects and improve reliability incorporates a bicistronic design (BCD), wherein a ribosome translates a leader peptide and then the same ribosome initiates translation from a second coding sequence (CS) immediately downstream. The second peptide benefits from an absence of mRNA secondary structure around the start codon. To make improved BCDs, we sought to determine the optimal spacing between the BCD stop codon and the start codon of the second CS. We constructed fluorescent protein-expressing plasmids including BCDs with start and stop codons separated by different DNA lengths. Plasmids were built using Golden Gate assembly, transformed into *E. coli*, and protein expression measured using a fluorescence assay. We report increased expression levels of 50-80% for a BCD variant with overlapping start and stop codons while increasing spacing between the BCD and CS did not impact expression. These results will inform genetic circuit design in our future experiments.

A Well-Balanced Entropy-Conservative Discontinuous Galerkin Method for The Quasi-1d Shallow Water Equations

Charlie Liu – Poster Session B 206

The shallow water equations (SWE) are a system of nonlinear conservation laws that models fluid flows where the vertical scale of motion is much smaller than the horizontal scale. It is of great interest in oceanography and climate modeling due to its application in river, lake, dam, and near-coastline modeling. By integrating the 2D SWE in one horizontal dimension, one obtains the quasi-1D SWE system, which can effectively model water flow in channels with non-constant width and non-flat bottom topography at a much lower computational cost compared to its two-dimensional counterpart. In this work, the author presents a well balanced, entropy stable, high-order accurate discontinuous Galerkin (DG) method for the quasi-1D SWE. The well balancedness and entropy conserving property are both proven and verified with numerical experiments. To the author's knowledge, this is the first entropy conservative numerical scheme proposed for quasi-1D systems of nonlinear conservation laws.

Dimerization of dCas9-DNMT3A3L

Samantha Lydon - Poster Session A 103

This project aims to directly link immune gene silencing in pediatric TB patients to the methylation of target genes, including INFG and IL12RB2, by synthetically targeting DNA methylation via the dCas9-DNMT3A3L complex in WT T-cells, as paired with a multiplex plasmid with four mRNA sequences. Our result should be a diseased cell with similar epigenetic hallmarks to those in patients' T-cells. This project aims to develop a modified version of dCas9-DNMT3A3L that is controlled with both the doxycycline-inducible chemical promoter for dCas9 within transduced cells and rapamycin-inducible dimerization of DNMT3A3L, increasing the precision of methylation.

Rapamycin-inducible dimerization includes choosing a cut site within DMNT3A3L that, when split and relinked using rapamycin, will not alter the final structure or function of the protein. Then, we must design a small peptide (FR) on the N-terminus of the cut site that binds to rapamycin, linking it to another small peptide (FK) attached to the C-terminus on the cut site. The protein will only be functional and activate the pathways to methylate target genes when the cells are exposed to rapamycin.

Generating Electricity from Natural Evaporation Using PVDF Thin Films Incorporating Nanocomposite Materials

Ariel Ma - Poster Session B 207

Natural evaporation has recently come under consideration as a viable source of renewable energy. Demonstrations of the validity of the concept have been reported for devices incorporating carbon-based nanocomposite materials. In this study, we investigated the possibility of using polymer thin films to generate electricity from natural evaporation. We considered a polymeric system based on polyvinylidene fluoride (PVDF). Porous PVDF films were created by incorporating a variety of nanocomposite materials into the polymer structure through a simple mixing procedure. Three nanocomposite materials were considered: carbon nanotubes, graphene oxide, and silica. The evaporation-induced electricity generation was confirmed experimentally under various ambient conditions. Among the nanocomposite materials considered, mesoporous silica (SBA-15) was found to outperform the other two materials in terms of open-circuit voltage, and graphene oxide generated the highest short-circuit current. It was found that the nanocomposite material content in the PVDF film plays an important role: on the one hand, if particles are too few in number, the number of channels will be insufficient to support a

A Novel Pediatric Sleep Study Recording Device

Jaanita Mehrani, Elise Gibney, Dustin Belsha, Leo Sanchez, Aidan McAnena, Dara Okeremi – Poster Session A 104

Each year, more than 800,000 children in America partake in polysomnography (PSG), commonly known as sleep studies, in order to diagnose sleep and breathing disorders like sleep apnea. Although adult sleep studies are now typically conducted as at-home tests, pediatric sleep studies have not yet made the shift away from being done traditionally in a hospital. PSG's require an extensive use of electrodes and other sensors at precise locations in order to measure neural, heart, and respiratory activity during sleep. Setting up and attaching the sensors takes time and compliance from the patient, and this process can be apprehensive, especially to pediatric patients. Additionally, motion artifacts and noisy data may be more prevalent for kids. These issues and the fact the patients are sleeping in a different environment than they are used to can bias data. In order to gain a quality of data comparable to a normal night of sleep at home, we have designed an integrated cap with the sensors used in PSG's that is reliable, comfortable, and affordable. The novel device—along with advances in bluetooth technologies—can be a step towards at-home sleep testing for pediatric patients.

A Methodology for Porting CUTEst Optimization Problems to Julia

Prani Nalluri - Poster Session B 208

Nonlinear programs (NLPs) are groups of equations designed to optimize the value of a function. They are especially useful when modeling real-world engineering problems. Due to the complexity of these programs, scientists often rely on repositories of well-studied, pre-existing functions to hone NLP optimizers before applying them in research. One such repository is CUTEst (a Constrained and Unconstrained Testing Environment on steroids). Despite its popularity, however, CUTEst has major drawbacks in terms of usability. Many of its functions are written in older, obscure internal file formats, such as the Standard Input Format (SIF), and are dependent on a Fortran compiler. These detriments render CUTEst unable to operate exclusively in a modern coding language. To streamline and modernize the process of using CUTEst, I formulated an approach to read the SIF files and create Julia ports of these NLPs. By developing my own automatic parser, I decoded 80% of the unconstrained NLPs and packaged them into a Julia module equipped with the features of the older CUTEst architecture, providing a user-friendly replacement that is straightforward to use in relevant computational research.

Elaborating the role of 9aa TADs in transcription activation using a dCas9 based CRISPRa platform

Abinand Parthasarathy - Poster Session B 209

Transcriptional activators can be fused to nuclease dead CRISPR dCas9 to specifically induce the expression of a target gene (CRISPRa) when guided via appropriate gRNA. Transcription factors contain acidic and disordered transactivation domains (TADs) that activate transcription by recruiting coactivators. 9aa TADs (nine amino acid long TAD regions) are the shortest segments within the TAD that are predicted and validated to activate gene expression in synthetic loci. However, it is unknown whether predicted 9aa TADs can increase transcription of a gene endogenously in mammalian cells or work as transactivation modules in dCas9 based CRISPRa platforms. We cloned a tandem fusion of three 9aa TADs (3x 9aa TADs) into expression vectors for the direct fusion, SAM, and SunTag based CRISPRa architectural platforms to determine which modality is most effective. We also measured the transactivation potential of many 1x 9aa TADs and heterotypic multipartite 9aa TADs (up to 6x 9aa TAD arrays) to determine the ideal effector length and combination. Optimizing the potency and size of 9aa TAD-based activator will improve current CRISPRa technologies and enable future CRISPRa based therapeutics.

Estimation of Heat Flux in Thermal Images

Tyler Pitts - Poster Session B 210

Heat flux is the measurement of the flow of energy per unit of area over time. Knowing the magnitude and direction of the heat flux is useful to the development of thermal devices. Thermal cameras can be used to obtain the temperature field but are currently unable to measure the heat flux. While heat flux can be estimated by measuring the temperature at specific points, this technique is mostly used for linear temperature gradients. This project attempts to use the Sobel operator, which is used to find an estimated gradient, to estimate both the direction and magnitude of the heat flux in an object given an image taken with a thermal camera, as well as some necessary information about the object. The program performs perspective correction on the base image, then uses the Sobel operator to estimate the gradient, and then maps the gradient to the thermal gradient using the input information, and finally the program outputs the estimated temperature gradient. This program could be used to assist the development of thermal devices, by making it easier to measure the thermal gradient across a plane, as well as easily identify the direction of the heat flow.

A Testbed for Studying Human-Robot Collaboration during Disaster Response

Bill Qian - Poster Session B 211

Substantial progress has been made in developing robots to support first responders performing safety-critical tasks. To ensure that the robots effectively support the humans, it is essential to train both entities to collaborate with each other. Because conducting such training in the real world is highly resource intensive, we have developed a computer-based simulation testbed in Unity in which human-robot (HR) teams are tasked with performing time-critical search and rescue tasks. To simulate the demanding nature of these operations, the first responder also needs to complete secondary tasks that may increase her workload. The performance of the HR team is monitored using both behavioral and physiological measures. A wearable heart rate sensor (Zephyr BioHarness), an eye tracker (Tobii Pro Nano), and a software system built using the Lab Streaming Layer are used to collect physiological data. Further, to enable training and testing of HR teams in diverse settings, the testbed allows for easy reconfiguration of the environment, task, and the robot characteristics. In our ongoing research, we are using this testbed to train robots to model and adapt to their human teammates.

Kinematics of Diaphragm During Large Tidal Breathing is Modulated by Increased Muscle Shortening, Increased Volume Displacement, and Maintenance of its Curvature

Haruto Sasajima, Scott Fessler - Poster Session B 212

We hypothesized that kinematics of diaphragm during large tidal breathing is modulated by increased muscle shortening and volume displacement as well as maintenance of its curvature. To test this hypothesis, radiopaque markers were attached along three neighboring midcostal muscle fibers in six dogs (8.2-9.5 kg). The three-dimensional locations of the markers were tracked by a biplane video fluoroscopy during quiet spontaneous breathing (SB), large tidal SB with open airway after occluded forceful efforts. This was conducted at lung volumes spanning the vital capacity at functional residual capacity (FRC), FRC+1/2 inspiratory capacity (IC) and total lung capacity (TLC) in the supine posture. Diaphragm muscle shortening, maximum principal curvature, and its volume displacement (VD) were computed using MATLAB and Rhino 6. At end of quiet SB as well as after occlusion at FRC, FRC+1/2IC, and TLC, values of curvature were maintained. Muscle shortening and normalized VD relative to that during quiet SB were increased. Our data suggest that during large tidal SB the diaphragm maintains its curvature, leading to a greater contribution of its muscle shortening to VD.

Parallel RRT Algorithm for Robotic Motion Planning

Mantej Singh - Poster Session B 213

The advent of autonomous technology ranging from self-driving cars to robotic surgery has propelled motion planning algorithms to the forefront of research. The Rapidly-exploring Random Tree (RRT) algorithm is one such example that is used by robots to find a suitable path between two points while avoiding obstacles. Traditionally, RRT is designed to run sequentially on a single thread. Increasing the speed and efficiency of the algorithm would facilitate its use in highly complex realistic scenarios. This research presents a novel parallel-RRT motion planning algorithm that performs computationally intensive steps such as node creation and collision checking in batches simultaneously on multiple threads, hence finding paths faster. To test the novel algorithm, we recorded the time taken for a car in a two-dimensional space to navigate from a start to a goal point while avoiding obstacles in unknown environments. Results proved that the algorithm successfully utilized the additional threads to calculate paths quicker and more efficiently. These preliminary results show promise for leveraging parallel implementations of motion planning algorithms.

Enhanced Stability of Halide Perovskite Solar Cells with Removable Barrier

Savannah Tiemann - ***Shapiro Showcase Presenter***

Global energy demand is constantly rising and is anticipated to grow 47% by 2050[1]. This growth further emphasizes the need for renewable energy, and perovskite solar cells have shown they may be the solution for meeting the increasing demand. Halide perovskites has emerged as a new class of solution-processed semiconductors, which have demonstrated an exponential rise in photovoltaic efficiencies >25.5% within just a decade. However, a long enduring challenge for halide perovskite-based photovoltaic device technology is their propensity to undergo degradation when exposed to ambient humidity. Since conventional encapsulation technologies are not compatible, a key enabling solution would be to develop robust encapsulation materials that are modular and do not require high-temperature curing. Here we report an alternative solution to traditional epoxy encapsulation methods; a thick (100 Œºm) graphite barrier with a polymer-based pressure-sensitive adhesive achieves similar performance with significant advantages due to its ease of application and ability to be removed. These results show that a simple sticker-like graphite barrier maintains 84% of a device's original PCE over 1430 hours, significantly reducing degradation from moisture, which exactly matches the performance of a permanent epoxy barrier. With comparable performances and significant advantages in scalability, ease of application, and non-permanence, a removable graphite barrier serves as an effective alternative solution.

Designing an Inverted Gadolinium-Neodymium Thermal Switch for Temperature Regulation

Dylan Ueyama-Burke - Poster Session B 214

Thermal switches are useful for passive thermal management in many applications because they turn on/off in response to a temperature (T) change. Thermal switches have an ON state with a high thermal conductance G (rate of heat transfer for a ΔT) which facilitates heat flow in/out of the system, and a low G in the OFF state. Many thermal switches have a high G at high T and a low G at low T. Here, we use T-dependent Gadolinium (Gd)-Neodymium (Nd) magnetic forces to design a switch with a high G at low T and a low G at high T. This "inverted" switch uses two copper plates separated by a moving piece holding a Nd magnet; the switching depends on the balance of the magnetic and gravitational forces acting on this piece. At low T, the magnetic force is stronger than the weight of the piece and brings the surfaces into contact, allowing for conduction. At high T, the Gd is non-magnetic so the piece breaks contact, opening a gap to block heat flow. The prototype exhibits switching T in the ranges of 15.7-16.8oC (OFF→ON) and 18.9-19.6oC (ON→OFF), giving a thermal hysteresis of 2-4oC. The inverted switch shows promise for T regulation of refrigeration cycles or other cold environments.

Engineering of LwaCas13a with Enhanced Collateral Activity for Ultrasensitive Nucleic Acid Detection

Jeffrey Vanegas - Poster Session B 215

CRISPR-Cas13 has been rapidly developed for nucleic acid-based diagnostics by utilizing its characteristic collateral activity, easy programmability, and equipment-free nature. Despite recent progress in CRISPR based diagnostics, engineering the Cas13 enzyme is challenging due to its complex structural dynamics, but promising for point-of-care detection from raw patient samples. Here, we successfully employed a novel strategy to engineer the *Leptotrichia wadei* (Lwa)Cas13a by inserting different RNA binding domains (RBDs) to increase enzyme-substrate binding affinity. Two LwaCas13a variants achieved up to 58-fold enhanced collateral activity over the wild-type (WT) in a fluorescence-based assay. When using an electrochemical detection method, our variants achieved 50,000-fold sensitivity over the WT, showing a clear detection of ~1 attomolar (0.6 copy/μL) of the SARS-CoV-2 genome within 30 minutes. We are currently integrating our engineered LwaCas13a enzymes into a new diagnostic test for HIV with lateral flow strips. Most importantly, our engineered LwaCas13a enzymes can be further integrated into other fields including biological assessments and environmental surveillance.

Modeling the Transient Response of a Pulsed Thermoelectric Cooler

Edward Walker - Poster Session B 216

Thermoelectric coolers (TECs) provide reliable, solid-state, noiseless refrigeration; however, further research in TECs is required as the coefficient of performance is lower than competitive cooling methods. Previous work has shown that pulsing the applied electric current creates a period in which the TEC exceeds standard refrigeration performance (cooling period) followed by a period of warming and returning to steady state (return period). Here, we used a finite-difference model to explore the relationship between this pulse and the TEC response.

Our model showed larger pulse magnitudes decreased the cooling period width and increased the return period width, while increased pulse widths increased the cooling period width with negligible effects on the return period width. Optimized pulse magnitudes can create temporary cold-side temperature differentials (*dT*) 30% better than steady-state (no pulsing) operation. Using a thermal switch that contacts the TEC during a pulse, a substrate can be cooled to an average *dT* that is 20% better than steady-state operation. Future work will investigate the optimal pulse waveform and the use of thermal diodes with a pulsed TEC."

Optimization of a Magnetic Temperature-Dependent Heat Switch for Lunar Spacecraft Applications

Alisa Webb - Poster Session B 217

Passive heat switches have been used as thermal control management tools in spacecraft to minimize power usage. These switches alternate between thermally conducting and thermally insulating states above/below a predetermined switching temperature to achieve minimal energy use for thermal regulation . In our lab, a gadolinium-based switch that uses magnetic forces to create or disrupt thermal contact was created to accomplish a high turndown switch ratio of at least 400:1. I used finite element modeling to optimize thermal and structural characteristics of the switch. Considering both transient and steady-state simulations, I calculated the time constants of the switch, turndown switch ratios, and geometry effects on heat flow. The structural limit was investigated through Euler and Johnson methods to establish critical loading leading to buckling. Current analysis indicates a switch ratio of over 400:1 can be achieved in a range of contact conductances, and that the switch can approach steady-state in less than a minute. This research paves the way for high-performing, lightweight thermal switches that can be applied to future lunar spacecraft missions.

Semiparametric count data regression for self-reported mental health

Bohan Wu - ***Shapiro Showcase Presenter***

"For how many days during the past 30 days was your mental health not good?" The responses to this question measure self-reported mental health and can be linked to important covariates in the National Health and Nutrition Examination Survey (NHANES). However, these count variables present major distributional challenges: the data are overdispersed, zero-inflated, bounded by 30, and heaped in five- and seven-day increments. To meet these challenges, we design a semiparametric estimation and inference framework for count data regression. The data-generating process is defined by simultaneously transforming and rounding (STAR) a latent Gaussian regression model. The transformation is estimated nonparametrically and the rounding operator ensures the correct support for the discrete and bounded data. Maximum likelihood estimators are computed using an EM algorithm that is compatible with any continuous data model estimable by least squares. STAR regression includes asymptotic hypothesis testing and confidence intervals, variable selection via information criteria, and customized diagnostics. Simulation studies validate the utility of this framework. STAR is deployed to study the factors associated with self-reported mental health and demonstrates substantial improvements in goodness-of-fit compared to existing count data regression models.

Color of van der Waals layered 2D materials

Yiyi Yang - Poster Session B 218

Color is one of the fundamental physical properties perceived by human eyes. Van der Waals layered 2D materials have been widely explored in the past decade for their outstanding performance in electronic and optoelectronic devices. However, the colors of van der Waals layered 2D materials remained elusive due to their complex atomic structures by various synthesis techniques and conditions. Here, we reveal the colors of weakly-bonded layered 2D materials (including transition-metal dichalcogenide family, graphene, and CrX_3, X=Cl, Br, I) by first-principles calculations and transfer matrix method. Their colors are related to the band structures of 2D material monolayers. We also identified the evolution of color with respect to defect, thickness and stacking ordering of these materials. The colors obtained from our calculations matched closely with those appearing in reported experiments. Hence, the desired colors can be obtained by fine-designed material combinations. Our work provides a viable method for materials characterization in experimental synthesis and color-oriented device applications.

Bionanocomposite coating to improve the quality of eggs and reduce waste

Aasha Zinke - ***Shapiro Showcase Presenter***

Food insecurity is a rampant global problem, while rates of food waste are higher than they have ever been. In the United States, up to 40% of the food supply produced is wasted, lost primarily at the retail and consumer levels. These amounts correspond to approximately 133 billion pounds of food. Food waste is not only a problem of inefficiency, but also environmental impact. When food is thrown away, it releases methane as it decomposes in landfills, further contributing to greenhouse gas emissions. This source of pollution is entirely avoidable, and improving the food supply chain is a crucial step. In North America, 31.4% of all eggs produced are wasted in the supply chain, accounting for around 2% of total food waste. The egg white, yolk, and shell all contribute to this waste. We propose a novel coating that incorporates each element of egg waste to preserve eggs and reduce waste overall. While the egg white and yolk are utilized primarily in their waste form, the eggshell is ground into a nanopowder to create eggshell nanoparticles (ESNP) with applicable structural properties. These often wasted materials possess key chemical and mechanical properties that make them ideal components of a protective barrier coating. The coating is all-natural, antimicrobial, and inexpensive as it is made from wasted ingredients. Furthermore, it extends the shelf life of an egg by up to three weeks without refrigeration. As a result, we anticipate this coating will be particularly applicable in settings in which eggs are not refrigerated, as is common throughout the world. The coating we propose utilizes egg waste to significantly extend the shelf life of an egg.

Humanities Poster Presentations

The CCP's Authoritarian Toolkit

Saumya Jhaveri, George Huang, Mehek Jain, Spring Xia - ***Shapiro Showcase Presenters***

How does the Chinese Communist Party (CCP) organize and operationalize political tools to exercise and maintain power? We find that ideology, economy, the Constitution, and the party-state are used to legitimize and reinforce CCP rule. Rather than constitutional supremacy, the party has merged itself with the state, allowing it to nearly completely exercise the party's will. The CCP organizes the socialist market economy and uses propaganda to promote its ideology. Ultimately, these tools--ideology, economy, the Constitution, and the party-state--together reflect ways by which the CCP legitimizes and sustains its rule.

Reconstructing the Coastwise Trade in Enslaved African Americans to Texas in the Nineteenth Century

Katelyn Landry, Ben Schachter, Victoria Zabarte - ***Shapiro Showcase Presenters***

The following presentation reports the results of a year-long research project funded by the Fondren Fellows program at Rice University on the coastwise trade in enslaved African Americans to Texas during the nineteenth century. The research was largely based on slave manifests filed at New Orleans, Savannah, and Mobile between 1827 and 1860. These documents contain personal details on approximately 15,000 African Americans, including their names, age, sex, and stature, in addition to information about their enslavers, the ships that transported them, and their captains' intended destination on the Texas coast. The results show that the coastwise traffic to Texas started years before the 1836 Revolution, that it peaked following statehood in 1845, and that it involved ports stretching from the Sabine Lake to Rio Grande, with Galveston being the principal destination. The information analyzed is crucial for the understanding of the history of Texas, the U.S. South, as well as the Black experience in the Americas. Genealogists may find the data discussed particularly relevant to their research. The project's final results will be made freely available on the renowned website SlaveVoyages.org, hosted at Rice University.

The Sugarland 95: A Demographic Perspective on Fort Bend County

Juliana Phan – Poster Session A 105

Despite now being recognized as some of the most diverse areas in the U.S., Sugarland and Fort Bend County are still haunted by the legacy of slavery. Modern Sugarland cannot be understood without first recognizing the slave labor and convict leasing that sustained the sugar industry that the city is named for. Only in 2011 did the Imperial Prison Farm, the main source of the convict leasing system, shut down, and both school districts and development countries are still working to conceal that history today. This project will expand on existing research and advocacy related to the Sugarland 95, a mass cemetery of victims of convict leasing in Fort Bend County, TX. In particular, I consider the demographic trends in Sugarland and Fort Bend County over time, examining racial and socioeconomic development and how it was shaped by the Imperial Prison Farm. A combination of archival materials, census data, and mapping tools are used to produce a story map of the convict leasing system and the Sugarland 95.

The Effects of Federal Legislation on Sex Work/Sex Trafficking in the Digital Age

Kierstin Wilkins - ***Shapiro Showcase Presenter***

This talk will outline general trends within the Underground Commercial Sex Economy (UCSE) in the United States and the federal government's attempts to regulate sex work/sex trafficking through legislation from 1970 to the present. I will discuss how the Internet affected the UCSE and how the federal government attempted to adapt to that effect. I argue that legislative attempts to regulate sex work/sex trafficking, such as the TVPA and SESTA/FOSTA, have failed in two main ways. First, legislation concerning the UCSE erroneously conflates sex work with sex trafficking, which had the effect of driving sex workers away from internet-based work and toward traditionally more dangerous street-based work. Second, it is unclear if this legislation was effective in decreasing the severity of sex trafficking. This legislation made it more difficult for law enforcement to track sex traffickers' actions since the new websites hosting UCSE content now operate overseas, complicating efforts of law enforcement to collect evidence. This talk will attempt to explain why recent legislation unintentionally harmed sex workers and why it failed to decrease the severity of sex trafficking.

Community Medical Cartography: Mapping Licensed Practitioners and Clinics Beyond the TMC

Katherine Wu – Poster Session A 106

Race and socioeconomic status affect health outcomes in the US. Whether uninsured, undocumented, un-informed, un-represented, many groups remain invisible in studies on medical access. As a result, underserved minorities turn to local institutions, such as community centers, churches, temples, clinics, and apothecaries for their health care needs. Few people have studied alternative modes of health care. The research cluster within the Medicine Race Democracy Lab fills this gap by exploring health and healing outside of the TMC. Using critical cartography as a medium, we de-center the hospital as a site of medical care by engaging with grassroots public health movements such as community centers, clinics, and non-biomedical services to offer a shifting perspective of healthcare access in Houston. Specifically, we use two data sets comparing the location of acupuncture practitioners of National Certification Commission for Acupuncture and Oriental Medicine (NCCAOM) certification with representations of median household income, mortality rates, and vaccination rates. In doing so, we aim to take on larger questions of medical racism as far as it inhibits access to health care.

Natural Sciences Poster Presentations

The Role of Evolutionary Feedbacks in the Evolution of Aggressive Behavior in Drosophila melanogaster

Arnav Amruth, Ryan Armijo, Maggie Bao - Poster Session A 107

Despite being an important factor in the behavior of organisms, the role of evolutionary feedbacks in influencing behavioral evolution is unclear. Multiple factors, such as short-term behavioral plasticity, indirect genetic effects, and evolutionary feedback, can impede direct observations of behavioral evolution through manipulation of genotypes and the expressed phenotypes. Therefore, our project aims to clarify the role of evolutionary feedbacks by providing empirical evidence through experimental manipulations of Drosophila melanogaster populations. We hypothesize that evolutionary feedbacks alter evolutionary rates and evolutionary trajectories, and we predict that positive feedbacks will increase and negative feedbacks will decrease the rate of evolution. Moreover, feedbacks should result in non-linear patterns of behavioral evolution and changes in behavioral plasticity, whereas selection without feedbacks should not. To test this, we create positive, negative, and zero feedback treatment groups alongside a control group to track how aggressive behavior between flies in each group evolves across generations.

Assessment of Patient-Reported Outcomes in Adolescents and Young Adults with Cancer

Truman Archer – Poster Session B 219

Measuring a patient population's quality of life is essential to guiding care. Adolescent and young adult (AYA) patients with cancer have been shown to have poor mental health outcomes when compared to the general population. However, most studies focus on the clinical aspect of this relationship.

This study is examining the Patient Reported Outcomes (PROs) of AYA cancer patients using the Patient-Reported Outcome Measurement System (PROMIS) and determining which demographic factors are associated with poorer psychosocial outcomes to identify higher-risk patients and direct services to meet patient needs. We extracted demographic, clinical, and PRO data containing select PROMIS questionnaires completed by AYAs between 1/1/2018 and 12/1/2021. Generalized linear models will be used to identify factors (e.g. age group, gender, insurance coverage, and race/ethnicity) that are associated with PROMIS mental health measures at the 0.05 significance level. We expect to find demographics that are associated with poor mental health outcomes. In the future, intervention strategies can be implemented to prevent patients from experiencing these detriments to mental health.

Amphibian Biodiversity Measured by eDNA or Recorded Calls Depends More on Biotic Factors Than Wetland Age

Amanda Mae Ashley – Poster Session A 108

Urban expansion causes loss of wetland and associated ecosystem services which restoration can mitigate. Amphibian biodiversity is a biological indicator for wetland health which may depend on time since restoration and other wetland characteristics. Amphibian communities can be measured by auditory surveys or environmental DNA (eDNA) from water samples, but it is not known which method is more efficient and accurate. Here we used eDNA methods (using a vertebrate primer and a new amphibian specific primer) and auditory calls from overnight recordings to assess amphibian diversity in six similarly sized wetlands in the Houston area with varied in time since restoration. Both primers gave similar results but terrestrial species were only sampled acoustically. Amphibian diversity depended on biotic factors with lower diversity with greater fish diversity or grass dominated edges, but was only weakly correlated with wetland age. Results suggest limitations of both eDNA and auditory methods with a trade-off between sampling effort and completeness. This study indicates that characteristics of wetlands that support high amphibian biodiversity can be developed in a short amount of time.

The Effects of NF1 on Breast Cancer Brain Metastasis

Matthew Baik – Poster Session A 109

NF1 is a known tumor suppressor by its ability to downregulate the RAS pathway and act as a corepressor for estrogen receptors. NF1 is often lost in breast cancers, and this has been found to be associated with brain metastasis. Moreover, NF1 knockdown breast cancer cells have been shown to upregulate more genes affecting the central nervous system than NF1+ cells, and studies have also found brain metastasis tumors to display lower NF1 mRNA levels than the primary tumor counterparts. Thus, this project aims to study the role of NF1 in brain metastasis using the naturally NF1 null brain-tropic metastasis subclone (831) of MDA-MB-231 breast cancer cells. Previously, brain metastatic indicative properties such as the cell's ability to grow in suspension and increased cell motility were studied. These results showed no relation between NF1 presence and cell growth in suspension but indicated that NF1 absence can increase cell motility. However, follow-up experiments revealed contradictions. As data collected in this study do not replicate previously acquired results, no correlation between NF1 loss and incidence of brain metastatic properties in vitro can currently be established.

Antigen-Specific T Cells for Sarcoma

Harrison Berger – Poster Session A 110

Sarcomas comprise a heterogeneous group of mesenchymal neoplasms originating from bones and soft tissues in the body. Roughly 1700 children under the age of 20 are newly diagnosed with sarcoma in the United States each year. Current standard of care approaches using high-dose chemotherapy is debilitating for these children long-term. Adoptive T-cell immunotherapy is promising to meet the need for an alternate approach for this patient cohort. However, a dearth of tumor-restricted antigens makes the development of such an intervention difficult. A longitudinal autoantibody follow-up of a late-stage rhabdomyosarcoma patient who had achieved sustained remission after treatment with a HER2-specific CAR-T cell therapeutic in our clinical trial (NCT00902044) identified immune reactivity to novel antigens with testis-restricted expression. The purpose of the research project is to validate the expression of the target antigens in cancer-derived cell lines representing various sarcoma subtypes namely, osteosarcoma, rhabdomyosarcoma and Ewing sarcoma and measure the MHC Class I binding stability of synthetic immunogenic peptides for developing antigen-specific T cells. The RNA and protein expression was measured through RT-PCR and immunocytochemistry of 8 unique sarcoma cell lines, while MHC I binding stability was determined via a flow cytometry approach utilizing the T2 cell line. Herein, we report the antigen expression in various subtypes of sarcoma and the peptide binding concordance.

IRF3 Localization During the Pam2/ODN-Induced Innate Immune Response

Jack Bodnar – Poster Session A 112

This study characterizes the localization of the IRF3 transcription factor in the innate immune response induced by the synergistic drug combination Pam2CSK4 (Pam2) and ODN M362 (ODN) in lung epithelial cells. Lung epithelial cells are sufficient to combat many inhaled pathogens through Pam2/ODN-inducible resistance. Although IRF3 nuclear translocation is well-characterized in infection, activation in response to Pam2/ODN remains unknown. Thus, characterization of IRF3 response and localization in lung epithelial cells is important to better understand the protective action of Pam2/ODN treatment. IRF3 localization in MLE-15 cells following Pam2/ODN treatment was characterized by cellular fractionation and immunoblotting, as well as by immunofluorescence microscopy techniques. Here it is reported that Pam2/ODN treatment depletes cytoplasmic IRF3 and increases nuclear IRF3. These results support the hypothesis that Pam2/ODN treatment stimulates IRF3 nuclear translocation and likely leads to increased expression of protective gene products.

Drug Loaded Exosomes for the Treatment of Pancreatic Ductal Adenocarcinoma (PDAC)

Mia Brakebill – Poster Session B 220

Pancreatic ductal adenocarcinoma (PDAC) is a major contributor to cancer related death, with a dismal five-year survival rate of only 5-10%. Chemotherapy drugs like gemcitabine have improved patient survival rates; however, the toxicity of these drugs is burdensome for patients, and a lack of targeted delivery limits the ability of drugs to fully eliminate tumors. Novel nanotechnologies, such as exosome mediated drug delivery, show promise to revolutionize cancer treatment. These small extracellular vesicles are both inherently biocompatible and have demonstrated tumor tropism, making them ideal candidates for safe and targeted drug delivery vehicles. In the past, exogenous nucleic acids, proteins, and small molecules have been incorporated in exosomes for therapeutic benefit. Therefore, I hypothesize that exosome mediated delivery of chemotherapy drugs could decrease toxicity and increase efficacy of treatment by reducing the amount of drug required for treatment and increasing the overall specificity. Furthermore, exosomes could be key in developing an oral delivery system for drugs that have exceptionally low bioavailability, such as the novel KRASG12D inhibitors.

Determining the Level of Mindfulness in Patients Admitted to the Epilepsy Monitoring Unit

Victoria Chang – Poster Session A 114

Patients admitted to the Epilepsy Monitoring Unit, particularly psychogenic non-epileptic seizures (PNES) and epilepsy patients, have higher proportions of attention deficits compared to general populations. Recent research on seizure therapies has begun to focus on effects of mindfulness in seizure patients. We aim to determine whether mindfulness exercises impact the electroencephalogram (EEG) activity of these patients. We also hope to evaluate potential biomarkers associated with high or low mindfulness traits and identify potential differences in mindfulness levels across diagnostic seizure categories, including PNES, epilepsy, physiologic events, and non-diagnostic studies. The study was conducted in the St. Luke's Epilepsy Monitoring Unit. Patients completed a short-form Five Facet Mindfulness Questionnaire and a mindfulness exercise. EEG recordings were taken during the mindfulness activity. Preliminary results show overall low mindfulness scores in all patients (n=28, 71.1±10.3, mean±SD) compared to historical controls (79.2±3.8) with no significant difference between epilepsy and PNES patients thus far. Recruitment of patients and analysis of EEG variables are ongoing.

Biocompatibility of Flash Graphene

Gautam Chaudhry – Poster Session B 222

Graphene is a material composed of a single layer of carbon atoms connected in a hexagonal 2D structure. Graphene conducts heat and electricity and has been shown to increase the rigidity of other structures, like concrete, when incorporated as a nanocomposite filler. Previously, graphene has been shown to aid in gene and drug delivery and applications in biological sensors. Graphene can be made through flash Joule heating, where high voltage and high heat are used over a period of fewer than 1 second to convert carbonaceous feedstocks such as coal and waste into high quality "flash graphene." Due to the scalability of the flash Joule heating process, it would be advantageous to use flash graphene for biomedical applications. Hence, we decided to study the biocompatibility of flash graphene. In Human Embryonic Kidney (HEK) cells, exposure to increasing concentrations of graphene leads to fewer viable cells as determined by MTT and live/dead cell assays. Comparisons between flash graphene and commercial graphene indicate that cells immersed in flash graphene have increased cell viability after incubation for two days with varying concentrations of graphene in media solution.

ATRX-deficient sarcomas exhibit enhanced replication stress and DNA damage upon stabilization of G-quadruplexes

Brandon Chen – Poster Session B 223

Mutational inactivation of histone chaperone α-thalassaemia/mental retardation X-linked (ATRX) is a defining molecular alteration in many cancers. Loss of function in ATRX leads to the formation of abnormal DNA secondary structures known as G-quadruplexes (G4s). The buildup of G4s in GC-rich regions of ATRX-deficient cancers leads to transcriptional dysregulation and genomic instability through replication stress and DNA damage, selectively inducing cell death. Previous findings show promise in G4 stabilization as a novel therapeutic strategy. Here, we demonstrate a dose-sensitive response to G4 stabilization in ATRX-deficient sarcomas with G4 stabilizer CX-5461. Specificity was confirmed via cell viability assays. Similar to findings in glioma stem cells, ATRX-deficient sarcoma cellular models exhibit an upregulation of ATR and ATM pathways upon G4 stabilization, indicating enhanced replication stress and DNA damage. Next steps are to test G4 stabilization with other DNA-damaging therapies like ionizing radiation. Our work builds on previous findings in high-grade gliomas and outlines mechanisms of action and efficacy for novel therapeutic strategies for ATRX-deficient cancers.

Characterization of the Role of Dnmt3a in Skeletal Stem Cell Quiescence

Sierra Chen – Poster Session B 224

Skeletal stem cells (SSCs) are crucial for bone formation, homeostasis, and repair. SSCs actively divide and differentiate during development but become quiescent in adulthood, reactivating only in the event of bone injury. However, the mechanisms regulating this process are unknown. Recently, our lab found that the targeted deletion of DNA methyltransferase 3 (Dnmt3a), a key epigenetic regulator, in SSCs significantly increases bone size in aged mice. Furthermore, we observed in the bone that expression of Dnmt3a increases while SSC activity decreases with age. To better characterize the role of Dnmt3a in SSCs, we investigated signaling pathways involved in Dnmt3a regulation in intact tissue by developing an ex-vivo bone culture model. We found that TGF-β1 can induce expression of Dnmt3a in young mice, but not aged mice. Immunofluorescence staining in mice with Dnmt3a deletion in SSCs revealed a marked increase in SSCs and their descendents in the bone, resulting in increased bone formation. These results indicate that Dnmt3a is a key negative regulator of SSC quiescence. Our ongoing studies will lead to new biological and clinical insights to improve regenerative bone therapies.

Differential Responses of Prelimbic Neurons to Food-Associated Cues in Hungry and Satiated Rats

Claire Cho – Poster Session A 115

The prefrontal cortex differentially responds to food cues depending on if one is hungry or satiated, but the neural mechanism underlying this transition between hunger states is unclear. Prelimbic (PL) neurons in the prefrontal cortex respond to food cues, so we hypothesized that PL neurons reduce their responses to food cues when animals are satiated. We recorded neural activity in male Long-Evans rats implanted with an electrode in PL. Rats were trained to press a lever for sucrose when presented with a cue. During the test, hungry rats responded to 12 cues, underwent a satiation phase, and responded to 12 more cues once full. PL activity was compared between hunger and satiation. While overall excitatory and inhibitory responses did not change across hunger states, PL subpopulations arose with differential activity in hunger and satiation. One group with inhibitory responses in hunger reduced this response in satiation. A separate group significantly increased their inhibitory responses and another increased their excitatory responses from hunger to satiation. This suggests a role for distinct PL subpopulations in responding to food cues based on internal hunger states.

Investigating Abasic Sites in DNA and its Interactions with the T7 gp4 Helicase

Neil Chopra – Poster Session A 116

Abasic sites (AP sites) in DNA are missing nucleotides that destabilize the DNA structure and can be lethal. As one of the most common types of DNA damage that can occur spontaneously or from environmental assault, abasic sites in DNA are not well understood in the context of DNA replication. Previous studies have suggested that the T7 gp4 helicase can bypass an abasic site after pausing near the abasic site. There has not been a reported structure of DNA helicase interacting with an abasic site and the mechanism is not well understood. We used single-stranded DNA composed of 15 thymine bases (T15) along with 6 variants of T15 with different abasic sites and the E343Q mutant of the T7 gp4 hexameric helicase (EQ) to test DNA binding to the EQ protein with varying abasic site locations. Additional biochemical and biophysical assays allow us to characterize the helicase's interactions with the abasic site. The results of this project will help us eventually solve the structure of the helicase in complex with DNA with an abasic site.

Characterizing Large-Maf Regulation of Complement Inhibitors in Multiple Myeloma

Cody Clayhold – Poster Session A 117

Multiple myeloma (MM) is the second most common hematological malignancy in the United States. Derived from mutated populations of antibody (Ab)-secreting immune cells called plasma cells, MM remains incurable. Immunotherapies—which harness and guide the body's immune system to target diseased tissues—have emerged as a new frontier of treatment, particularly in patients with multiple prior rounds of treatment. Two FDA approved monoclonal Ab (mAb) immunotherapeutics, daratumumab and isatuximab, activate complement-dependent cytotoxicity (CDC), which kills targeted cells by forming pores in their membranes. CDC is impeded by complement inhibitors (CIs) CD46, CD55, and CD59, which correlate differentially with drug resistance in MM. Studies suggest that large MAF-family genes (L-MAFs)—which are dysregulated by common MM chromosomal translocations and code for transcription factors (TFs)—mediate crucial MM pathways, yet their regulation of CIs remains unstudied. Initial data show a correlation between L-MAF and CI expression in patients. Thus, I suspect L-Maf TFs regulate CI transcription and I have characterized this regulation using luciferase reporter assays and flow cytometry.

Transfection Efficiency Across Different Cell Lineages

Madeleine Cluck – Poster Session A 118

Researchers use dCas9, a variant of the Cas9 protein with deactivated endonuclease activity, fused to varied transcriptional effectors to modulate targeted gene expression. This control over gene expression has important implications in both clinical and basic research and offers new potential for research in the fields of cancer biology, drug delivery, and gene therapy. There are many different methods of delivering the dCas9-CRISPR system; a common delivery method, generally known as transfection, entails introducing a DNA plasmid vector coding for the dCas9 system into a target cell in vitro, however the receptiveness of a cell to exogenous DNA varies between different cell lines. This confounding variable could lead to over or underestimation of the transcriptional modulation ability of a tested dCas9 system. In order to address this deficiency, this study seeks to compare the transfection efficiency of DNA plasmids across five commonly used human cell lines using a standardized eGFP expressing DNA plasmid.

Putative Viral Induction in a Common Bacterial Symbiont of Coral

Kennedy Coleman -– Poster Session A 119

The health of corals and other marine invertebrates are influenced by their core microbiota; Endozoicomonas bacteria dominate many of these communities. Endozoicomonas genomes tend to have multiple prophage and when these viruses enter a lytic cycle –often following the onset of stressful conditions– they may influence the composition of their host's microbiome. However, few studies have tested whether prophage are viable. We, therefore, exposed Endozoicomonas montiporae CL-33, a strain encoding 8 prophage sequences, to physicochemical stressors known to induce temperate viruses in other systems. Mitomycin C resulted in early signs of culture lysis 5-6 h after treatment, while other stressors tested did not, and accumulated up to a 43±2% decrease (n=3) in absorbance values by 30 h. Prophage gene expression was monitored using transcriptome sequencing of cultures before mitomycin C treatment and at 2 and 6 h post-treatment. Final results will include differential gene expression analyses between mitomycin C-treated and untreated cultures to confirm prophage activity. Ultimately, these findings will provide insights into virus co-evolution with an ecosystem engineer: stony corals.

A Droplet Microfluidics Platform for the Discovery of Novel Antibiotics

Saoirse Disney-McKeethen – Poster Session B 228

Antibiotic resistance is a global health crisis, but the rate of drug discovery has stalled since the late 1980s. Bacteria in the genus Streptomyces are the main source of natural antimicrobials, but the majority of these molecules are only produced as part of a network of interactions within a complex and microbially rich soil environment. Microfluidic emulsions allow researchers to recreate microbial interactions that select for antimicrobial production by co-encapsulating potential antibiotic producers with competing pathogens, then use fluorescent sorting to enrich for producing strains. Our goal was to select for antimicrobial production in a heterogenous *Streptomyces venezuelae* population by co-encapsulating it with *Pseudomonas aeruginosa*. We successfully enriched antimicrobial producers by selecting for droplets where *P. aeruginosa* growth was inhibited. Additionally, we isolated four producing strains from the final enriched population and confirmed their production of a diffusible molecule. Genomic and biochemical analysis will aid in identification of the bioactive molecule. Overall, this work establishes microfluidics as a novel platform for drug discovery.

CRISPR/Cas9 Expression in *Drosophila melanogaster* and *Schistocerca gregaria* Embryos

Jason Dong – Poster Session A 154

This study investigates promoter sequences' abilities to drive transgenic expression in *Drosophila melanogaster* and *Schistocerca gregaria* embryos. Our long term goal is to develop CRISPR/Cas9 genome editing tools in *S. gregaria* to better understand and regulate locust phase polyphenism, a form of phenotypic plasticity where a few phenotypes may result from one genotype. This manifests as locusts swarming with severe effects on food supply. To make functional editing tools, we have to develop functional promoters. To test if promoters known to express in flies can also work in grasshoppers, we cloned the promoters upstream of a superfolder Green Fluorescent Protein in plasmids. These pieces were combined with control promoter OpIE2—derived from baculovirus and known to express in *Schistocerca*—and another fluorescent reporter, *Discosoma* Red. Analysis of green versus red fluorescent expression in embryos after injection will show the efficacy of each promoter compared to OpIE2. We intend to use the results of these experiments to develop better promoters directly from *Schistocerca* to make a genome editing cocktail to express components for CRISPR/Cas9 editing.

Simulating Gravitational Direct Detection of Dark Matter

Charles Dyall – Poster Session B 229

Dark matter is known to comprise around 80% of all matter in the universe. Although the gravitational effects of dark matter have been observed, direct detection of dark matter continues to be an unsolved problem in experimental physics. The new detector proposed by the Windchime Collaboration consists of an array of optomechanical impulse sensors. When noise is reduced to a satisfactory threshold at the quantum limit, this detector may be capable of detecting the gravitational force from a passing dark matter particle. To model and understand this concept, Python packages were developed to simulate sensor arrays and determine under what conditions the noise could be reduced to acceptable levels. The results of this project will help us identify design requirements and required sensitivities for constructing a detector that will probe for dark matter near the Planck Mass.

Relationships Between Symbiont Community Dynamics and Coral Health During a Reef-Wide Bleaching Event

Sara Emami – Poster Session B 230

Coral reefs are degrading as warming seas cause coral bleaching, a disruption of the partnership between corals and their obligate nutritional symbionts (family Symbiodiniaceae). In some corals, stress tolerance has been linked to symbiont community composition and dynamics. We conducted an island-wide field study to test whether Symbiodiniaceae composition influences stress tolerance in a temporal study of 72 colonies of *A. hyacinthus* around Mo'orea, French Polynesia. Community diversity was quantified from individual corals sampled 6 times over a 3-year period that included a thermal stress event. Our preliminary findings show that most corals were initially dominated by Symbiodiniaceae in the genus *Cladocopium*, with variable quantities of lower abundance types. Most corals that appeared healthy at the end of the stress event transitioned from *Cladocopium* to *Symbiodinium*, whereas most corals that bleached and/or died remained dominated by *Cladocopium*. Although our findings show that symbiotic flexibility helps some species acclimatize to anthropogenic stress, this process alone is insufficient to ensure reefs can withstand thermal stress due to climate change.

Exploring Genetic Links between Pediatric and Adult Neurodegenerative Disorders

Oladipupo Fagbongbe – Poster Session A 120

Parkinson's Disease (PD) is an age-associated progressive neurodegenerative disorder that affects motor and cognitive functions. Patients who do not meet clinical criteria for PD may still suffer from symptoms resembling PD (parkinsonism). Emerging evidence suggests that lysosomal storage disorders (LSDs) may be an underlying mechanism for PD pathogenesis. Genetic variants causing LSDs, as a group, have been associated with an increased risk of PD and parkinsonism, but the specific LSD genes that confer this risk and the unique phenotypic signatures that each gene may manifest are largely unknown. Therefore, we developed a family-based model to identify specific LSD genes associated with PD risk. We obtained comprehensive pedigrees for families with histories of LSDs, and we assessed symptoms that are associated with PD, parkinsonism, or other neurodegenerative diseases to measure the proportion of family members that exhibited symptoms of neurodegenerative disorders. The results of this study could lead to the discovery of novel genetic and phenotypic markers for PD and parkinsonism and add valuable data to the growing research on PD heritability, onset, and progression.

Differential Changes in Energy Metabolism in Response to Oxidative Stress Give Rise to Human Scarring Heterogeneity

Fayiz Faruk – Poster Session A 121

Identical dermal injuries heal with varying degrees of fibrosis in different patients. Fibroblasts (FB) rely on oxidative phosphorylation and glycolysis to generate ATP to fuel tissue repair. Emerging evidence shows aerobic glycolysis underlies pathologic fibrosis (in radiation/cancer), but its role in physiologic wound healing is unknown. As FB proliferation post-injury relies on increased lactate production, a prelude to aerobic glycolysis, we hypothesize that differences in FB bioenergetic metabolism underlie differential scarring in patients. To test this, we measured the expression of PKM2, the rate-limiting enzyme of aerobic glycolysis, in patient skin FB and found markedly higher expression and phosphorylation under TGFb in FB from patients with clinically stratified high scar (HS) phenotypes. Murine wounds implanted with these HS FB also showed expedited wound closure at D7 and pronounced fibrosis and thick epidermis at D28. Our data suggests that FB of different scarring phenotypes display characteristic metabolic profiles and produce distinct scarring in murine wounds and that a shift to aerobic glycolysis under oxidative stress is associated with increased fibrosis.

Exploring Combined Menin-MLL and LSD1 Inhibition as a Therapy for *DNMT3A*-mutant Acute Myeloid Leukemia (AML)

Anne Gao – Poster Session B 231

Mutations of DNA methyltransferase 3A (*DNMT3A*) are common in Acute Myeloid Leukemia (AML) and portend poor outcomes; therefore, targeted therapeutic strategies are needed. In *DNMT3A*-mutant AML, inhibiting either menin-MLL or lysine-specific demethylase 1 (LSD1) results in antileukemic effects through two distinct pathways: inhibiting menin-MLL reduces expression of stem cell associated genes, while inhibiting LSD1 promotes expression of genes associated with myeloid differentiation. We found previously that the combined targeting of both pathways enhances antileukemic effects in *DNMT3A*-mutant AML, including reduced cell proliferation, differentiation, and apoptosis. To determine the effect of combined menin-MLL and LSD1 inhibition on colony forming capacity and stem cell self-renewal capacity, we plated mouse *Dnmt3a*-knockout and wild type cells in methylcellulose containing individual or combined menin-MLL and LSD1 inhibitors. Analysis of results will help us isolate the effect of DNMT3A loss on sensitization to combined menin-MLL and LSD1 inhibition, as well as further define antileukemic effects of this treatment, particularly on the leukemic stem cell population.

Utilizing a Novel Method of CRISPR to Identify The Inhibitor Genes Causing Wnt Adaptation

Aishani Gargapati – Poster Session B 232

Wnt/β-catenin signaling is essential to cell differentiation, apoptosis, and stem cell renewal during embryogenesis and adult tissue homeostasis. In The Warmflash Laboratory, we have observed the process of Wnt adaptation. When human pluripotent stem cells (hPSCs) are treated with exogenous WNT3A, GFP-β-catenin initially rapidly accumulates in both the nucleus and cell membrane. Eventually, hPSCs adapt to constant Wnt signaling and nuclear GFP-β-catenin thus begins to decrease four hours after adding WNT3A. We would like to explore the genes that may promote a decrease in nuclear GFP-β-catenin approximately four hours after WNT3A addition. CRISPR-Cas9 gene editing is utilized to knock out genes from GFP-β-catenin-labeled hPSCs. WNT3A treatment will be added, and quantitative live cell imaging will measure the nuclear accumulation of GFP-β-catenin. We hypothesize that the genes SP5 and AXIN2 are two major inhibitors of the Wnt/β-catenin signaling as SP5 has been shown to downregulate the transcriptional activity of genes previously activated by the pathway, and AXIN2 directs the synthesis of Axin-2, a scaffold protein that aids in phosphorylating and thus degrading β-catenin.

GlioPro: The Implementation of High-Throughput Screening with Artificial Intelligence Optimization as a Novel Approach for Inhibition of Brain Tumor

Arnav Garyali – Poster Session B 233

Glioblastoma Multiforme (GBM), one of the most lethal primary brain tumors, possesses a minute range of treatment options. Given these single-agent therapies are limited in both efficacy and ability to curtail side effects, a more compelling approach utilizes combination therapies that can amplify currently dysfunctional cytotoxic drugs. Evaluating a library of 342 DNA repair genes through gene knockdown distinguished several genes that induced synergistic cell cytotoxicity through cell viability assays and bioinformatic analysis. Further experimentation indicated that the silencing of ATRIP, TERF2, and POLR2G potentiated TMZ-induced tumor cell apoptosis. The link between current TMZ ineffectiveness and DNA repair pathway inhibitors supports development of a therapeutic drug model. Moreover, convolutional neural networks trained on GBM patient datasets generate accurate predictions of tumor features and pathways. A novel drug-delivery design, GlioPro, proposes a targeted, synergistic mechanism that uses deep-learning predictions to yield substantial developments in both GBM treatment and other prominent tumor areas via a decrease in side effects and improved tumor death efficacy.

Modeling Seasonal and Interannual Climate Variability in Modern Precipitation Pathways Across Western North America

Elizabeth Gaviria – Poster Session B 234

The hydroclimate history of western North America presents evidence for a precipitation dipole with a transition zone separating comparatively wetter and drier regions over many timescales. This transition zone migrates in response to global changes in climate, thus impacting regional precipitation. Here we present an analysis of precipitation events from 1979-2019 using NOAA's HYSPLIT model to evaluate the moisture origins and pathways for two locations on each end of the North America precipitation dipole. This research characterizes precipitation events using spatial variance clustering to isolate the most common moisture delivery pathways and illustrate how moisture origins and $\delta^{18}O$ composition of precipitation varies with seasonality, El Niño events, and geographic location. We expect the isotope records forming in the summer to have less depleted $\delta^{18}O$ values compared to winter-biased records, but potentially be highly variable in northerly sites where the effects of the North American monsoon are not present. With observations about past climates, these modern precipitation trends will be essential in the prediction of future water availability in western North America.

The Nicotinic Receptor α5 subunit as a Potential Biomarker for Suicidality

Puneetha Goli – Poster Session B 235

The acetylcholine nicotine receptor α5 subunit (CHRNA5) is critical for nicotine withdrawal and is expressed in the habenula, a brain region associated with suicidality. While numerous CHRNA5 variants exist, the GG, AG, and AA variants of the rs16919968 single nucleotide polymorphism are strongly associated with tobacco abuse and can influence nicotine dependency risk. The dominant GG "low risk" variant is associated with decreased nicotine withdrawal symptoms and smoking risk. The AG and AA are high-risk variants. Given the associations between CHRNA5, drug addiction, and suicide, our main objective is to study whether rs16969968 is a biomarker for suicidality. We used patient data from the lab database to conduct statistical tests analyzing the association between the gene variant and past suicide attempt. Initial analyses indicated a significant relationship, however, the findings were not replicated with a new patient cohort. We are investigating differences between the first and second samples that may explain the lack of replication. Identifying another biomarker linked to suicidality can significantly improve the development of individualized treatments.

The Role of CAMKK2 in Promoting the Growth of Prostate Cancer Tumors

Pavithr Goli – Poster Session B 225

This study focuses on the role of the CAMKK2 gene and how the gene plays a factor in tumor cell growth in patients who have prostate cancer. Literature over the past decade has demonstrated the important effect that CAMKK2 plays in utilizing methods such as angiogenesis to help proliferate castration-resistant prostate cancer cells. The study that will be described will specifically aim to further explore the role of this gene by altering mouse models to give a clearer image of prostate cancer tumor growth. By altering factors such as diet in mice with prostate cancer, this study aims to understand the extrinsic functions of the CAMKK2 gene in mice that have castration-resistant prostate cancer. Through examining tumor cells in the mice, numerous experiments were conducted to analyze the tumor cells including slide analysis. The slide analysis tested for cell positivity rate. These data points were combined with others collected throughout experiments to come to propose convincing conclusions regarding the dynamics of the CAMKK2 gene in prostate cancer.

Fetal Defects Following Exposure to Dolutegravir in Mouse Embryos

Shivani Gollapudi – Poster Session A 121

Serious birth defects affect an estimated 8 million newborns every year, resulting in considerable mortality and long-term morbidity (Webber, 2015). The risk of birth defects is often determined by a combination of genetic and environmental factors (Burren, 2008). Dolutegravir (DTG), an integrase strand transfer inhibitor for the treatment of HIV, became first-line regimen for treatment of people with HIV in 2016 (Romach, 2019). While DTG was approved as a part of combination antiretroviral therapy, there was a lack of sufficient data regarding the safety associated with DTG use during pregnancy. Often, drugs that exhibit human teratogenicity show teratogenic defects in animal models as well. Given the uncertainty of whether DTG presents a significant teratogenic risk in humans due to limitations in previous clinical studies, it becomes necessary to conduct further animal studies to model the clinical effect of DTG on embryonic and fetal development. We conducted a mouse DTG toxicity study by evaluating gross anomalies in embryonic mice. Following exposure to DTG, embryonic mice were dissected to assess for neural tube, cardiac, or any other abnormalities in development.

Determining Structures of High Solvent Content Proteins Using a Hybrid Input-Output Algorithm

Elijah Gonzalez – Poster Session B 236

Determining a protein's structure directly from X-ray crystallography data is challenging. The crystallographic phase problem refers to the systematic loss of complex-valued information needed to reconstruct a crystallized protein's electron density map using its diffraction pattern. Further experimental methods can be used to recover these so-called missing phases, however approaches such as molecular replacement (MR) and single/multiple anomalous dispersion (SAD/MAD) may not be biologically feasible for the protein of interest. Developments in computational algorithms have made it possible to determine protein structures directly from diffraction data–that is, *ab initio*. Here, we present results from a hybrid input-output (HIO) algorithm that successfully reproduced several known protein structures *ab initio*. Furthermore, tuning certain HIO parameters can even optimize the rate of convergence. This HIO method is a desirable solution to the phase problem in crystallography, and can even be used in tandem with other structure determination modes such as Google's AlphaFold, cryogenic electron microscopy, and others.

Initial Steps in Establishment of "Bioprospecting Pipeline" for Novel Antibiotics through *Streptomyces* Isolation from Gall-Forming Wasps

Rodolfo Gutierrez – Poster Session B 297

Increased resistance to current antibiotics poses a significant threat to global health. A majority of antibiotics have historically originated from *Streptomyces*, a genus of bacteria largely observed in soil. However, there is a lack of research in *Streptomyces* in unique symbiotic relationships with higher-level organisms, such as insects, as a promising source for undiscovered species that produce novel antibiotics. The aim of this collaborative project is to establish a bioprospecting pipeline to discover novel antibiotics from eukaryotic-derived Actinobacteria, using gall-forming wasp larvae as a model. To this end two methods were employed – antibacterial analysis with actinomycete isolation on selective media and microbiome sequencing of gall environments – which have been successfully done on a trial basis. Here, we show preliminary results of both analyses on several gall-wasp species found on the Rice University campus.

Assessment of Interferon Scores in Pediatric Systemic Lupus Erythematosus (SLE) Patients

Sophia Hafner – Poster Session A 123

Type I interferon signaling is a major inflammatory cytokine pathway of the innate immune system. It is upregulated in a number of immune dysregulatory diseases such as the autoimmune disease systemic lupus erythematosus (SLE). Interferon signaling can be quantified using a system to generate an interferon score, but this testing is research based and not available for patient care, despite recent understanding that blocking type I interferon signaling can treat SLE. This project seeks to quantitate interferon scores for a pediatric SLE patient cohort (46 patients) in order to further understand the role of interferon signaling in the pathology of SLE, and to assess candidacy for a novel treatment. Methodology included RNA isolation from peripheral blood cells, cDNA synthesis, and real time (RT)-PCR. Fall semester I isolated and quantified RNA concentrations for all 46 patients and began the process of RT-PCR. This semester I finished RT-PCR and calculated an interferon score for each sample. In future work, I plan to use clinical data collected on the patient cohort to further analyze correlations between the interferon scores and clinical characteristics and treatment responses.

Exploring temporally restricted MYCN overexpression effects on Neural Crest Cell development

Thomas Hamre – Poster Session B 237

Neuroblastoma (NB) accounts for 15% of pediatric cancer deaths, making it an important target for cancer research. Additionally, a subsegment of NB patients with particularly high-risk tumors experience poor health outcomes despite intense multimodal treatment. A high percentage of high-risk tumors are characterized by amplification of MYCN, leading to high levels of this transcription factor. It has been suggested that aberrations during neural crest cell (NCC) development lead to NB tumor formation. In this project, we aim to analyze the effect MYCN overexpression has on early NCC development. Thus, we are generating the *sox10*:MYCN-P2A-EGFP construct to drive the expression of human MYCN in the NCC under the control of the *sox10* promoter. We are currently working on the isolation and generation of the construct to then create a stable zebrafish line that will allow us to study changes in NCC differentiation during early zebrafish development. This project will help elucidate the effect MYCN overexpression has on NCC population and could help gain insight into the early mechanisms of NB onset.

Designing Collagen Triple Helices that "Bundle"

Maria Hancu – Poster Session A 125

As the most abundant protein in animals, collagen is ubiquitous but remains understudied. Containing short, bundled, collagen-like domains, the family of Defense Collagens is a tantalizing target for studying higher-order oligomerization of collagen, with the ultimate goal of designing "bundling" collagen. To identify shared patterns necessary for oligomerization, we first identified conserved residues among members of the family using NCBI BLAST, then designed and synthesized a "template" backbone collagenous domain. Successful synthesis was confirmed with mass spectrometry, triple-helix assembly was confirmed via circular dichroism, and higher-order oligomerization was assessed with size-exclusion chromatography. Though the designed peptides self-assembled into triple-helices, they did not form higher-order structures. Higher-order oligomerization may have been complicated by low thermal stability of the triple helices (~15C), with many disruptions to the stabilizing POG backbone repeat. Further peptides are currently being designed with fewer POG interruptions, in the hopes of identifying supramolecular interactions essential to collagen's higher-order oligomerization.

Requirement of M1 Macrophages in Eradication of Large Established Melanoma by Trp-1 CD4+ T Cells in Adoptive Cell Therapy

Adam He – Poster Session A 126

Whereas antigen-specific CD8+ T cells are well established for their critical role in cancer immunotherapy, evidence suggests CD4+ T cells also confer anti-cancer activity. In contrast to CD8+ T cells' direct cytotoxicity towards cancer cells, the mechanisms underlying the antitumor activity of CD4+ T cells are more complex and understudied. We use the murine antigen tyrosinase-related protein 1 (Trp1)-specific CD4+ T-cell receptor and performed single-cell RNA sequencing analysis of tumor-infiltrating immune cells in melanoma-bearing mice that were adoptively transferred with antigen-specific TRP-1 CD4+ T cells. Strikingly, very few TRP-1 CD4+ T cells localized in the tumor environment, in comparison to a large number of tumor-resident macrophages. These tumor-resident macrophages upregulated T cell inhibitory receptor ligands (PD-L1) and pro-inflammatory cytokine IL-1β. In support of its role in tumor clearance, macrophage depletion during TRP-1 CD4+ T cell transfer therapy led to tumor recurrence. These findings reveal the M1 macrophage as a critical effector cell population in TRP-1-specific CD4+ T cell transfer therapy and suggest a potential therapeutic target for the future.

Elucidating the Role of DDX41

Jessica He – Poster Session A 127

Previous studies suggest the importance of the DDX41 gene in cellular RNA metabolism. In recent years, DDX41 has been linked to many unexpected functions, such as neoplasm association. Despite extensive research, the retinal role of DDX41 remains largely unstudied.

Exome sequencing identified candidate disease genes in vision loss patients. We identified DDX41 in a patient with retinitis pigmentosa (RP), a group of disorders with mutations involved in rod and subsequent cone photoreceptor death. Due to whole body embryonic lethality of DDX41, a conditional knockout mice line specific to the retina was constructed. Electroretinograms (ERGs) were used to assess retinal functions of the wild type, heterozygous, and knockout (KO) mice.

ERG data of conditional knockout mice (tm1c/tm1c; chx10-cre) exhibited significant photoresponse reductions by 3 months of age, indicating rod and cone photoreceptor and rod bipolar cell dysfunctions, as well as impaired phototransduction. Data analysis demonstrated retinal dysfunction in DDX41 KO mice, providing a framework for further analysis of retinal cells in the mice sample groups to study the impact of knockout of the DDX41 gene on retinopathy.

Exploration of WNT morphogens' dynamics and role during early embryogenesis.

Kaitlyn Heintzelman – Poster Session B 238

Secreted WNT proteins are significant morphogens in early embryogenesis. Around the 3rd week of human development, the formation of critical tissues and the nervous system occurs. It is speculated that a WNT gradient spans the nervous system, resulting in the formation of the brain when low and the spine when high. However, WNT ligands' exact dynamics and the gradient's existence remain elusive. Current theories propose that WNT ligands move through free diffusion, cytonemes, or exovesicles. However, the mechanisms and roles of individual WNTs remain unclear. Our project seeks to uncover WNT dynamics and observe their differential impact on cell fate decisions and axial position during embryogenesis, utilizing overexpression assays. WNT genes were cloned into constructs under a TRE inducible promoter to enable temporal expression control and transfected into human embryonic stem cells. Preliminary results suggest a unique role of different WNTs in axial position determination. Deeper knowledge of the dynamics and roles of specific WNTs during early development has potential applications in regenerative and reproductive medicine.

Maladaptive Social Information in *Drosophila melanogaster*

Autumn Hildebrand – Poster Session B 239

Social information is a form of knowledge exchange between two individuals of the same species. The theory behind social information is that a demonstrator organism will broadcast a decision, for example, selecting a mate, and an eavesdropping organism will then integrate that information when making its own choices. Social information can be a wonderful tool for individuals to work smarter, rather than harder, but social information can be detrimental if a demonstrator broadcasts harmful choices. This is where maladaptive social information comes into play. Occurrences of maladaptive social information happen when a demonstrator showcases harmful information and it is integrated into the eavesdropper's schema. This phenomenon is especially prevalent in mate choice copying which is what this research will be examining. In behavioral trials, *Drosophila melanogaster* female genotypes 40, 707, 365, and 335 were selected to participate in an experiment to observe instances of maladaptive mate-choice copying. Results were then analyzed for instances of maladaptive mate choice copying as well as genetic variation of behavior among genotypes.

Bone Morphological Analysis and Lung Metastasis Detection in Aged Atrx Knockout Mice using Micro-Computed Tomography

George Hung – Poster Session A 128

The ATRX gene is an X-linked chromatin remodeler essential for normal cognitive and musculoskeletal development. Disorders resulting from ATRX mutation present with developmental and skeletal deformities. Using in vivo mouse models, preliminary data revealed the short term (8 week) effects of Atrx knockout (KO) on skeletal bone composition: phenotypically, increased trabecular bone density and transcriptionally, decreased Opg/Rankl bone resorption marker ratio. However, the long term (1.5 year) effects of Atrx KO on skeletal bone composition have yet to be investigated. μCT analysis revealed similar increased trabecular bone density in the aged cohort. In the context of osteosarcoma, preliminary data revealed formation of lung metastases in aged Atrx KO mice, a phenomenon frequently observed but yet to be investigated. μCT analysis with ORS DragonFly software was utilized to formulate an artificial intelligence protocol capable of distinguishing between metastatic and lung tissue. This approach was focused on samples containing less than 15% metastasis burden in the lung where such a protocol could increase automation in the analysis of future samples with larger tumor burdens.

Preparation and Analysis of TRPV2 Proteoliposomes by Cryogenic Electron Tomography

Kevin Huynh – Poster Session A 129

Transient receptor potential vanilloid family type 2 (TRPV2) is a cation channel implicated in numerous physiological processes in mammals including immune response, cardiac function, and neural development. Previous structural studies of TRPV2 have used cryogenic electron microscopy (cryo-EM) to resolve high-resolution structures of the ion channel in nanodiscs. In this present study, we use liposomes as a system to study the near-native structure of TRPV2 and to image it under the influence of a membrane potential. Numerous proteoliposome conditions were tested using a variety of lipid mixtures and a range of protein-to-lipid ratios (1:40000 to 1:40 protein:lipid molar ratios). Sample vitrification was also optimized to maximize the yield of proteoliposomes on electron microscopy grids. By developing a robust workflow for the preparation of TRPV2 liposomes, we aim to expand the study of membrane proteins by cryo-ET under varying membrane dynamics.

The Mouse Grimace Scale in Head and Neck Cancer Pain Studies

Nisa Ilsin – Poster Session A 130

Mice are commonly utilized models for oncological research, such as those involving head and neck cancers. One issue often found within tumor-inducing experiments of mice is the difficulty in quantifying pain. In humans, facial expression has been coded to allow for pain assessment in a consistent manner. This method has been extended to mice through the mouse grimace scale (MGS), a pain-coding system that evaluates mouse facial expressions. This scale is still in the infancy of its utilization and has not yet been widely applied to mice with head and neck squamous cell carcinoma (HNSCC) tumors. We evaluated the utility of the MGS for pain quantification within mice with HNSCCs through filming tumorous and control mice, and additionally by filming mice following tongue injections to induce pain. We intend to compare the MGS rankings for both experiments to analyze if significant differences exist between mice with and without pain, with food consumption as an alternate method of pain analysis. These findings may have implications for not only a better understanding of pain within mouse models, but also in how pain within HNSCC treatments may apply to human patients.

STAT3 shRNA knockdown

Sriya Kakarla – Poster Session A 131

STAT3, a signal transducer, helps control cell proliferation, migration, and apoptosis in various tissues in the body. It has been shown to play a critical role in the repair of injured bronchiolar epithelium and lung development and differentiation. This study aims to create an shRNA-based knockdown of STAT3 in HBEC-3kt. To do so, we will select plasmids for shRNA constructs, do plasmid minipreps to purify plasmids, perform a lentiviral infection of HEK 293T, infection of HBECS, sorting, and validation. We intend to verify the success of our knockdowns using Western Blot analysis. This finding will allow us to plan for future experiments studying the role of STAT3.

Colon Tumor Initiates Neuronal Damage in Mice and the Development of CIPN

Neha Kalakuntla – Poster Session A 132

Colorectal cancer, in conjunction with oxaliplatin therapy, has been reported to lead to debilitating chemotherapy-induced peripheral neuropathy (CIPN) in patients. However, whether the tumor leads to neuropathic pain independent of oxaliplatin is unknown. This study was conducted to determine the tumor's role using an orthotopic colorectal cancer mouse model. MC38 colon carcinoma cells were injected into C57BL/6J mice and CT26 colon carcinoma cells were injected into BALB/c mice. Behavioral tests did not show significant indicators in tumor-bearing mice, aside from pain hypersensitivity three weeks after injection; tests are ongoing to determine whether this is paralleled in numbness thresholds. However, a loss of intraepidermal nerve fiber (IENF) density was observed in tumor-bearing samples, indicating potential subclinical neuropathy. Key inflammatory mediators were present in higher concentrations in tumor-bearing samples, providing a possible mechanistic link between the tumor and neuropathic pain. Finally, functional analyses were conducted to investigate differences iDRG neuronal activity. The results of key experiments were compared across MC38 and CT26 samples.

Targeting Adult Hippocampal Neurogenesis: Using Tlx Agonists to Improve Learning and Memory in Alzheimer's Mouse Models

Aanika Kashyap – Poster Session B 241

Neurodegenerative diseases like Alzheimer's Disease (AD) are becoming more prevalent globally. Therefore, exploring interventions that prevent or delay processes underlying pathology development is essential. Neurogenesis declines with age and in AD, thus it is a potential therapeutic target. The hippocampus, a prime neurogenic niche, is involved in forming episodic memories and is severely affected in AD. We focused on a druggable target Tlx, a master regulator of neurogenesis. Tlx regulates neural stem cell proliferation and renewal. The goal of the study is to screen the effectiveness of small molecule Tlx agonists in inducing neurogenesis, and optimize a working protocol for pattern separation, a hippocampal-dependent memory test, in 5XFAD mice. We found the number of proliferating neural stem cells (identified by GFAP/Sox-2/EdU) and newly mature neurons (identified by NeuN/EdU) increased in Tlx-agonists fed AD animals. To determine whether this increase in neurogenesis also improves cognition, we will utilize the aforementioned pattern separation test. The implications of this research are relevant in identifying molecules for drug development for neurodegenerative diseases.

Understanding the Role of gene A in Liver Development of Alagille Syndrome Mouse Model

Marzieh Keivandarian – Poster Session B 242

Alagille syndrome (ALGS) is a multi-system developmental disorder caused by JAG1 or NOTCH2 mutations. *JAG1* mutations are responsible for the majority of the cases, but *NOTCH2* mutations are also involved in a small number of them. ALGS patients have health challenges in major organ systems such as heart, liver, and kidney. Liver is the primary focus of this research. We used a heterozygous deletion of the *Jag1* mouse model to investigate the effects of altering *A* gene dosage on the severity of the ALGS liver phenotypes. The *Jag1*+/– mouse model has bile duct paucity, abnormal biliary tree formation, and low body weight. Previous research has shown that *Sox9* is a dosage-sensitive modifier of mouse liver phenotypes. Our findings suggest that removing one copy of A in the liver can also modify ALGS phenotypes, providing further insight into a potential mechanism for the variability of liver disease phenotypes in patients with ALGS. Note: I will be using aliases for gene names for non-disclosure reasons.

The Construction of an Alpha-Particle Irradiator for in-vitro studies of High-LET radiation

Mohammad Khuroo – Poster Session B 243

Particles with high-LET (Linear Energy Transfer) have scarcely been studied for their effects on cancerous cells. Having a LET of about 100 keV/mm, these particles like He2+ ions (alpha-particles) are predicted to have promising effects on cancerous cells. High-LET particles cause double-stranded breaks in the DNA resulting in the activation of repair mechanisms, and the recruitment of the immune system which ultimately leads to cell death. To study the impact of He2+ ions on cancerous cells, we have designed an irradiator that can deliver He2+ particles to the cells efficiently. The source of the He2+ ions is Am-291. The irradiator is a small, steel box of dimensions ___. To ensure that nearly equivalent radiation is supplied to the cells, the source will be attached to a rotary motor that will make the radiation uniform. An electronically controlled shutter is also present between the source and the cells, to ensure accurate dosage is being delivered. The shutter, rotary motor, and a timer will be centrally connected to an Arduino board, where each will be characterized and controlled.

Utilizing CcaSR to Engineer Optogenetic Control of Hydra Neuropeptides

Jae Kim, Hira Tariq, Emma Ting – Poster Session A 134

Bacterial biosensing aims to engineer bacterial cells to respond to various extracellular and intracellular stimuli and has applications across medicine, agriculture, and industry. In the past, all bacterial biosensors have been developed for the exponential growth phase. However, bacteria exist almost entirely in the stationary phase in real-world applications. CcaSR, an optogenetic bacterial biosensor with wide-ranging applications, has recently been developed into a variant that functions in the stationary phase. I characterized the expression dynamics of CcaSR that lead to this functional system by dynamically monitoring GFP-tagged CcaS/CcaR expression variants through the exponential and stationary phase. I am further developing an application of this technology, a method to optogenetically control neuropeptide production in the gut of Hydra. I have cloned functional variants of neuropeptides FR-amide1 and FR-amide2 under the control of CcaSR and have probed their ability to be expressed through functional GFP-tagged variants. This would be the first case of bacterial biosensing modulating an organism's behavior and opens doors to various medical and industrial applications.

Towards characterizing the antiviral response of Symbiodiniaceae

Julia Kim – Poster Session A 133

Endosymbiotic microalgae in the Family Symbiodiniaceae are critical to the development and growth of reef-building corals. Genomic and microscopic evidence suggest that Symbiodiniaceae viral infection and lysis jeopardize coral reef health. However, elucidating the dynamics between this microalga and its specific virus has been proven difficult. This project aims to examine the antiviral mechanisms of Symbiodiniaceae and whether they reflect antiviral responses of other dinoflagellates. We tricked the protoplasts of Symbiodiniaceae into an immune response with transfection of poly(I:C), a synthetic analog of dsRNA, which is diagnostic of most RNA virus infections. Transfection efficiency was quantified using immunofluorescence staining of dsRNA and segmentation analysis in ImageJ. Successful transfection results justified starting transcriptional analysis, which will reveal the molecular changes Symbiodiniaceae experience during a true RNA virus infection. Ultimately, these efforts will inform researchers about biomarkers to detect and harvest RNA virus-infected Symbiodiniaceae in order to better understand viral effects on coral reef health.

Catalytic Activity of Clays in Pyrolytic Remediation of Heavy Hydrocarbons

Caroline Koester – Poster Session A 135

Remediation of soils contaminated with petroleum is a pervasive environmental challenge. Pyrolysis offers a method of destroying toxic heavy hydrocarbons at lower temperatures than the conventional incineration method, lowering the cost of remediation. Catalysts such as ion-exchanged clays may lower the required temperatures and contact times further. This research investigated the theoretical basis for the catalytic activity of clays, which rests on the pi-cation interaction between the ions exchanged into the clay structure and the electron-rich pi systems of the aromatics. Pyrolysis proceeds via the generation of radicals on the contaminants' aromatic rings, which initiate a cascade of charring reactions wherein the aromatic molecules condense into noncarcinogenic char. The pi-cation interaction facilitates the generation of such aromatic radicals, and could initiate charring at lower temperatures. This analysis agreed with the results detailed in the group's latest paper (in preparation). Prepared samples of ion-exchanged clays contaminated with crude oil were pyrolyzed, and regulatory compliance achieved with the unprecedently-low temperature of 300 C.

The Role of Fatty Liver in Ornithine Transcarbamylase (OTC) Deficiency

Sara Koh – Poster Session B 244

Ornithine transcarbamylase (OTC) deficiency, the most common urea cycle disorder, is an X-linked disorder that is characterized by a wide phenotypic heterogeneity. Here, we used the *Otcspf-ash* mouse model to study whether OTC deficiency accelerates the transition from non-alcoholic fatty liver disease (NAFLD) to non-alcoholic steatohepatitis (NASH) and possibly even hepatic cirrhosis in a diet-induced mouse model of NASH. A second objective was to test whether diet-induced NAFLD leads to a reduction of OTC enzyme activity and reduced urea cycle function in the OTC deficient mouse model. Wild-type males (*Otc+/y*), wild-type females (*Otc+/+*), hemizygous *Otcspf-ash* males (*Otcspf-ash/y)*, and heterozygous *Otcspf-ash* females (*Otcspf-ash/+*) were placed on low-fat (LF) or high-fat (HF) diets, and body weights were recorded weekly for a total of 24 weeks. At the end of the 24 week period, biomarkers of liver disease and liver histology will be evaluated. Preliminary analysis suggests reduced survival rates for *Otcspf-ash/y* mice on the LF diet. Data collection is ongoing.

Community-based research requires more effective communication with Community Health Workers

Scott Koh – Poster Session A 136

Community Health Workers (CHWs) play an important part in public health research as they are responsible for navigating project participants, delivering culturally appropriate information, and collecting data. However, despite being such a vital part of the research process, there is currently no systematic way for reporting data and findings of public health interventions back to CHWs. As CHWs are often not trained to interpret the complex data associated with public health research, my goal was to obtain feedback from CHWs on effective ways of reporting project findings. I conducted interviews with 11 CHWs to determine what information they would like to receive and how they would prefer the data to be presented. Through conducting these interviews, I concluded that the CHWs primarily wanted to know the health outcomes of the participants they worked with through simple graphics. They also stressed the importance of including both negative and positive results and clearly stating how the data and conclusions were obtained. These findings can help inform CHWs on the implications of their work and recognize new areas of improvement, leading to more effective interventions.

Exploring Student Athletes' Perceptions of Acceptance and Belonging on Campus

Sini Koivu, Miles Adams – Poster Session B 245

Fitting in on campus can be especially hard for athletes at academically rigorous schools, as there may be a stigma that they have only gotten in based on their athletics. The purpose of this study was to examine the relationship between athletic identity and academic self-concept among college student-athletes. We were particularly interested in exploring this relationship in the context of how athletes view they are perceived on campus and how their team is perceived on campus. Finally, we also wanted to investigate whether there are differences between perceptions based upon gender and nationality. Data was collected from 141 Rice University student-athletes via an online survey. There were 87 of the participants who identified as male and 52 as female. Sixteen of the participants were international students. Results from this study can be used to support student-athletes and enhance their experiences on campus. Future studies should conduct in-depth interviews to further explore relationships between athletic identity and academic self-concept among student-athletes in relation to how athletes view themselves and their teams are perceived on campus.

Glutaminase Inhibition Radiosensitizes Cancer Cells via Modulation of Oxidative Stress Defense

Rishab Kolachina – Poster Session B 246

Glutaminolysis is often upregulated in cancers to meet increased energy demands. Glutaminase-1 (GLS1) regulates the conversion of glutamine into glutamate which is further metabolized to produce glutathione (GSH), a reactive oxygen species (ROS) scavenger and important cellular antioxidant. We showed previously that IACS-6274, a novel GLS1 inhibitor (GLS1i), sensitized cancer cells to radiation therapy. Here we investigate the sensitization mechanism induced by IACS-6274. We characterized oxidative stress status by determining the ratio of reduced (GSH) to oxidized GSH (GSSG). Lipid peroxidation was quantified using flow cytometry. Additionally, we determined radiosensitization from oxidative stress by performing clonogenic assays with GLS1i combined with N-acetyl-l-cysteine (NAC), a ROS scavenger. NAC significantly recovered the cytotoxic effect of IACS-6274 and decreased radiosensitization of lung cancer cells to X-rays and protons. Preliminary results show reduced GSH:GSSG ratio and increased lipid peroxidation in cells treated with GLS1i. This result suggests that IACS-6274 radiosensitizes by limiting a cell's capacity to neutralize radiation-induced oxidative stress.

Investigating Gene Expression in Neural Crest Development Utilizing a Zebrafish-specific Optogenetic Toolkit

Grayson Kotzur – Poster Session A 137

Neural crest cells (NCCs) are migratory, transient, and multipotent stem cells found in vertebrate embryos. Although NCCs are a widely researched topic within developmental biology, the genetic drivers of proliferation and differentiation remain largely unknown. Thus, determining these genes has immense potential in translational research and treating developmental disorders. We utilize model zebrafish (*Danio rerio*) for their rapid and timely development, transparent embryonic phenotype, robust fecundity, and ease in introducing genetic changes. Here, we investigate the consequences of altering NCC spatiotemporal gene expression by developing a blue light-activated TAEL 2.0 optogenetic toolkit, which utilizes a TAELn transcription factor that activates the *C120* promoter to allow for time and tissue-specific control of gene expression. By creating an NCC-specific optogenetic system, we have created a tissue-specific toolkit to gain insight into the behavior of stem cells. The nature of the system additionally permits the spatiotemporal analysis of NCC proliferation and differentiation by focusing light on specific regions of the embryo and live imaging techniques.

Near Infrared Imaging of Bone-Forming Prostate Cancer Via Alendronate Targeting

Ajay Kumar – Poster Session A 138

A non-invasive method that selectively targets and images bone formation from metastasis in prostate tumor associated cells is currently lacking. We present a novel contrast agent via the synthesis of Cy5.5 dye, which has optical properties in the near infrared region, conjugated with alendronate. In vitro assays reveal the conjugate dye has a mean binding affinity of 62% to hydroxyapatite, which is expressed on remodeling bone surfaces, compared to just 7% for Cy5.5 alone. Fluorescence imaging reveals the conjugate dye selectively attaches to differentiated osteoblasts. In vivo mouse models show that the targeting dye accumulates in bone dense regions and remains for at least 28 days with a signal intensity of 1.2 x 10^10 photons/s. Accumulation of the dye is long-lasting and dose dependent with proportional uptake at low concentrations. In tumor bearing mice, the conjugate dye accumulated preferentially in bone-forming tumors. Histology analysis confirms the selective attachment of alendronate to calcified portions of the tumor only. The data suggests the conjugate dye offers a convenient non-invasive approach to selectively targeting and imaging bone-inducing prostate tumors.

Examining the Evolution and Integration of Flatfish Skulls

Brian Lee – Poster Session A 139

Flatfishes (order: Pleuronectiformes) exhibit the most extreme case of asymmetry in the vertebrate world, where both eyes are present on one side of the body. This distinctive trait is believed to be an adaptation to better inhabit seafloor habitats. The initial evolution of this cranial asymmetry was a rapid process that involved global coordinated changes across the skull over a brief (three million year) timespan in a process known as integration. And while flatfishes today exhibit more evolutionary integration than their non-flatfish relatives, questions remain about how these patterns of trait covariation evolve at shorter timescales and change between species. Here we examine patterns of integration and modularity within an Alaskan starry flounder population containing dextral and sinistral morphs. Data was generated through micro-CT scanning, reconstruction with NRecon, and segmentation and landmarking through Amira. The resultant anatomical data will be analyzed to determine the role of integration on the evolution of flatfish skulls. The findings of this project can inform a greater understanding of the mechanisms of trait variation across larger timescales and taxa.

Functionalization of Serine Derived Piperazines

Evan Lenkeit – Poster Session B 247

The piperazine heterocycle is frequently encountered within FDA-approved drugs and other reported biologically active compounds; however, its derivatization has mostly been limited to 1,4-substitution on the nitrogen atoms. Our research group has previously reported various di-substituted piperazine acetic acid esters starting from different natural and non-natural amino acids including serine. In this study we are further aiming to incorporate various substitutions on to the piperazine building blocks by using serine derived piperazines as starting materials. We aim to develop a practical and efficient method to incorporate different substitutions through Csp3 –Csp2 cross coupling.

Characterizing Novel Mitophagy-Activating Compounds in Neurodegenerative Models

Terri-Jeanne Liu – Poster Session B 249

Mitochondria are essential to cellular function, generating most of the cell's energy. Disruption of mitophagy is implicated in neurodegeneration and associated protein aggregation. As such, mitophagy activation through PINK1 protein stabilization is a promising target in neurodegeneration research. Previously, the Kirienko Lab screened 45,000 molecules and identified 8 PINK1-Stabilizing (PS) compounds. One compound, PS106, significantly improved motility in a *Caenorhabditis elegans* Alzheimer's Disease model expressing β-amyloid in body muscles, significantly reduced protein aggregate number in a Huntington's Disease model with polyglutamine protein aggregates, and reduced aggregate number and improved motility in a Parkinson's Disease model with α-synuclein aggregates. Biochemical assays showed PS106 reduced mitochondrial membrane potential while oxygen consumption rate was unaffected, suggesting an uncoupling mechanism. Interestingly, PS106 is an FDA-approved drug commonly known as sertraline. Our findings strengthen the connection between mitochondrial and neurological health, indicating a potential repurposing of this drug for treatment of neurodegenerative disorders.

Investigating Protein Arginine N-Methyltransferase 6 as a Therapeutic Target for Medulloblastoma

Jeffery Liu – Poster Session A 141

Medulloblastoma is the most common malignant brain cancer in pediatric patients. Commonly prescribed treatments for medulloblastoma include surgery, chemotherapy, and radiation therapy, which can all cause significant physical and cognitive side effects. Therefore, less invasive epigenetic-based therapies would be clinically invaluable. Previous work in the field has identified RE-1 Silencing Transcription Factor (REST) is overexpressed in Sonic Hedgehog (SHH) line medulloblastomas. Subsequent gain of function screens identified Protein Arginine N-Methyltransferase 6 (PRMT6) as a high priority REST-interacting protein. To better understand the nature of PRMT6-REST interaction, we performed a series of cytotoxicity assays with various PRMT6 inhibitors. Our results demonstrate the effectiveness of Licochalcone A, MS023, and EPZ inhibitors in reducing SHH medulloblastoma viability in vitro. These results support our overall hypothesis that REST requires PRMT6 to effectively drive medulloblastoma tumor proliferation. Ongoing work aims to characterize specific anti-PRMT6 antibodies to confirm the overexpression of PRMT6 in vivo using medulloblastoma PDX mouse models.

Increasing Symbiodinium Thermotolerance through Transgene Insertion with RAD51 Transient Transfection

James Liu – Poster Session B 248

This study aims to genetically engineer coral symbionts, Symbiodinium, to be more thermotolerant by increasing their antioxidant capacity. To achieve this goal, we are developing a CRISPR/Cas9 genome editing system to insert a hyperactive gene encoding the oxidant-consuming enzyme ascorbate peroxidase (APX). In this process, expression of Cas9 plus a guide RNA cuts the Symbiodinium genome and the APX is inserted via homologous recombination. To favor the latter reaction over the competing NHEJ DNA repair system where DNA insertion does not occur, I designed and constructed a RAD51 transient transfection plasmid to increase the rate of homologous directed recombination. Transformation of Symbiodinium will be performed to allow transient expression of RAD51 to promote insertion of APX DNA. I intend to compare transformation rates of the APX transgene with and without the transient transfection plasmid for RAD51 expression. Results will show the effects of RAD51 transient transfection on the incorporation of exogenous DNA into the Symbiodinium genome. If successful, this project will be one of the first to transform Symbiodinium with a transgene.

Combinatorial CRISPR-Cas9 Screen to Identify de novo Synthetic Lethal Interactions in a KRAS-Knockout Colon Cancer Cell Line

Abhinav Madduri – Poster Session B 251

In 2021, colorectal cancer, or CRC, was the third highest contributor to overall cancer deaths in the United States. Current treatments remain insufficient to appropriately address the heterogeneity of tumors and accurately specialize care for colon cancer patients. With the growing demand for precision therapy in CRC treatment, it is essential to examine which genes exacerbate cell proliferation and how various genes work together to establish the common phenotypes observed in the clinic. The use of CRISPR-Cas9 to induce the simultaneous double stranded break of two genes to perturb them, or what is commonly referred to as a double knockout, enables researchers to better understand how various genes and combinations of them can affect cell fitness. Using this high precision genetic tool, a screen was conducted using a combinatorial guide RNA library to evaluate how SW480, a KRAS mutant CRC cell line, responds to combinatorial knockouts of more than 100 selected oncogenes. Using this data, a genetic interaction network will be systematically mapped out for the SW480 cell line to identify lethal combinations of target genes for KRAS mutant CRC patients.

Increased Inflammation and Lipogenesis in African American Men with Prostate Cancer May Drive Tumor Aggressiveness

Sai Manikonda – Poster SessionB 252

In the United States, African American (AA) men are 1.76 times more likely to be diagnosed and 2.14 times more likely to die from prostate cancer (PCa) compared to European-American (EA) men. This disparity is a result of a complex interaction between socioeconomic status (SES) and genetics/biology. Studies controlling for SES have found that AA men have worse overall survival and risk of biochemical recurrence, which strongly argue for a role of genetics and biology in driving disease aggressiveness. To address this question, we carried out high throughput RNA sequencing of matched normal and PCa tissue from 30 AA and 19 EA men. Our results indicated differential expression of 976 genes between AA cancer and EA cancer: 637 genes were downregulated, and 339 genes were upregulated. Gene set enrichment analysis highlighted downregulation of DNA repair pathways and enrichment of the Hallmark Akt/mTOR signature in AA cancer compared to EA cancer. Taken together, our results further highlight the role of biological differences in promoting PCa aggressiveness and mortality in AA men and support the need for further investigation into AA PCa and disease etiology.

Food Insecurity and Dietary Behaviors Among Houston College Students During the COVID-19 Pandemic

Casley Matthews - ***Shapiro Showcase Presenter***

Objective: This study assessed the impact of the COVID-19 pandemic on college students' nutrition, including dietary behaviors and food security status. Participants: Participants included 140 students between 18 to 25 years of age, who were enrolled in a college or university in the greater Houston area. Methods: Analyses included descriptive statistics, t-tests and ANOVAs to analyze differences in dietary behaviors by demographic variables, and chi-square tests to assess characteristics associated with food security status. Results: The majority of participants reported changing their diets due to the COVID-19 pandemic. There were no significant differences by demographics. However, there were significant differences in food security status by race/ethnicity and social class. Conclusion: This study identified changes and disparities in college students' dietary behaviors and food security status during the COVID-19 pandemic. Findings help inform future policy, programs, and research to address college students' nutrition during the ongoing COVID-19 pandemic.

The role of HIF2 signaling in CAFs in the tumor microenvironment

Nafiza Meher – Poster Session 253

The desmoplastic stroma of pancreatic ductal adenocarcinoma (PDAC) promotes treatment resistance and immunosuppression, and there are currently no successful treatments to inhibit these oncogenic traits. Cancer-associated fibroblasts (CAFs) are the main components and producers of stroma in PDAC. The hypoxia-inducible factors-1 (HIF1) and -2 (HIF2) are stabilized in low oxygen and have been hypothesized to mediate therapeutic resistance and aggressive growth of PDAC. Our previous work demonstrated that loss of stromal HIF2 doubled the median survival of mice with pancreatic cancer, likely through interfering with secretion of an immunosuppressive factor involved in CAF-macrophage crosstalk. Our goal is to validate mouse KPF-CAF HIF2-WT and HIF2-KO cell lines which will then be used to help identify the immunosuppressive factor. Initial validation of HIF2 knockdown in HIF2-KO CAFs by western blot and immunofluorescence were inconclusive and further characterization is necessary. Future studies will use human CAF cells to validate the species reactivity of the antibody used.

Hydrodynamic Simulations of Au-Au Collisions

Jaanita Mehrani - ***Shapiro Showcase Presenter***

The quark-gluon plasma (QGP) is an exotic state of matter, where quarks and their force-carrier gluons—which typically reside inside nucleons like protons and neutrons—will deconfine or "melt" into a soup at high temperatures and densities. In fact, the universe was primarily in the state shortly after the Big Bang. Colliding heavy-ions like gold or lead at ultra-relativistic energies can create such conditions, and analyzing the resulting spectra after collisions can help identify the formation of and characteristics of QGP. Simulating heavy-ion collisions, more specifically, simulating the QGP phase of the collision as a hydrodynamic expansion of a viscous fluid, and comparing the model data with experimental data can give insight into properties of the plasma. The entire collision is generated using JETSCAPE, a software package that sequences different programs to simulate different phases of a collision, and MUSIC in particular performs the hydrodynamical evolution of the QGP, by taking in parameters like shear and bulk viscosity (how "thick" a fluid is) and freeze-out temperature (the temperature at which a QGP reconfines back into hadrons). The experimental data are Au-Au collisions from the STAR experiment at the center-of-mass energies 7.7, 11.5, 14.5, 27.0, 36.0, 62.4 GeV. These relatively low energies are unique in that the presence of the QGP will be less certain, especially those below 15 GeV, and analyzing these energies can reveal more features of the QGP phase diagram. To find the ideal parameters into JETSCAPE that will reproduce the given experimental data, Bayesian Analysis is employed. Sets of input parameters, create an input space and are simulated through JETSCAPE to generate an output space. The input and output spaces along with the experimental data are used to calculate the most probable input values. Using these ideal inputs, one can then determine thermodynamic properties of the QGP, like the speed of sound through such a plasma, and additionally discern energies where the model and experiment diverge. The results from this study and others are crucial in understanding the conditions for formation of the QGP and—more generally—the early moments of the universe.

ODN Treatment Efficacy by Tail Vein Injection

Michelle Miao – Poster Session B 254

Viral pneumonia is a leading cause of death in many patients globally, specifically those that are immunocompromised. This requires finding novel treatments to aid in fighting against such pulmonary diseases. A previously established treatment against bacterial and viral infections is Pam2-ODN (oligonucleotide) which uses Pam2, a TLR2/6 agonist, and ODN, a TLR9 agonist. The objective of this study focuses on ODN to observe whether tail vein injection delivery of ODN treatment to mice significantly increases survivability against viral infection as opposed to nebulization delivery of ODN treatment. Previous experiments have shown that nebulization delivery of ODN treatment was largely ineffective in inducing antiviral response. In vivo mouse models will be used to observe for antiviral activity induced by ODN treatment through intravenous tail injections. The mice will be challenged with influenza A virus through nebulization to simulate real-world transmission of pulmonary diseases following injection of ODN. After infection, the mice will be monitored in the following weeks to determine relative survivability.

Bifluorescent Reporter Design for Alternative Splicing Analysis in C2C12 Skeletal Muscle Myoblasts

Andrew Miller – Poster Session A 142

Many human genes express pre-mRNAs that are alternatively spliced to express mRNAs encoding several different protein isoforms depending on regulated inclusion or exclusion of specific exons. While many diseases are associated with changes to alternative splicing, much remains to be learned about the regulation of such events. We developed a bifluorescent reporter in which alternative splicing results in expression of different fluorescent proteins, providing a read-out of splicing patterns in individual cells. One goal is to use the reporter to follow splicing events during C2C12 differentiation to determine the timing of the transitions within individual cells of the population. Another goal is to use the reporter in knock down screens to identify genes required for temporally regulated splicing transitions. I have used mutagenesis to optimize a minigene containing the Mef2d-beta exon and have used transient transfection to demonstrate that the minigene undergoes a change in splicing in parallel with the endogenous gene. I am now creating stable cell lines containing the construct and modifying the construct to contain exons of other genes regulated during C2C12 differentiation.

The Effects of Rapamycin on mTOR in *Candida albicans* Hyphae Development and Hyphae-Yeast Transition

Raul Montes – Poster Session A 143

Candida albicans is an often-harmless yeast found in the human body that can become harmful to human health if allowed to overgrow. Virulence increases as it spreads onto multiple tissue surfaces or medical devices. The regulation of the hyphal to yeast transition has been shown to have the ability to control the virulence of C. albicans infection. The drug rapamycin, an inhibitor of the mTOR pathway, has effects on biofilm density. Using an in vitro biofilm growth model with the SC5314 strain of C. albicans, Rapamycin treatment increases the absorbance of biofilms indicating increased hyphal growth and density. When rapamycin concentration is increased beyond 20 nM, however, the increase in density is negligible. Imaging is being done to determine the method of hyphal growth leading to the increased absorbance which may be due to increased hyphal vertical growth or increased density of hyphae present in the biofilm. To further test the role of the mTOR pathway, in addition to other pathways such as PES1, in hyphae to yeast transitions, a genetic approach will be applied in which mutants causing changes in genetic activity will be tested.

Investigating immune response induced in breast cancer cells across varying radiation type, PARPi concentration, and BRCA status

Emma Moran – Poster Session B 255

Ionizing radiation induces DNA damage in cells. One response to DNA damage accumulation is cell death. However, other cellular responses include formation of micronuclei (MN) or induction of senescence, both of which activate immune pathways. We hypothesized that greater levels of senescence, MN, and cell death would be elicited in breast cancer cells when exposed to higher LET radiation (protons vs. x-rays). Additionally, we hypothesized that these effects would be greater with pharmacologic (PARP) and genomic (BRCA1 mutation) inhibition of DNA repair. BRCA1 mutated and BRCA1 intact breast cancer cell lines were treated with 6 MV X-rays or 9.9 keV/μm protons alone or with a PARP inhibitor (1-2 μM, Olaparib). Flow cytometry, clonogenic assay, and MN staining were used to quantify levels of senescence, cell survival, and MN and cGAS-positive MN, respectively. Senescence was significantly higher for BRCA deficient compared to BRCA intact cell lines. No significant differences were seen between protons and x-rays or with different PARPi concentrations. PARPi combined with protons increased the amount of cell death and MN density significantly compared to x-rays.

Understanding the Evolution of Learning Ability in Drosophila

Omar Moussa Pasha – Poster Session A 144

Among factors believed to facilitate the evolution of learning ability is environmental variability. We investigated this view by comparing learning ability between *Drosophila simulans* and *Drosophila sechellia* due to natural differences in the variability of their habitats. *D. simulans* is a generalist while *D. sechellia* is a specialist that occupies *Morinda Citrifolia*, or Noni fruit, because it is rich in a dopamine precursor called L-DOPA. Due to their more variable evolutionary ecology, we hypothesized that *D. simulans* would exhibit higher learning ability, but our results have shown the opposite. Our flies were not reared on L-DOPA which has many cognitive functions. Hence, a possible explanation for the results is a deficiency in L-DOPA. To test this, we will compare learning ability between flies reared in the presence and absence of dietary L-DOPA using an aversive conditioning assay. We will also compare brain dopamine production across those treatments using high-pressure liquid chromatography. We hypothesize that flies reared in presence of dietary L-DOPA will exhibit higher learning performance and higher brain dopamine production, and vice versa.

Spatial genomic analysis of opioid receptor inhibition of the enteric nervous system during development in zebrafish

Nikhita Mummaneni – Poster Session B 256

The largest part of the peripheral nervous system is the enteric nervous system (ENS), which is responsible for functions of the gastrointestinal tract, water balance, and hormone secretions. These are important bodily functions that are hindered in diseases affecting the differentiation of enteric neurons from enteric neuron progenitors (ENPs). The spatial regulation of gene signatures of ENPs that are known to be involved in enteric neuron differentiation offers insight into these diseases. Opioid receptor genes such as OPRL1 and OPRD1B have been found to be expressed in developed enteric neurons and the drug LY2940094 has been shown to be a specific OPRL1 inhibitor. We analyzed specific gene transcripts involved in neuron differentiation along the gut of zebrafish embryos after LY290094 drug treatment at single cell resolution using confocal imaging via whole-mount immuno-coupled hybridization chain reaction (WICHCR) in transgenic labeled enteric neural crest cells. Machine learning cell segmentation using Ilastik and ShapeMetrics (a MATLAB software) identified differences in migration, cell number, and gene expression upon drug treatment.

Directed Evolution of a Gas Reporter Enzyme for Environmental Sensing Applications

Dru Myerscough – Poster Session B 257

Traditional visual biosensors often rely on optical readouts, which are difficult to detect in dense, opaque, or autofluorescent matrices. Our lab has developed methyl halide transferase (MHT) reporters that function by synthesizing methyl halide gases to report on biological and chemical processes. Unfortunately, the performance of these reporters in real-life environments is limited by their low substrate affinities. To overcome this challenge, we have systematically mutated an MHT and selected for high-performing mutants under low substrate conditions. To establish potential mechanisms for the increased activity of mutant MHTs, we used computational modeling and molecular dynamics simulations to understand how mutations affect stability, structure, and dynamics. Ongoing work is focused on characterizing the biochemical properties of the top-performing mutants *in vitro*. Insights from this study will contribute to the development of improved MHT reporters for environmental studies and a deeper biophysical understanding of methyltransferase dynamics and catalysis.

MYCN Overexpression Expands Neural Crest Signature in Developing Sympathoadrenal Progenitors

Annika Nambiar – Poster Session A 145

Neuroblastoma (NB) is a deadly pediatric cancer that originates from neural crest cells (NCC) and presents tumors along the sympathetic nervous system, specifically in adrenal medulla and sympathetic ganglion chain. One genetic factor identified as a major driver of NB is MYCN, which is linked to high risk, aggressive tumors. It is believed that NB develops when NCC are unable to differentiate; however, the exact mechanisms behind early onset of NB remain unknown. To analyze if MYCN overexpression affects sympathetic cell differentiation from the NCC, in a zebrafish model, we used whole-mount immuno-coupled hybridization chain reaction (WICHCR) on zebrafish embryos across stages to assay gene expression of NCC and sympathetic gene markers like crestin, foxd3, sox10, dbh, phox2bb, and twist1a. Our preliminary results show that MYCN overexpression induces cells to maintain an undifferentiated state by promoting retained expression of NCC genes past their normal time of expression. Overall, this study will help identify the effect MYCN overexpression has on early NCC differentiation and shed some light over the mechanisms leading to NB onset.

Expression of Genes 45 and 46 of Phage SPO1 Prevents *B. subtilis* Cell Division Without Preventing Cell Growth

Hajera Naveed – Poster Session B 258

When *B. subtilis* is infected by bacteriophage SPO1, the phage directs the remodeling of the host cell to convert it into a factory for phage reproduction. The inhibition of host cell division is one feature of this host-takeover process. Previous research has shown that SPO1 gp56 inhibits host cell division during infection, and also when expressed individually in uninfected cells, without preventing continued growth of the cells. We are testing the possibility, suggested by an earlier student in the lab, that SPO1 genes 45 and 46 have effects on cell division similar to the effects of gene 56. Expression of genes 45 and 46 in uninfected cells is provided by inducing expression of the cloned genes from a plasmid. Cell growth is monitored via the culture's turbidity, and cell viability is measured by colony-forming capability. Results thus far have indicated a loss of cell viability in cells induced with gp45/46 expression, while turbidity of the culture continues to increase, indicating continued cell growth. However, repeated experiments and microscopy data are needed to confirm the significance of these observations.

Recombinant Thrombomodulin Exhibits an Antitumor Effect and Enhances the Sensitivity of Gemcitabine Treatment of Pancreatic Cancer via G-protein Coupled Receptor 15

Nathan Nguyen – Poster Session B 261

Recombinant thrombomodulin (rTM) is approved to safely treat disseminated intravascular coagulation in Japan. We investigated whether rTM's anti-inflammatory role in blood translated to anti-inflammatory and anti-tumor effects in pancreatic ductal adenocarcinoma (PDAC) cells.

A Japanese prospective study, which examined a PDAC patient-derived xenograft cell line PATC66 with overexpression of GPR15, discovered that PATC66 cells treated with rTM plus gemcitabine (GEM) reduced cell proliferation and significantly enhanced apoptosis in a subcutaneous xenograft model by inhibiting NF-KB/p65 and ERK phosphorylation via GPR15 as compared to a single GEM treatment.

The goal of our study was to validate the Japanese study's in-vitro results with 5 additional PDAC cell lines of varying GPR15 expression, to examine the rTM/GPR15/NF-kB signaling axis in the regulation of PDAC development. We examined the efficacy of rTM as a stand-alone and cocktail treatment for PDAC. The researchers concluded that rTM had anti-tumor effect and enhanced cytotoxic effect of GEM for PDAC cells by inhibiting NF-KB and ERK activation via GPR15, suggesting that rTM is a therapeutic option for PDAC.

Reprogramming of Non-sensory Cells into Hair Cell-Like Cells in the Mature Mouse Cochlea by *Atoh1*, *Gfi1*, and *Pou4f3* Expression

Ken Nguyen – Poster Session A 148

Previous studies have shown that overexpression of key transcription factors such as Atoh1, Gfi1, and Pou4f3 in the neonatal mouse inner ear can prompt the ectopic reprogramming of non-sensory cells to become hair cell-like. However the effect of these transcription factor combinations on non-sensory cells of the mature inner ear is not well understood. Our lab has targeted the Rosa26 locus to generate mice to conditionally express Atoh1 (Rosa-A) alone, Gfi1 and Atoh1 (Rosa-GA), or Gfi1, Atoh1, with Pouf43 (Rosa-GAP). Our lab also modified the FBXO2 allele to express CreER in non-sensory tissue and combined the Fbxo2CreER mouse with Rosa-A, -GA, or -GAP mice to induce transcription factor expression at three weeks of age. Identifying the underlying genetic pathways that allow for reprogramming of non-sensory cells to hair cells in mature mouse models could uncover potential therapeutic strategies for acquired hearing loss. Our study highlights a possible strategy of how Atoh1, Gfi1, and Pou4f3 could be utilized in hair cell reprogramming in mature mice models.

Designing synthetic phosphorylation circuits with scFv receptors capable of transmitting signals from endogenous cytokines

Jaison Nguyen – Poster Session B 260

Cytokine and cytokine receptors are potential tools that can be used to expand the usability of synthetic circuits. However, endogenous cytokine receptors are difficult to engineer and modularize. To solve this problem, we sought to identify scFv (single chain variable fragment) receptors that use natural cytokines as ligands. Our circuit was designed using an scFv as a receptor for the cytokine TNF-a. Binding of TNF-a results in the downstream phosphorylation of the substrate CD3Z. The circuit was transfected into HEK293T cells and cytokine-induced phosphorylation level was measured using flow cytometry. We detected measurable output from the cells, and our future goal is to extend the usability of the circuit into more complicated cell signal processing and potential cell therapy in MSCs.

Elucidating the Effects of atrx and hox family Genes on Neural Crest Cell Differentiation

Margarita Nino – Poster Session A 149

Neural crest cells (NCCs) are embryonic stem cells that differentiate into a variety of derivatives, including bone and cranial neurons. Although NCCs are vital to proper development, the genes required for differentiation of NCCs derivatives are yet to be determined. To elucidate what genes are essential to the differentiation of two NCC lineages, the heart and the enteric nervous system (ENS), we aim to disrupt gene expression. From single-cell transcriptomic analyses of the ENS, our team identified genes highly expressed in NCCs, including, atrx, a chromatin remodeler, and transcription factors hoxb5b, hoxd4a, and hoxa5a. To discern the pertinence of these genes on NCC development, we have used CRISPR-Cas9 technology to perturb gene expression in Danio rerio. Through sgRNA injections of D. rerio embryos, we have successfully created indels for hoxd4a and hoxa5a. D. rerio larvae with indels for hoxd4a and hoxa5a appeared to have pericardial edema and delayed growth. From the observed effects we may surmise that hoxd4a and hoxa5a are essential for proper growth and cardiac development in D. rerio. Future steps include replicating this procedure successfully with atrx and hoxb5b.

A Novel Epigenetic Modifier Induces Regeneration in a *Spata7-/-* Retinal Degeneration Mouse Model

Soo Oh – Poster Session A 150

Inherited retinal dystrophies (IRD) affect 2 million people worldwide. IRDs are caused by the irreversible death of retinal neurons, and currently patients have limited treatment options. In some non-mammalian species like the teleost fish, the Müller glial cells (MGs) enter a regenerative state in response to injury and replace retinal cells to restore visual function. However, MG proliferation is repressed in mammals; thus, regeneration does not occur. In our study, we made an exciting observation that robust retinal regeneration can be induced by using a novel epigenetic modifier drug in a Spata7-/- neurodegenerative damage mouse model. To determine the extent of regeneration within the adult mouse retina, we intravitreally injected the novel SYC-1127 compound and performed H&E and immunofluorescence staining techniques to observe a substantial increase in the total number of retinal cells. Findings from this study show that SYC-1127 can potentially regenerate different types of retinal neurons in Spata7-/- mice, putatively from the proliferation of MG cells. This work opens up the potential for developing a new field of therapeutics for treating retinal degenerative diseases.

Myelination in the L-PGDS KO Mouse Model

Elizabeth Pan – Poster Session B 262

Over 2.5 million people in the U.S. have central nervous system (CNS) demyelinating conditions, marked by neurodegeneration and cognitive dysfunction. Currently, there is a lack of disease-modifying therapies that promote remyelination and prevent progressive demyelination. Lipocalin-Prostaglandin D synthase (L-PGDS), an enzyme highly expressed by oligodendrocytes, is downregulated in mouse and human models of demyelination. However, the role of L-PGDS in CNS myelination has not yet been elucidated. L-PGDS produces the natural ligand for PPARβ, a transcription factor that promotes myelin lipid synthesis. To analyze L-PGDS loss in CNS myelination, we are utilizing an L-PGDS mouse model where L-PGDS is genetically deleted in all cells (L-PGDS KO). In KO mice, qPCR showed the downregulation of PPARβ target genes in the brain and transmission electron microscopy showed reduced L-PGDS myelination in the optic nerves. These findings suggest that L-PGDS may play a vital role in CNS myelination and is a promising therapeutic target to restore myelination. Moving forward, unbiased RNA sequencing and behavioral tests will be performed to observe other ways L-PGDS loss affects myelination.

Impact of a Peer-Mentored Diabetes Prevention Intervention

Esteban Pantoja, Heather Kong, Meghan Lim, Elizabeth Pan – Poster Session B 263

Educational avenues for promoting physical activity (PA) and healthy eating are commonplace and have shown general effectiveness, but are not usually disease-specific or family-centered. This study analyzes the impact of a peer-mentored, prevention-oriented diabetes education program for elementary school-aged students in an underserved Houston community. Students learned about diabetes prevention through hands-on activities and family-centered exercises and also had access to weekly food distribution events sponsored by a local food bank. 15 participants completed a post-survey and two month follow-up survey which evaluated familiarity and attitudes about diabetes, effectiveness of family-centered exercises, PA, and fruit and vegetable consumption. Students reported satisfaction with the family-centered exercises, increased consumption of fruits and vegetables, and higher rates of PA at the conclusion of the summer program; however this trend did not continue into the fall. Despite limitations, these results indicate similar programs may be impactful and more studies should focus on how these interventions can work to affect lifestyle changes during the school year.

Vitro Validation of In Silico RyR2 Targets for CPVT

Vaidya Parthasarathy – Poster Session A 151

Catecholaminergic Polymorphic Ventricular Tachycardia (CPVT), is a deadly cardiac arrhythmia that affects roughly 1 in 10,000 individuals around the world. The disease is heritable and infamous for causing the sudden death of infants. These treatments options, namely beta-blockers can only control between 30 and 50% of the symptoms caused by the delayed afterdepolarizations that are the root cause of the disease. The other potential treatment is defibrillators which can cause fatalities as well. The advent of gene editing offers a strong alternative to conventional current medication methods due to its personalization. Last year, we performed an in-silico project to find out which of the known RyR2 mutations were correctible with the current gene-ed technology. One of the main takeaways was that spCas9 could potentially correct over 84.17% of the known causative RyR2 mutations or in terms of raw numbers over 100. The work this semester focused on an in vitro validation of the in silico analysis in order to see the real-world validity of what the computer is showing. To test this we are running a fluorescence invitro assay on CRISPR-Cas9 on reporter efficacy.

Effect of Expression of SPO1 Genes 55-53 on Cell-Division, Cell Growth, and Protein Synthesis

Vinay Pattalachinti – Poster Session A 152

When the bacteriophage SPO1 infects the bacterium B. subtilis, it converts the host cell from a factory for making new bacteria into one for making new phage. This host-takeover is accomplished by the genes of SPO1's host-takeover module, which includes genes 55-53. Expression of genes 55-53 in an uninfected B. subtilis cell induces a bacteriostatic effect. The products of genes 55-53 attenuate, but do not prevent, cell growth, as measured by turbidity. However, despite cell growth continuing when genes 55-53 are expressed, the number of viable host cells remains relatively constant, suggesting cell division inhibition. Micrographs support this, as B. subtilis cells expressing genes 55-53 were longer than control cells. Regardless of expression of genes 55-53, cells display a similar pattern of protein synthesis over time: a ramp up into two distinct points of maximal synthesis that are separated by a trough. However, the points of maximal protein synthesis are delayed by ~45 minutes when genes 55-53 are expressed. During the ramp-up, rates of protein synthesis are strongly correlated with cell mass, with the same correlation coefficient regardless of expression of genes 55-53.

Characterizing the Role of PEX10 in Pexophagy

Sophia Peng – Poster Session B 264

Peroxisomes are organelles that house various metabolic reactions, including β-oxidation of fatty acids and sequestration of the resultant damaging ROS. Peroxisomes are subject to regulation, including pexophagy, the degradation of entire peroxisomes through autophagy. Peroxins are proteins that orchestrate peroxisome biogenesis and maintenance. A few peroxins also are implicated in pexophagy. PEX10 contains an AIM (autophagy-interacting motif) – providing a potential docking site for autophagy machinery (ATG8) during pexophagy. We seek to elucidate the role of PEX10 in pexophagy. We will query if PEX10 and ATG8 colocalize, and if so, whether the AIM site of PEX10 is required for colocalization. To accomplish this goal, we created DNA constructs expressing a fluorescent reporter fused to either wild-type PEX10 or mutant pex10 lacking the AIM region. These constructs also report peroxisome lumen and ATG8 localization. We transformed Arabidopsis plants containing a null pex10-5 mutation to restrict available PEX10 to that of our reporter. Next we will visualize the reporters and monitor PEX10 functions in pexophagy and peroxisome biogenesis in the progeny of our transformants.

Strategies to Optimize the Secretion of Therapeutic Proteins from *E. coli* and to Treat Gut Inflammation

Vedha Penmetcha – Poster Session B 265

Inflammatory Bowel Disease (IBD) is an incurable disorder characterized by painful inflammatory episodes. Existing cytokine and small molecule-based treatments require high dosing and immunosuppression that can cause undesirable effects. In addition, administration relies on invasive approaches like subcutaneous injection, which can affect patient recovery. Localized delivery of therapeutics could significantly improve outcomes and minimize the risk of side effects. We employ synthetic biology tools to genetically engineer bacteria as living therapeutics which have the potential to circumvent current challenges by directly targeting the site of inflammation. We engineer E. coli and L. reuteri to secrete biomolecules of therapeutic interest, such as the anti-inflammatory cytokine Interleukin-10 (IL-10). We improve bioactive protein production through multiple bacterial secretion systems. For future in vivo delivery to the animal gut, the bacteria are encapsulated within a hydrogel carrier which we optimize to preserve their viability and biocompatibility in a hostile gut environment. The secretion modes and therapeutic techniques developed could be applied to other disease targets.

Experimental evolution on E. coli BW25113 with Minocycline and Trimethoprim

Gabriela Perez – Poster Session B 266

With the rise of antibiotic resistance, multi-drug therapies and combinations could play an important role by increasing antibiotic efficacy and slowing down resistance evolution. However, in previous research, it was found that *Francisella tularensis* rapidly evolved to an equipotent ratio of a non-interacting antibiotic drug pair using a switch-back evolutionary pathway. We wish to understand the generality of this phenomenon and the drug ratios that could potentially favor it. We are using the model organism, *Escherichia coli* (*E. coli*) BW25113 and evolving it to the non-interacting drug pair of trimethoprim (TMP) and minocycline (MIN). Using an experimental evolution method, we grew *E. coli* in different ratios of TMP and MIN for seventeen days in order for the strain to become highly resistant. Subsequent phenotypic and genomic analysis will allow us to identify mechanisms leading to resistance to different ratios of the combination and understand if switch-backing has a role to play in this organism.

New Grain Size Measurements of Windblown Sand in the Stimson Sandstone, Gale Crater, Mars and Implications for the Climate of Ancient Mars

Sarah Preston – Poster Session B 267

The grain size of sedimentary rocks can tell us about the density and speed of the water or air that moved the grains when the rock formed, which we use to understand the conditions on ancient Mars. However, it is difficult to determine grain size in Mars rover pictures because of dust and surface textures, so we need to use creative methods.

We created a digital grain size card, based on a common field method for measuring grain size, to identify textures and estimate grain size in pictures taken by the Mars rover Curiosity . We focus on the Stimson sandstone, a wind-blown formation, because we can compare it to modern wind-blown sand. We measured grain size for images from each textural group. Most textures are dominated by fine to medium grains, which is consistent with wind transport. Our findings show, however, that a significant fraction of the dune-forming grains in the Stimson are much larger than the sand forming modern dunes.

This difference in sizes suggests that either the sand supply or the atmospheric conditions that led to the Stimson sandstone may have been different than modern conditions. We will present the implications for Mars' ancient atmosphere and climate.

Box C/D Small Nucleolar RNA Regulation of the Ethanol and Stress Response Element

Jaime Ramirez – Poster Session B 268

Metazoans have evolved highly conserved mechanisms for monitoring of mitochondrial health. These include pathways such as the mitochondrial unfolded protein response and mitochondrial MAPK, which are upregulated in response to mitochondrial damage. The Ethanol and Stress Response Element (ESRE) is another important mitochondrial surveillance pathway induced by reactive oxygen species in addition to mitochondrial damage. Here, I study ESRE regulation by box C/D small nucleolar RNAs (Box C/D snoRNAs). Box C/D snoRNAs are non-coding RNAs found to play a variety of roles maintaining cellular homeostasis, especially their catalysis of ribosomal RNA methylation. I have tested the ability of a Box C/D snoRNA to regulate ESRE using a worm deletion strain. Literature from mammalian cell culture suggest several peroxidases and nuclear export factors that may be important to this regulation. Using RNA interference, I have tested their orthologs in *C. elegans*. This work studies a new regulatory role for Box C/D snoRNA in mitochondrial surveillance.

Evolutionary feedbacks and aggression in Drosophila melanogaster

Jose Ramirez – Poster Session B 269

Evolutionary feedbacks are the cyclical relationships between evolutionary change and ecological interaction. Researching evolutionary feedbacks is vital to understanding the relationship between the individual and its environment; however, there is a lack of empirical data spanning multiple generations to reinforce that understanding. To fill this knowledge gap, we use *Drosophila melanogaster*, who have a short reproductive cycle, and measure their aggression in three artificial environmental situations which are positive feedback, negative feedback, and zero feedback. From each, we expected to see different trends in rates of evolution: accelerated, dampened, and linear, respectively. We use arenas containing yeast paste to give incentive for aggressive behavior and to hold the flies while we measure aggression. The two replicates we've observed have supported our hypotheses for the rates of evolution in each feedback. As we continue to observe more generations of Drosophila, we hope that our data reinforces our understanding of evolutionary feedbacks and that it will provide a great leap in behavioral evolutionary research.

Engineering Transcription Factor Cooperativity

Eddie Ramos – Poster Session A 153

In mammals, cooperativity is an essential mechanism by which cells coordinate the interaction of transcription factors and co-activators to regulate gene expression. Multi-valent protein interactions act to stabilize transcription factors at a location in the genome and – by recruiting different protein constituents – to affect important features of the genetic response to environmental stimuli, including basal state, maximal expression, sharpness of activation, and expression noise. This mechanism of transcriptional activation allows mammalian cells to access a variety of regulatory responses using a relatively small set of transcription factors. In nature, the gene activation by transcription factors involves a combination of parameters, including the spacing and number of transcription factor binding sites, the affinity of the transcriptionally active complex for the DNA and other proteins, concentration of the constituents of the complex, and greater chromatin landscape. Engineering cooperativity in synthetic transcription factors can simplify an otherwise very complex biological system and will help develop more sensitive and reliable genetic switches in mammalian cells.

Converting 844 nm Light into 422 nm Light for Use in Resonant Laser-Induced Fluorescence Diagnostics of Strontium Plasmas

Caleb Robinson – Poster Session A 155

Ultracold neutral plasmas (UNP) are formed by photoionizing a collection of atoms that have been laser-cooled to about 10 mK. UNP offer an opportunity to examine the physics of strongly coupled plasmas where the Coulomb interaction is stronger than the thermal energy of the system. We study the properties of UNP using an optical probe called laser-induced fluorescence. The plasma is illuminated with an imaging laser and the resulting fluorescence is analyzed to measure plasma properties. In this project, we upgrade the source of 422 nm light used to image strontium ions, the main constituent of our UNP. Strontium ions have a natural resonance and scatter light strongly at 421.7 nm, allowing us to study strontium plasmas using optical probes. We replace a complex system used to convert 844 nm light into 422 nm light with a single-pass, fiber-optic-based system for this process, called second-harmonic generation (SHG). We then characterize the 422 nm light produced by the new SHG module and find the experimental conditions that optimize the SHG efficiency, showing that the amount of 422 nm power produced by the SHG displays a quadratic dependence on the amount of input 844 nm power.

Effects of Sensory Deprivation and Genetic Mutation on Attention in Mice with Absence Epilepsy

Max Ruiz – Poster Session A 156

Recent studies have shown that Attention Deficit Hyperactivity Disorder (ADHD) is a comorbidity associated with absence epilepsy. It is therefore beneficial to understand how an individual's genetic and environmental propensity for seizures impacts their ability to focus. The *stargazer* mouse model of absence epilepsy arises from a mutation in *Cacng2*. Mutants exhibit ataxia and frequent absence seizures. In this study, we investigate how sensory deprivation via whisker trimming affects attention task performance in wild type, heterozygous, and homozygous mutant mice. We also evaluate frequency changes in the frontoparietal network with video EEG monitoring during a 5-Choice Serial Reaction Time Task (5-CSRTT). Homozygous mutant mice (n=23) performed significantly worse than wild type mice (n=24, p = 0.001, Mantel-Cox test). Paradoxically, whisker trimming caused significantly improved performance on the 5-CSRTT in trimmed (n=11) compared to sham heterozygous mice (n=13, p = 0.019, Mantel-Cox test). Ongoing analysis of EEG biomarkers continues to evaluate potential frequency bands in the EEG that may be modulated by genetic mutation and/or whisker trimming.

Characterizing Group B. *Streptococcus* and Clinical *Lactobacillus spp.* Isolate Morphologies

Korinna Ruiz – Poster Session B 270

The health and stability of the vaginal microbiome has been attributed to the dominant presence of *Lactobacillus* and the stable composition of the microorganisms. Foreign bacterial introduction and colonization disrupt the microbiome and can result in potential infection or overgrowth. Both of these conditions can lead to vaginal dysbiosis. The dominant presence of *Lactobacillus spp.* has shown correlation to maintaining balance within the vaginal microbiome by exhibiting an inhibiting effect on pathogens *in vitro*. A common pathogen of the vaginal microbiome, Group B *Streptococcus*(GBS), can lead to a dangerous infection for women who are immunocompromised, women who are pregnant, and newborns if they are born while the mother is actively infected. This research presents the characterization and comparison of the species *Lactobacillus crispatus* and *Lactobacillus gasseri* isolates' changes in growth kinetics and colony morphology in different media of MRS and chromagar. This research also presents the *Lactobacillus* isolates inhibition assays with GBS. The aim is to characterize the isolates and highlight variability between the strains of the same species.

Role of Platelets in the Development of Delayed Neurological Deficits after Subarachnoid Hemorrhage in Mice

Bibek Samal – Poster Session B 271

Microthrombosis has been suggested as a major factor contributing to delayed neurological deterioration in stroke patients after subarachnoid hemorrhage (SAH). However, experimental studies on the role of microthrombi in delayed deficits after SAH has not been investigated. Our hypothesis is that, following SAH, mice which develop delayed neurological deficits have a greater number of microthrombi than mice which do not develop delayed neurological deficits. SAH was induced in adult male and female C57BL/6 mice via endovascular perforation. Mice were randomly assigned into sham or SAH groups. Neurobehavior tests were performed on days 1-3, 5, and 7 post-SAH using a composite neuroscore. Following this, microthrombi count and vessel diameters were measured using H&E stained brain slices. All outcomes were performed and all data were analyzed by a blinded investigator. 17% of male mice and 36% of female mice developed delayed deficits on days 3-5 post-SAH. Those mice which developed delayed deficits also displayed more microthrombi, signaling a positive correlation. The study's data thus depicts that preventing platelets and microthrombi may improve functional recovery.

The Effect of Mitochondrial Inhibitor Drug, Meclizine, on the RAS-dependent Growth of Cancer Cells

Arnav Sankaranthi – Poster Session A 157

RAS mutations are observed in 19% of patients suffering from cancer. RAS-driven cancers often exhibit increased mitochondrial respiration. The drug Meclizine, an antiemetic, has been shown to inhibit mitochondrial respiration through the direct repression of the PCYT2 enzyme. The goal of this study is to examine the potency of the repurposed drug Meclizine in decreasing cell proliferation of RAS-driven and RAS-independent cancer cell lines. Through a series of cell proliferation experiments involving cancer cell lines such as HN31, T24, MiaPaCa, BxPC3, SW780, 5637, RT4, and MOH, the effect of concentrations of 50 uM Meclizine and 50 uM DMSO were examined. Each cell line was seeded in plates, treated, stained with crystal violet, and analyzed via spectrophotometer. Time course experiments were performed, and spectrophotometer data was used to construct logistic growth curves and inhibition index graphs. When normalized for growth rate without the drug, Meclizine has a strong deterring effect on cell growth for some cell lines and a moderate deterring effect on other cell lines. Future studies will enable us to determine mechanisms by which Meclizine affects cancer proliferation.

Spreading Patterns of Pathological Tau in Drosophila Larvae

Abinav Sankaranthi – Poster Session A 158

Protein aggregation in the nervous system can lead to neurodegenerative diseases such as Alzheimer's Disease. Studies show that protein aggregation stems from specific gene mutations that can cause an overproduction of proteins and changes in the protein's structure and function. Tau protein aggregation, formed by the alternative splicing of Microtubule Associated Protein Tau (MAPT) genes, can lead to Tau hyperphosphorylation and the formation of filament structures that cause synaptic and neuronal damage. In Alzheimer's disease, Tau spread is correlated with pathological progression. Our experiments demonstrate that human Tau protein can spread in the Drosophila nervous system. Our study aims to determine the mechanism of Tau release from neurons, identify the target cells that take up these proteins, and understand the process by which Tau is released and internalized. Our preliminary experiments demonstrate that knock down of TRPML endolysosomal channels might prevent the spread of Tau, and thereby, mitigate the toxicity associated with Tau expression. Here, we discuss our findings and the potential to target these channels in humans to suppress pathological Tau spreading.

The Effects of Fungal Symbionts on the Survival of *Poa autumnalis*

Isabelle Scherick – Poster Session A 159

This study investigated how successful previous heat treatment on the grass species *Poa autumnalis* (abbreviation POAU) was at eliminating fungal endophytes. This was done by conducting leaf petals on the grass planted and using microscopy to comb the cells for fungal hyphae. Current results indicate that there was a 42.2% success rate in the heat treatment eliminating fungal endophytes. There is still more data to collect from heat-treated plants with too little tissue to conduct endophyte scores. We intend to move the endophyte-free heat-treated POAU to replace dead plant grass in a long-term experiment testing the effect of fungal endophyte on host survival.

Characterization of Periocular Neural Crest Migration in Developing Chick Cornea

Braedon Schlechte – Poster Session A 160

The cornea endothelium and stroma disruption during development and lead to vision impairment. The spatiotemporal migration of a multipotent stem cell population, the periocular neural crest (PNC) to form these tissues has not been well characterized. We investigated PNC migration to understand how these stem cells populate the developing cornea during the formation of the corneal endothelium and stroma. We dissected chick corneas at various time points during development to capture the migratory patterns during the formation of the cornea endothelium and stroma. Our results revealed that the PNC migrate preferentially through the temporal-nasal (TN) axis of the eye to form the corneal endothelium and stroma. Next, we performed focal injections of quail PNC into the dorsal, ventral, temporal, and nasal regions. Analysis of injected embryos revealed that injected PNC recapitulated the TN axis of migration. Combined, our results reveal a preferential migration of PNC in to the temporal and nasal regions of the cornea during development and provide a foundation for further investigation into the role of signaling pathways in the periocular region and how they regulate this process.

Pollination Ecology and Plant Range-Edge Dynamics in the Desert Shrub *Larrea tridentata*

Alden Sears – Poster Session B 272

Plant range dynamics are often subject to effects of density-dependence on fitness. Positive density-dependent reproductive output can cause Allee effects in populations that slow the advance of leading range edges or cause population decline. Plant-pollinator interactions contribute to positive and negative density-dependence in different systems, through effects such as facilitation and dilution of pollinator visitation. Though much literature has explored the effect of pollination ecology on plant density-dependence, less is known of the contribution of pollination ecology to plant range dynamics via these effects. To understand this relationship in the context of range-edge dynamics, we measured variation in pollinator abundance, richness, community composition, and flowering rates along a density gradient of *Larrea tridentata* at the plant's northern range edge. We use linear modeling to analyze the effect of density on flowering rates and pollinator richness and abundance, as well as non-metric multidimensional scaling to examine how pollinator community composition varies across the density gradient.

Morphological Features of CRISPR dCas9-VPR Engineered Mesenchymal Stromal Cells Reflect Immunosuppressive Activity

Syed Shams – Poster Session A 162

Human mesenchymal stromal cells have been developed as a therapeutically relevant tool to suppress immune responses in human and animal models of disease. However, current approaches using biochemical activation of immunosuppressive activity through interferon stimulation are costly and difficult to implement. To circumvent this issue, our lab has engineered MSCs using dCas9-VPR transcriptional activation to activate immunosuppressive pathways without the addition of a priming agent. We have used an RNA guide system to target specific secretion pathways, increasing the overall level and activation of secreted anti-inflammatory proteins. Additionally, we have characterized a number of changes within the morphological features of the engineered MSCs through fluorescence image analysis. Changes in features reflected similar morphological changes studied previously in chemically activated MSCs. Our work aims to improve the immunosuppressive function of MSCs through cell engineering methodology, and confirms meaningful expression change through the analysis of MSC morphology.

Machine Learning Detection of P-Waves in Laboratory Acoustic Emission Events to Understand Deep-Focus Earthquakes

Jack Sheehan - ***Shapiro Showcase Presenter***

Deep-focus earthquakes (DFEQs) typically occur at depths of 350 to 700 km. The mechanisms of DFEQs remain poorly understood due to our inability to directly measure their fault structures *in situ*. To analyze their structures in more detail, deformation events were conducted in a controlled laboratory environment on Mg2GeO4, the leading mineralogical candidate of the transformational faulting hypothesis. Six orthogonally oriented sensors recorded Acoustic Emission (AE) events to detect P-wave arrival times, returning continuous waveform data for 34.5 minutes at 50 MHz for each of the six stations. To analyze this large quantity of raw waveforms, this study uses a deep-learning-based detector called EQTransformer (EQT; Mousavi et al., 2020) to perform P-wave detection and arrival time picking. By applying EQT directly to one experiment with manual phase picking, we determine that EQT detected 93.4% of AE events picked manually, as well as 57.3% additional events missed by the human analysts. Since this study trained EQT on global seismic data, these results potentially offer key insights into the robustness of EQT and DFEQ analogs at various scales.

Targeting TCA Cycle Metabolites by Small Molecule Inhibitors Ameliorate LPS Induced Immune Tolerance in Macrophages Through Epigenetic Mechanisms

Daanish Sheikh – Poster Session B 273

Background: Severe chronic infections (such as sepsis or Tuberculosis) can often lead to macrophage immune tolerance, a mechanism that prevents overexuberant or pathological inflammatory states. Immune tolerance is believed to be the result of a dysregulated TCA cycle, and TCA metabolites seem to regulate the epigenetic shifts underlying immune tolerance. *Methods*: An in-vitro LPS tolerance model was used to determine if targeted manipulation of the TCA cycle via various metabolic inhibitors could mitigate immune tolerance. Intracellular signaling, DNA methylation, and nuclear localization was measured using RPPA, Illumina EPIC, and fluorescent confocal microscopy. *Results*: Inhibitors of glycolysis, TCA cycle, and the mTOR pathway block the development of LPS induced immune tolerance. LPS treatment induced hypermethylation of key genes in the TCA cycle and increased nuclear localization of TCA enzymes IDH and CS; these effects are ameliorated by treatment with inhibitors.

The Role of sSAC GABA and Dopamine Signaling in Olfactory Behaviors

Aashka Sheth – Poster Session A 163

Improving our knowledge of olfactory bulb (OB) circuitry helps us understand olfaction abnormalities in neurodevelopmental disorders. In the OB, superficial short axon cells (sSAC) co-transmit GABA and dopamine (DA). While the GABAergic and dopaminergic targets of sSAC are known, their function in olfactory behaviors remains unclear. The objective of this study was to identify the contributions of sSAC GABA and DA signaling towards odor detection and discrimination.

Previously, we found that loss of all sSAC signaling impaired odor detection, but loss of only GABA or DA did not cause a detectable difference in time to find buried food. Therefore, we designed an odor detection threshold assay and found that selective loss of DA improved detection while loss of GABA had no effect. In contrast, when we measured odor discrimination using the Go-No-Go assay, we found that loss of DA impaired odor discrimination.

Our results suggest GABA and DA contribute differently to olfactory functions which demonstrates the impact of co-transmission on olfactory behavior. Improved understanding of olfactory circuits expands our knowledge of neurodevelopmental disorders with olfactory deficits.

How does pH affect cell density, cell viability, and the production of ethanol and ethyl acetate in *Saccharomyces cerevisiae*?

Claire Shi – Poster Session B 275

Saccharomyces cerevisiae is a species of yeast that plays a key role in fermentation during the production of beer. Previous research has investigated the effects of temperature and glucose concentration on kveik, a strain of *Saccharomyces cerevisiae*, but less is known about the effects of pH. This study examines the effect of pH on cell growth and the production of ethanol and ethyl acetate in kveik. Yeast cultures were tested under pH conditions of 3.0, 4.0, 5.0, 6.0, and 7.0. A spectrophotometer and hemocytometer were used to calculate cell density and viability. Furthermore, isolation techniques were used to measure the production of ethanol and ethyl acetate by kveik. Data from these methods are currently being collected. Since cell growth contributes to the efficiency of fermentation, and ethanol and ethyl acetate influence the flavor profile of beer, properly understanding how these factors vary with pH is essential for successful beer production. Overall, this research will facilitate a stronger understanding of the kveik strain and potentially lead to a more widespread usage of this strain in commercial settings for increased fermentation efficiency.

Socioeconomic Barriers to Randomized Clinical Trial Retention for Patients Undergoing Adjuvant Radiation Treatment for Early-Stage Breast Cancer

Julia Shi – Poster Session B 274

Socioeconomic barriers contribute to disparities in breast cancer clinical trial enrollment. We sought to further identify the impact of socioeconomic factors on trial retention. We analyzed predictors of study retention in 253 breast cancer patients using secondary analysis of a randomized phase III trial of conventionally fractionated vs hypofractionated whole-breast irradiation. Patients' retention outcome was classified as retained vs. dropped out at completion of the trial's primary breast cosmesis outcome assessment at 3-year follow-up and 5-year follow-up. A total of 21.7% (n=55) patients dropped out by 3 years and 36.7% (n=92) by 5 years. Median Area Deprivation Index (ADI) was 36.5 (interquartile range [IQR] 22 - 57) for retained and 46.0 (IQR 29 - 60) for dropout patients. While on study, patients who ultimately dropped out were more likely to require social resource assistance for practical needs (transportation, housing, financial) than for psychological stress (mental stress, family or relationship stress, grief) or advance care planning. Thus, multi-level interventions may be needed to improve trial access and minimize bias in trial findings.

Preserving liver function and improving survival using local radiation therapy for metastatic intrahepatic cholangiocarcinoma patients

Christopher Shi – Poster Session A 164

Intrahepatic cholangiocarcinoma (ICC) is an aggressive bile duct cancer diagnosed in approximately 800 patients in the US annually. Only about 15% of patients present with primary tumors capable of surgical resection, the only potentially curative treatment, and the 5-year relative survival rate remains low at 2% for patients with distant metastatic disease. Among such patients, tumor-related liver failure (TRLF) has been shown to account for up to 72% of deaths. However, adjuvant radiotherapy or chemoradiotherapy (RT) may improve outcomes. To retrospectively investigate the benefits of liver-directed RT, compared to chemotherapy alone, for M1 ICC patients with extrahepatic disease and non-resectable primary tumors, 62 patients were analyzed in a RT cohort and 56 in a comparison cohort. From diagnosis, the RT and comparison cohorts respectively had TRLF rates of 34.9 versus 72.4 percent as well as median overall survival of 19.9 versus 9.97 months, liver progression free survival of 4.52 versus 4.02 months, and distant metastasis free survival of 3.87 versus 3.83 months. From these preliminary analyses, liver-directed RT appears to be associated with better patient prognosis.

Multivariate fMRI Pattern Decoding of Fine-Grained Object Categories Across Human Occipito-Temporal Cortex

Will Slatton – Poster Session B 276

Multivariate pattern analysis of fMRI data has become a key tool for studying the human visual hierarchy. In particular, the amount of information about a visual stimulus linearly decodable from fMRI data gives a measure of the information available in a region of interest and can be used to compare regions along the visual hierarchy. There are many reasonable choices for linear classifiers for such a task, and previous work has compared their performance in differentiating between visual stimuli. However, these comparisons were limited to simple, binary classification tasks. We performed the first comparison of linear classifiers on complex, fine-grained object classification tasks and found that the Gaussian Discriminant Analysis (GDA) classifier has a large advantage for fine-grained tasks and achieves much greater than chance accuracy in a difficult, 32-way classification. We also propose an explanation for the advantage of GDA in terms of the geometry of the distribution of fMRI responses to a given category, providing support for models of the visual hierarchy as successively reducing the dimensionality of object manifolds.

Gene X Impairs CD8+ T Cell Cytotoxicity in Male Colorectal Cancer

Max Slotnik – Poster Session A 165

The biological mechanisms associated with observed sex differences in cancer outcomes remain largely underrepresented in research. Here, in the context of colorectal cancer (CRC), we strive to discover a mechanistic pathway in the tumor microenvironment responsible for worse outcomes in male versus female CRC patients. Gene X, a histone demethylase located on the Y chromosome and only expressed in males, was recognized in a previous study as a potential negative regulator of CD8+ T cells from an in vivo CRISPR screening, thus prompting us to validate and uncover the extent to which Gene X negatively regulates CD8+ T cells and to determine the mechanism through which Gene X acts. We established Gene X's effects on CD8+ T cells in vitro by knocking out Gene X in CD8+ T cells with a CRISPR/Cas9 system and using them in a Cytotoxicity Assay and Proliferation and Activation Marker Profile. We found that CD8+ T cells with Gene X knocked out generated greater immune cell-mediated tumor cell death and increased expression of proliferation and cytotoxicity markers, thus elucidating Gene X's role in negatively regulating CD8+ T cells in vitro, providing evidence for a male CRC therapy.

Examining Transcriptional Changes in the Thalamus following Seizure Onset in Childhood Absence Epilepsy

Anika Sonig – Poster Session B 277

Childhood Absence Epilepsy (CAE) is a common form of pediatric epilepsy where patients have non-convulsive seizures and behavioral arrest. We aim to determine how T-type calcium currents in thalamic relay lead to spike-wave seizures in the CAE mouse model tottering. We hypothesized that upregulation of genes encoding T-channels lead to the increase in T-channel function. We performed single-cell transcriptional analysis of Cacna1g, the T-channel α-subunit gene expressed in thalamic relay using a in-situ hybridization technique, RNAscope, and our data show that Cacna1g is significantly elevated prior to seizure onset (P14) and remains elevated in adult tottering mice (P120-180). Unexpectedly, we also find a significant increase in the number of nuclei in the same size thalamic relay region of tottering mice at both timepoints that is gene dose-dependent as shown by proportional increases in number of nuclei. These results show that transcriptional changes in Cacna1g may drive seizures. We are now identifying the cell type of the increased nuclei detected. Our study will help clarify the mechanisms leading to seizure onset and possible therapeutic intervention.

Elucidating the Role of the Ccdc136 gene in Retinal Function

Tanmay Srinivasan – Poster Session A 166

Inherited retinal dystrophies (IRD) are degenerative diseases of the retina marked by clinical and genetic heterogeneity. Common symptoms of these disorders are night or color blindness, tunnel vision, and eventually complete blindness.This paper explores the role of Ccdc136 (coiled-coil domain-containing protein 136) in cone and rod photoreceptor function. Mutations in Ccdc136 were identified in two patients with retinitis pigmentosa (RP) and Usher syndrome II. To explore the role of Ccdc136 in the pathogenesis of IRDs, Ccdc136 knockout (Ccdc136-/-) mice were generated and bred. The Ccdc136 wildtype (Ccdc136+/+), heterozygous (Ccdc136+/-), and knockout (Ccdc136-/-) mice underwent retinal evaluation methods including electroretinograms (ERGs), blue opsin quantification, and H&E staining. The Ccdc136-/- sample group displayed reduced cone photoreceptor response to light along with a lower number of blue opsin positive cone cells in the Ccdc136-/- mice group. Taken together, our findings of decreased cone photoreceptor response to light and the decreased number of blue opsin positive cone cells in the Ccdc136-/- group highlights Ccdc136 as a target gene for IRD treatments.

Characterizing Cancer Cell Lines of Different Genotypes to Proton and X-Ray Radiations

Ananya Srivastava – Poster Session A 167

Currently, the use of a patient's tumor's specific biology and genotype when prescribing radiotherapy is limited; however, if we can better understand a cancer cell's inherent radiation sensitivity, the radiotherapy dose could be tailored to individual patients to make it more effective and potentially less toxic to normal cells. Towards this, we are working towards creating a model called "DNA Repair to Individualize Radiotherapy" (DRIVER) which strives to link gene expression for certain genes correlated with DNA repair to the intrinsic radiosensitivity of these cell lines. We will use clonogenic cell survival assays to characterize the survival of various pancreatic cancer cell lines, including BXPC3, PK1, ASPC1, and CAPAN1 cell lines exposed to x-rays or protons. Based on the survival curves for each cell line, we will calculate metrics like the dose where only 10% of the cells survive the x-rays or protons exposure (D10%). These data will then be incorporated into DRIVER which relates gene expression for a panel of DNA repair genes to radiosensitivity metrics such as D10%. In this way, we will train DRIVER to eventually predict cell radiosensitivity based on gene expression.

Development of the Cas9 System for Use in Symbiodiniaceae

Renee Stephenson – Poster Session B 278

Anthropogenic climate change is increasing ocean temperatures. The heat stress this causes coral leads to the loss of its endosymbiotic algae called Symbiodiniaceae, a reaction called bleaching. To elucidate cellular responses to heat stress, I am developing tools to genetically engineer the nuclear genes of the haploid Symbiodiniaceae species *Cladocopium goreaui* by DNA transformation using a CRISPR/Cas9-based system. I built an episomal plasmid that is predicted to express the DNA endonuclease Cas9 and a guide RNA (gRNA). To test this system in *C. goreaui*, algae will be transformed with a version of this plasmid expressing a gRNA targeting the URA3 gene for knock-out by frameshift mutations. URA3 encodes the uracil biosynthesis enzyme orotidine 5' phosphate decarboxylase, conferring sensitivity to toxic 5-fluoroorotic acid (5-FOA). URA3 loss-of-function will then be tested on agar plates containing uracil and 5-FOA, followed by confirmation via DNA sequencing. If successful, this plasmid will be incorporated into a multiplexed system to test how specific genes in Symbiodiniaceae affect heat stress sensitivity, thus testing or generating hypotheses about coral bleaching.

The effects of temperature and population density on intraspecific competition in *Daphnia pulex*

Lillie Stockseth – Poster Session B 279

The rise in global temperature is affecting many of Earth's populations. Freshwater ecosystems may be heavily impacted due to warming water temperature, which will adversely affect ectotherms' metabolic processes. Research suggests that temperature affects an individual's metabolic processes but little is known about how temperature affects population dynamics and carrying capacities of these organisms. Using an ex situ system of Daphnia pulex, a water flea, we seek to study the effects of temperature and population density on intraspecific competition represented by population growth rate. By studying the growth rate in 72 colonies with various environmental temperatures and starting population densities over time, this study will be able to analyze the effects of density and temperature on population growth and intraspecific competition in D. pulex. One time series was completed in winter 2021 and another is currently underway in spring 2022. Analysis will provide insight to how warming global temperatures will affect D. pulex and other aquatic invertebrates by affecting their carrying capacity, reproduction, and competition.

Early-life mTOR inhibitor treatment in a mouse model of Tuberous Sclerosis Complex delays onset of epileptiform activity, epilepsy, and mortality

Vishnu Susheer – Poster Session A 168

Tuberous Sclerosis Complex (TSC) is a genetic disorder characterized by brain malformations and severe epilepsy in up to 90% of patients. Mutations in TSC1 or TSC2 genes, encoding proteins hamartin (TSC1) and tuberin (TSC2) respectively, result in hyperactivation of the mTOR pathway. Brain malformations relate to areas of aberrant neuronal hyperexcitability and are highly epileptogenic. mTOR inhibitors (such as RAD001) are promising therapeutic, and perhaps, anti-epileptic agents. Littermate mouse pups with conditional forebrain deletion of the Tsc2 gene in excitatory neurons [Wild type, (WT) NEX-Cre+/Tsc2WT/WT; Knockout (KO), NEX-Cre+/Tsc2flox/flox] were treated with vehicle or 6mg/kg RAD001 (Everolimus) every other day starting on postnatal day 8 (P8). Video electroencephalopgraphy (vEEG) activity was recorded (Natus Nicolet). Offline EEG analysis of epileptiform and seizure activity was executed with LabChart v8 (ADInstruments). vEEG recordings revealed Tsc2 KO mice treated with RAD001 in early postnatal development exhibit notable delays in seizure development from P12 to about P50 and prevented early mortality. In NEX-Tsc2 mutant mice, as in TSC humans, RAD001 transiently suppresses seizures without enduring disease modifying effects. Studies are planned to explore the mechanisms underlying these findings. mTOR inhibitor resistance is also seen in humans with TSC and mechanisms underlying this phenomenon has the potential to have highly significant translational significance.

Effects of HSP Genes *Atlastin* and *VAP33* on Poly-Ubiquitin Aggregation and Autophagy Activity

Maanvi Thawani – Poster Session A 170

Hereditary Spastic Paraplegia is a group of inherited disorders caused by mutations in one of 72 genes that lead to muscle spasticity, locomotor deficits and axon degeneration. Some of these genes of interest include *Atlastin, Reticulon, Spichthyin, Spastin, Spartin, and VAP33* - each playing roles in different pathways such as ER membrane fusion, endosomal regulation, lysosomal autophagy, or microtubule formation. We have observed that the loss of atlastin inhibits the activity of autophagy proteins and possibly results in poly-ubiquitin aggregate accumulation which is often observed in cells with defects in autophagy. VAP33 has been shown to play a large role in ER-Golgi tethering and leads to poor lysosome degradation, thus also being a target of interest in examining poly-ubiquitin aggregates. In this experiment, we use *Drosophila melanogaster* models to analyze the effects of the loss of VAP33 in muscle cells in both wildtype and atlastin mutant backgrounds. We describe potential roles that the genes listed above play in the inhibition of autophagy and accumulation of poly-ubiquitin throughout different thoracic muscle segments through image quantification and analysis.

The Effects of Fermentation Temperature on Growth Dynamics of *Saccharomyces cerevisiae*

Emma Ting – Poster Session B 280

Saccharomyces cerevisiae, a strain of yeast commonly used in beer brewing, produces a variety of esters and alcohols during fermentation that determine the flavor and sensorial quality of the beer. Past studies have shown that increased fermentation temperature causes increased ethyl and acetate ester production in yeast cultures. However, yeast growth occurs in two distinct phases: exponential and stationary. Importantly, the effects of fermentation temperature on the onset of the exponential and stationary growth phases and the concurrent ester concentrations during these phases is currently unknown. In our experiment, we cultured a strain of yeast called Axhat Hornindal kveik at room temperature, 30°C, and 37°C. First, we tracked yeast cell density over time to determine how fermentation temperature affects the timing of the exponential and stationary growth phases in Saccharomyces cerevisiae. Using the growth curves generated, we then determined how fermentation temperature affects the ethyl ester and acetate ester production of Saccharomyces cerevisiae at the exponential and stationary growth phases. This research has implications in producing beer with greater precision.

Selective Activation of the IRE1α-XBP1 Pathway of the Unfolded Protein Response Through an Inducible Dimerization System

Stanley Tsou – Poster Session A 171

Activation of the unfolded protein response (UPR) in the endoplasmic reticulum (ER) is linked to multiple human diseases, including cancer. The inositol requiring enzyme 1α (IRE1α) and X-box binding protein 1 (XBP1) pathway is the most evolutionary conserved branch of the UPR. In response to unfolded proteins in the ER, IRE1α dimerizes and oligomerizes, leading to splicing of XBP1 mRNA to produce the active/spliced form of XBP1. Currently, the use of chemical ER stress inducers has been the predominant way of studying the IRE1α-XBP1 pathway. However, these drugs activate all three branches of the UPR, resulting in crosstalk from other parallel stress-signaling pathways. To selectively activate the IRE1α-XBP1 pathway, we developed an inducible dimerization system by replacing the luminal domain of IRE1α with a polypeptide containing a modified FK506 binding domain. Upon the addition of a dimerization ligand, we demonstrated that dimerization of IRE1α is sufficient to activate XBP1 and that PERK-ATF4, a separate branch of the UPR, is not activated. These findings represent a novel approach for investigating the IRE1α -XBP1 pathway with potential clinical applications in the future.

Ovarian Follicle Development in the Brown Anole *Anolis sagrei*

Erin Vance – Poster Session A 172

Fundamental research on the reptilian reproductive system has long been neglected, but *Anolis Sagrei* is quickly emerging as a model organism in multiple fields of biology, including genetics. This requires a more extensive base of knowledge on their reproductive structure and development. Because *A. Sagrei* lay a single egg at a time, the side in which the egg develops alternates and the growth of more follicles is thought to do the same. I am using 3-D segmentation software to produce models of *A. Sagrei* ovarian follicles from CT scans of two different individuals. I am also using that program to measure the volume of the follicles. I intend to compare the volume and orientation of the ovarian follicles between sides of the reproductive system and between the two specimens. Results could indicate whether there is a specific order to the development of ovarian follicles in *A. Sagrei*.

Attempts to Generate Synthetic Minicircles for the Chloroplast Transformation of the Coral Endosymbiont *Cladocopium goreaui*

Christopher Vargas, Audrey Moehring – Poster Session B 281

Climate change has increased coral bleaching events, a process thought to be related to reactive oxygen species accumulation in coral symbionts, among other factors. We aim to transform the chloroplast of the coral endosymbiont *Cladocopium goreaui* using a biolistic technique to insert an artificial minicircle containing an ascorbate peroxidase (APX) gene, the expression of which we hypothesize will decrease ROS concentrations and increase thermotolerance under heat stress. Here we report progress towards the construction and amplification of synthetic minicircles encoding either the APX gene or chloramphenicol acetyl transferase (CAT) gene built into a native atpA minicircle backbone. Initial attempts to generate minicircles were plagued by incorrect cultures and reagent incompatibilities. Currently, we have adopted the strategy of using Golden Gate cloning into a bacterial vector to ligate together DNA gBlocks comprising the desired minicircle sequence, a linearized version of each minicircle flanked by XmaI sites with the native gene replaced by a codon-optimized CAT or APX, which we believe will allow replication of our minicircles to quantities suitable for transformation.

Developing a CRISPR-Cpf1 tool to edit the genome of a coral endosymbiont

Saksham Vashistha – Poster Session A 173

Rising ocean temperatures present a great threat to the survival of coral reefs as they undergo massive and widespread bleaching events. During bleaching, the coral symbiont – a eukaryotic dinoflagellate, Symbiodinium – is ejected due to thermal stress. The use of a novel CRISPR-Cas system – Cpf1– has recently shown great promise in editing the genome of eukaryotic organisms. We believe that by genetically editing the symbiont, it is possible to induce thermotolerance and resistance to environmental stress, possibly preventing bleaching events. We have designed a modular DNA cassette using a pBSII vector plasmid, into which DNA encoding for Cpf1, its gRNA, as well as promoter and terminator sequences have been inserted. Our target species is Cladocopium goreaui, one of the most common classes of Symbodinieacae in the world. This algae contains URA3, a gene responsible for the conversion of the nontoxic 5'FOA to the toxic 5'deoxyfluoriuridine. We hypothesize that by targeting this gene for knockout using Cpf1, we can show not only the efficacy of our novel genetic engineering system but also the possibility of targeting genes that promote thermotolerance.

Interactions Between Lrp6 and Slc25a32 in the Risk for Neural Tube Defects (NTDs)

Madhu Venkatesalu – Poster Session B 282

Folic acid (FA) supplementation has been the primary public health strategy for decreasing the prevalence of neural tube defects (NTDs), a major congenital malformation of the central nervous system, for approximately 30 years, but some NTDs have proven unresponsive to folate supplementation at a rate of 5 per 10,000 births. NTDs that are resistant to FA have been found in mouse models with loss of function in certain mitochondrial one-carbon metabolism (mOCM) genes. Thus, the role of mOCM in NTD risk is an area of research interest. Investigating how dysfunction of mOCM may cause NTDs can help us discover more targeted prevention strategies for FA-resistant defects. Inactivation of the Slc25a32 gene, which codes for the mitochondiral folate transporter, causes severe FA-resistant NTDs in mice; and we found that the canonical WNT co-receptor, LRP6, interacts with SLC25A32 in neural tube development, finding that co-heterozygous Lrp6Cd/Slc25a32gt have increased risk for NTD phenotypes. We hypothesize that Lrp6Cd/Slc25a32gt double co-heterozygous embryos have an altered metabolism of folates compared to wildtype embryos, which may help explain why this gene-gene interaction increases risk for NTDs. We are testing this hypothesis using whole embryo metabolomics to determine alterations in quantity and distribution of folate species in these embryos.

Investigating the Migration, Proliferation and Differentiation of Enteric Neural Crest Cells (ENCCs) in the forming Zebrafish Enteric Nervous System (ENS)

Akshaya Venkatesh – Poster Session A 174

In jawed vertebrates, Enteric Neural Crest Cells (ENCCs) are multipotent stem cells that migrate into the early gut to form the Enteric Nervous System (ENS), which controls gut function. However, ENS development is understudied, motivating us to study this process in zebrafish, which have transparent embryonic development allowing for microscopic observations. Using the transgenic line, *-8.3phox2bb:kaede*, I performed immunochemistry with antibodies against Kaede to label ENCCs, against Elavl3/4 to label differentiating neurons, and against Phospho-Histone H3 (phh3) to identify proliferative ENCCs along the gut. I detected an increase in ENCCs, from an average of 32.67 at 60 hours post fertilization (hpf) to 228 cells at 98 hpf. I also noted a Kaede+/Elavl3/4- wavefront of ENCCs along the gut at 72 hpf, but a near 1:1 colocalization of Kaede+/Elavl3/4+ ENCCs at 98 hpf, showing increased differentiation with time. The number of phh3+ cells decreased from 60 hpf to 80 hpf, suggesting proliferation decreases as ENCCs migrate and differentiate. In all, this study has identified key developmental cell states and enhances our understanding of how the ENS forms.

The Impact of Climate Change on Gall Wasps (Family: *Cynipidae*) and Their Host Oak Trees (Family: *Fagaceae*)

Camila Vinson – Poster Session A 198

Oak trees (Family: *Fagaceae*) serve as home for a large community of herbivorous insects. The gall wasps (Family: Cynipidae) are a group of herbivorous insects that are parasites to oak trees. The life of gall wasps is closely tied to the oak tree as every part of their life cycle depends on the oak's tissue. The development of oak tree tissue is dependent on many biotic and abiotic factors. Temperature, a major factor impacting oak tree growth, is rapidly changing due to climate change which could cause cascading events for all communities that rely on oak trees. Examining the effects of climate change on oak trees and the gall wasp community that relies heavily on oak tree survival and tissue development provides an opportunity to understand the impacts of climate change across trophic levels.

Constructing a Genetically Encoded FRET-based Biosensor to Study Intracellular Bioenergetics of Pathogenic *Candida albicans*

Johnny Wang – Poster Session A 176

Candida albicans is a commensal yeast typically found in the human microflora. However, it may also act as an opportunistic pathogen, causing acute infections ranging in clinical severity from oral thrush to endocarditis. The goal of this study is to understand the energetics of *C. albicans* amid host-pathogen interactions, by measuring ATP levels through the expression of a genetically encoded, FRET-based biosensor. To construct the biosensor, the DNA sequence was adapted from the yAT1.03 biosensor developed by Botman et al (1). The sequence was synthesized commercially as multiple gene fragments, then assembled and inserted into the pENO1-mScarlet plasmid vector. After confirming assembly, bacterial cultures were transformed, and minipreps were performed to isolate plasmid stocks. Restriction enzyme digest experiments indicated successful amplification of the plasmid. Completion of this project represents a critical first step in the identification of trends in subcellular, metabolic production and consumption of ATP during *Candida* infections. Next steps include expression in *C. albicans* and FRET-based microscopy experiments in an in vivo zebrafish model.

Development of Nitric Oxide-Releasing Matrix (NOmatrix) for Wound Infections

Daniel Wang – Poster Session A 175

Nitric oxide (NO) is a highly reactive gas molecule, exhibiting antimicrobial properties. Because of its reactive nature, it is challenging to store and deliver NO efficiently as a therapeutic agent. The objective of this study was to develop a NO-releasing polymer matrix (NOmatrix), as an effective delivery platform for NO. NOmatrix was fabricated with a biopolymer solution of polyvinyl pyrrolidone (PVP) and derivatives of N-diazeniumdiolate (NONOate) as NO donor molecules, using 3D bioprinting technology (3DP). In vitro release kinetics of NOmatrix were evaluated, along long-term stability of NONOates in NOmatrix. In vitro cytotoxicity was evaluated in a human cell culture model, and antimicrobial effects against *Pseudomonas aeruginosa* were evaluated in vitro and in vivo in a mouse model. I demonstrated that NOmatrix extended the release of NO up to 7 days and showed inhibition of growth for *Pseudomonas aeruginosa* in vitro and in vivo, with no toxicity to human cells. This study presents the development of NOmatrix as an efficient storage and delivery platform for NO, which can be further developed as an antimicrobial bandage.

Determining the Mechanism of Amino Acid Induced Oxidative Stress Resistance in *Candida albicans*

Amilia Warkentine – Poster Session A 177

Candida albicans, a human fungal pathogen, causes deadly infections in immunocompromised patients. During disseminated infections, *C. albicans* must adapt to a variety of niches in the body and evade host defenses. Previous research suggests that alternative carbon sources serve as an environmental signal, triggering resistance to relevant stressors. Particularly, amino acids induce resistance to oxidative stress. First, we confirmed that amino acids induce robust stress resistance in *C. albicans*. We then wondered if the amino acid sensing SPS system mediates oxidative stress resistance. However, we found that mutants in the SPS amino acid sensor retain this resistance. To confirm the phenomena is biological, we assayed hydrogen peroxide concentration in amino acid media and found it reduced. Subsequent experiments accounting for the reduction continue to show resistance in casamino acids. As a result of these experiments, we conclude that the cause of amino acid induced oxidative stress resistance is most likely biological and continue to explore its mechanism.

Assessment of physical activity level and cognitive function in children and adolescents with cancer

Grace Waterman – Poster Session A 178

Anti-cancer treatment can negatively impact an individual's neurocognitive and motor functions. Physical activity (PA) can potentially mitigate these negative impacts. However, evidence to date has only evaluated the relationship between PA and global cognitive function with little known regarding specific cognitive function domains. Thus, we examined the relationship between PA and particular domains, including verbal comprehension, processing speed, working memory, sustained attention, impulse control, and reaction time in children, adolescents, and young adults (AYA) with cancer. We conducted a retrospective study to determine the relationship between both parent and patient-reported physical activity data and aforementioned cognitive function domains from 110 AYA and children with cancer. We hypothesized that a higher level of PA in the past 7 days would be associated with higher performance of specific cognitive function domains in these patients with brain cancer, leukemia, and lymphoma. The pending results of this project will determine what aspects of cognitive function can be improved the most by promoting the adoption of regular PA in cancer patients.

Establishing the Subcellular Localization of a Candidate Peroxin in *Arabidopsis thaliana*

Ashley Weeks – Poster Session A 179

Peroxisomes are organelles that house oxidative metabolism in eukaryotes and are built by proteins known as peroxins. In yeast, the Pex8 peroxin is involved in peroxisomal protein import. Pex8 is unique in that it has two peroxisome-targeting signals. Although most peroxins are conserved across eukaryotes, Pex8 has not been identified outside of yeast. However, candidate gene At1g73970 may encode for an ortholog of yeast Pex8 in the plant *Arabidopsis thaliana*. To explore this candidate gene, we created a tri-fluorescent construct to separately express mTagBFP2 attached to hypothesized PEX8, TdTomato targeted to the peroxisome lumen, and mNeonGreen targeted to the peroxisome membrane. In addition to the wild type construct, we are creating constructs where either or both peroxisome-targeting signals are non-functional. By imaging these constructs after expression in plants, we hope to visualize the subcellular location of hypothesized PEX8 and provide insight into the necessity of the two targeting signals. Preliminary imaging suggests that At1g73970 does encode a peroxisomal protein that localizes close to peroxisomal membranes.

Multiplexed engineered probiotics to diagnose gut inflammation

Rachel Wurmbrand – Poster Session A 180

Inflammatory bowel disease (IBD) is a chronic disorder characterized by recurrent intestinal inflammation flares. Improved IBD diagnostic tools are needed to monitor inflammatory episodes. Existing diagnostics rely on highly invasive, time intensive procedures. Here, we program genetically engineered probiotic bacteria to sense multiple biomarkers of inflammation and respond by producing biomarker-specific fluorescent proteins. These biosensing bacteria can then be deployed *in vivo* within a hydrogel-based biomaterial carrier, enabling access to the otherwise inaccessible gut microenvironment. Our group previously engineered the bacterial two-component system ThsSR to sense and respond to thiosulfate, a biomolecule associated with gut inflammation. Here, we improve delivery of this bacterial biosensor by hydrogel encapsulation to maintain bacterial survival and performance in the gut environment. Our platform is also designed to improve bacterial biocontainment and clinical translatability with attention to long-term storage. In addition, multiple biosensing strains can be deployed simultaneously to increase diagnostic confidence using multiplexed biomarker detection.

Green Hydra as a Model for the Heat Stress-Induced Coral Bleaching Response

Matthew Yonas, Audrey Moehring – Poster Session A 181

Global increases in ocean temperatures have led to mass-bleaching events in coral reefs, during which algal symbionts are expelled from the holobiont. However, investigating the expulsion of algae from corals is challenging as a result of the coral's tough calcium exoskeleton. *H. viridissima* is a freshwater soft-bodied cnidarian which also has an algal symbiont, *Chlorella*, and *H. viridissima* is a pre-established model organism for studying other biological phenomena. We aim to investigate and quantify the heat stress-induced bleaching response in *H. viridissima* in order to assess its potential as an easier-to-manipulate model of the bleaching response in cnidarians. To do so, we are conducting heat stress experiments in which hydra are exposed to increased levels of thermal stress to induce expulsion of the *Chlorella* symbiont. To qualitatively and quantitatively assess the hypothesized resultant bleaching response, we are using microscopy and qPCR to track changes in *Chlorella* population levels within the holobiont throughout the duration of each heat stress experiment.

Investigating the Cell Fate of BMP-Induced Mesoderm

Sumin Yoon – Poster Session B 283

In human gastrulation, the pluripotent epiblast differentiates into the three germ layers of the embryo: endoderm, mesoderm, and ectoderm. We previously showed that properly timed pulses of BMP treatment of human embryonic stem cells (hESCS) in vitro can reproduce the in vivo emergence of mesodermal cells by activating the secondary signal WNT; however, what subtype of mesoderm these cells later become remains unknown. In this research, we determine the identity of BMP-induced mesoderm by performing immunofluorescence of markers of primitive streak (*Brachyury*, MIXL1), lateral mesoderm (HAND1, ISL1), paraxial mesoderm (TBX6, CDX2), and extraembryonic (ISL1, CDX2, GATA3) fates. We observe that the formation of *Brachyury* positive cells formed with 24h of BMP pulse mostly become paraxial mesoderm after two days as indicated by the presence of TBX6+, as well as lateral mesoderm, which show GATA3-HAND1+ expression. These results shed light on the mechanisms of primitive streak and mesoderm specification during human gastrulation, a challenging stage to study in vivo due to technical difficulties and ethical concerns.

SARS-CoV-2 Epitope Mapping Using Phage Display Technology and Deep Sequencing

William Zhang – Poster Session A 183

The COVID-19 pandemic caused by SARS-CoV-2 has resulted in a devastating healthcare crisis. The antibody response against SARS-CoV-2 is critical for our survival. To understand the antibody response against SARS-CoV-2, it is important to identify the antibody binding sites to the virus. We mapped SARS-CoV-2 antibody binding sites by displaying overlapping peptides that encompass the SARS-CoV-2 viral structure on phage surface and allowing the peptides to bind with antibodies from recovered COVID-19 patients. The sequences of high affinity peptides were revealed as antibody binding sites. We found antibody binding sites on the Spike domain, which facilitates viral entry into cells. We also found a lesser-known binding site in the Nucleocapsid domain, which controls SARS-CoV-2 replication and packs genetic material; the site's involvement in accelerating SARS-CoV-2 replication makes it a promising antiviral and vaccine target. Overall, we demonstrated that the antibody response to SARS-CoV-2 in infected patients is mainly targeting the Spike protein and, to a less extent, the Nucleocapsid protein. These results can help inform optimized COVID-19 therapeutic and vaccine designs.

Structural and functional studies of a viral spike protein

Jim Lu Zhang - ***Shapiro Showcase Presenter***

Orsay remains the only known virus capable of infecting Caenorhabditis elegans, a valuable laboratory model in genetics and cell biology research. The non-enveloped virus presents a promising opportunity to develop a host-pathogen system capable of modeling eukaryotic viral infection in an intact animal. However, Orsay itself must be further characterized to support this potential. Orsay contains a (+)ssRNA genome encoding for capsid protein (CP), viral fiber δ, and an RNA polymerase. Previous studies in our laboratory indicate that δ can be expressed as either a free or fused CP- δ protein with implicated functions in viral release and host cell entry, respectively. However, the structure of the native, infectious virion remains unsolved; in addition, the function and localization of CP-δ remains unknown.

Here, I generate a method enabling the culture and purification of authentic Orsay particles from *C. elegans*. Isolated particles are infectious, with purity and yield allowing structural analysis via single-particle cryo-electron microscopy. Three-dimensional reconstruction of the viral particle indicates that CP-δ is covalently incorporated into the viral capsid as extended, pentameric head fibers at the five-fold symmetry axis of the icosahedron. Particle classification and alignment suggest only a single CP-δ fiber is incorporated per viral particle, introducing asymmetry in an otherwise ordered icosahedral virus. Subsequent in vivo infectivity assays I performed with anti-δ antibodies indicate incorporated CP-δ is essential for viral infection, thus firmly establishing the role of CP-δ in host receptor binding and entry.

Broadly, this work presents the first molecular description of an authentic, infectious Orsay viral particle, demonstrating that CP- δ is asymmetrically incorporated into the capsid surface and has a key function in viral entry. To the best of our knowledge, my 3D model is the first reported structure of a covalently bound viral spike protein, which until now were thought to associate exclusively via noncovalent interactions. These structures will guide future work examining the structural basis of Orsay uncoating and genome release, in addition to the mechanistic interactions that occur between Orsay and *C. elegans* host proteins during viral entry.

Ultimately, this knowledge will expand our understanding of viral structures and infection mechanisms.

Exploring how *KMT2D* mutation affects

Lillian Zhang – Poster Session B 284

KMT2D is a histone methyltransferase that has been shown to be frequently inactivated in lung cancer and act as a lung tumor suppressor. However, the metastatic progression that accompanies KMT2D mutations has yet to be mechanistically established. In order to investigate this, we harvested tumor cells from murine tail-vein transplantation lung adenocarcinoma models and showed that KMT2D-null cells have a much higher metastatic colonization potential. At the molecular level, we compared expression levels of NKX2-1 and HMGA2, both of which influence lung cancer metastasis, between KrasLSL-G12D/+;p53flox/flox cells with and without KMT2D function. Western blotting showed clear differences in expression where KMT2D mutants showed no expression of NKX2-1, a tumor suppressor, but also no expression of HMGA2, a high motility group protein associated with metastasis but typically repressed by NKX2-1. This finding indicates the potential for a novel mechanism. Future work will include the establishment of NKX2-1 mRNA expression fold difference via RT-qPCR and analysis of global gene expression changes via RNA sequencing to identify other genes of interest.

Oncogenic potential of alterations common in Down syndrome acute lymphoblastic leukemia

Matthew Zhang – Poster Session A 182

Patients with Down syndrome (DS) have an increased risk of acute lymphoblastic leukemia (ALL) and poorer outcomes. Furthermore, DS-ALL features a different spectrum of mutations compared to non-DS-ALL. We are studying the oncogenic effects of alterations that occur more frequently in DS-ALL, including two mutations in FMS-like tyrosine kinase 3 (*FLT3*), I836 deletion and V759A, and overexpression of *CEBPD*. We are performing site-directed mutagenesis to derive the *FLT3* plasmid containing the I836 deletion. Next, we will transduce vectors bearing these alterations into hematopoietic progenitor cells (HPCs) from a mouse model of DS (Dp16) and non-DS wild-type (WT) control mice. We will compare the growth of transduced and flow cytometry-sorted mouse HPCs using colony assays. This study will determine if these mutations yield a growth advantage in the context of a DS compared to non-DS genetic background, which may explain their increased prevalence in DS-ALL.

Alzheimer's Disease Spousal Caregiving on Markers of Inflammation and Glucocorticoid Receptor Resistance

Candi Zhao – Poster Session A 184

Caregiving for a spouse with Alzheimer's Disease (AD) is highly stressful due to the resulting poor quality of life and caregiver burden that the spousal caregiver experiences and living bereavement and chronic stress, age-related changes in proinflammatory cytokines. Though previous research has discussed biological markers of physical health concerning AD caregivers, this study will examine how relationship and individual personality characteristics affect those biological markers. Evidence-based treatments can be developed for the caregivers most vulnerable to the harmful physical health effects of spousal dementia caregiving. Methods include looking at attachment theory and coping styles through assessments of attachment and grief symptoms, and evaluating inflammation, heart rate variability, and glucocorticoid receptor resistance, one marker of chronic stress and elevated inflammation, over two years. Through these methods, the hypothesis is that spousal caregivers who are more anxiously attached will have greater burden and poorer overall QOL, and greater inflammation levels and glucocorticoid grief symptoms.

Potential Ribonucleotide Excision Repair Pathway Elucidated by Polymerases

Grace Zhou – Poster Session B 285

DNA replication plays an integral role in biological systems. During the process, the replisome that is made of DNA polymerases, helicases, DNA binding proteins continuously synthesizes DNA at a rapid rate. Such DNA polymerases incorporate complementary nucleotides with high fidelity, but errors still occur. Given the high concentration of rNTP in the cell, the misincorporation of rNTP onto DNA is a frequent error and DNA-embedded ribonucleotides are the most common DNA lesion on the genome. The exact mechanism behind the repair pathway of misincorporated rNTP is unknown, but it has been suggested that the mismatch repair pathway is used to excise rNTPs. In our single-nucleotide incorporation assays, we observed that DNA polymerase eta fidelity significantly decreased during ribonucleotide extension. While this phenomenon was not observed for replicative T7 and RB69 polymerases, the incorporation rate dropped significantly, suggesting that replisome stalling and polymerase switching might occur at DNA-embedded ribonucleotides. After polymerase eta incorporates the wrong DNA base, the mismatch repair pathway can then excise the ribonucleotide and deoxyribonucleotide lesions.

Social Sciences Poster Presentations

Story telling as a measure of cognition and language after stroke

David Ai – Poster Session B 286

Aphasia is an acquired communication disorder that impacts one's ability to express oneself. This study focuses on examining cognitive-linguistic deficits in people with aphasia (PWA) who have been categorized as either "mild" or "non-aphasic" based on standard clinical criteria. Despite this categorization, they frequently report difficulty communicating efficiently and performing everyday tasks. This study examines the discourse abilities of two PWA through narrative analysis, or storytelling in order to quantitatively and qualitatively demonstrate their underlying cognitive-linguistic deficits associated with mild aphasia. We have used a variety of measures for these purposes, including two measures of auditory comprehension we have developed. This presentation will focus on the overview of these two measures within the broader context of the examination of discourse abilities of PWA.

Attachment and Mental Health Following Spousal Bereavement

Temilade Dada – Poster Session B 287

The loss of a spouse is a highly stressful event that puts people at increased risk for poor mental health outcomes. One theoretical framework for understanding how people will respond to the death of a loved one is attachment theory. Those with a secure attachment (based on early-life experiences) may have more adaptive responses to relationship stress, including bereavement, than those with an insecure attachment. To understand the effect that attachment might have on bereaved individuals, Adult Attachment Interviews (AAIs) were conducted over the phone. Once transcribed, these AAIs were coded in order to categorize participants based on one of three primary organized attachment strategies: secure-autonomous, preoccupied, and dismissing. Participants may also have been classified as being disorganized. These classifications help us to determine how participants respond to relationship stressors. I will analyze novel data to determine if a secure attachment style is protective for mental health outcomes such as depression and grief in the bereaved population. This will allow us to better understand how attachment styles might be a resilience factor among bereaved individuals.

Truncating the Triple Threat: The Effect of Imposter Syndrome on the Relationship Between Perfectionistic Discrepancy and Psychological Distress

Jenna Diab, Katerina Arroyos, Dayan Berrones, Jazara Nelson – Poster Session B 295

Many undergraduate students experience imposter syndrome, a phenomenon in which individuals attribute their achievements to luck or external factors rather than their own ability (Clance et al., 1978). Importantly, perfectionism - a trait characterized by a desire to achieve flawlessness, an excessive concern over mistakes and self-criticism (Flett & Hewitt, 2002) - puts people at an increased risk for experiencing imposter syndrome (Lane, 2015). Imposter syndrome and perfectionism have both been linked to psychological distress.Building on research by Wang et al. (2019), we hypothesize that imposter syndrome will mediate the relationship between perfectionism and psychological distress (i.e. anxiety and depression), and these relationships will be strongest among underrepresented college students. Participants from a small, private southern university will complete an online survey and mediation models will be analyzed using the Hayes PROCESS Macro in SPSS. Our findings will offer insight into factors that contribute to college students' psychological distress.

For the Love of Exercise: Relationships Between Enjoyment and Adherence

Chanel Ericsson, Tiffany Padilla, Daniel Argueta, Tara Simpson-Sullivan, Cole Thompson – Poster Session A 185

Despite physical activity's contribution to health and well-being throughout the lifespan, an individual's perception of exercise and lack of enjoyment may act as barriers to participation. However, the Transtheoretical Model of Behavior Change suggests interventions are useful to adopt and maintain healthy behaviors. Our study, For the Love of Exercise: Relationships Between Enjoyment and Adherence, aims to resolve the current lack of understanding of relationships between motivations for adherence and attitudes towards exercise. Current physical activity levels and enjoyment will be measured prior to intervention, then adherence intentions and enjoyment after. By applying two known contributors to exercise enjoyment—music (Stork, Karageorghis, & Ginis, 2019) and encouragement (Williams & Raynor, 2013)—we hypothesize both motivators combined will have the highest ratings of enjoyment and intention to exercise, followed by conditions with one motivator. We do not expect rating changes for conditions with no motivators. Studying these phenomena could help researchers, physical therapists, trainers, and individuals implement more effective strategies for long-term exercise adherence.

Universal Mental Health Screenings in Texas Schools

Brittney Espinoza, Sahar Momin – Poster Session B 288

Mental health-related emergency department visits in 47 states increased 24% among children aged 5-11 and 31% for those 12-17 during the first year of the COVID-19 pandemic in comparison to 2019 (CDC, 2020). Approximately 20% of students in Harris County have mental health conditions, many of which have not been identified (BYAH, 2015). Emotional disturbances (ED) present in childhood are strongly correlated with poor physical health and lower economic status at age 42 (Case et al., 2005). The same research found that if EDs were treated by age 16, students could avoid those outcomes. Thus, it is critical to identify struggling students early and provide them with the support they need. I propose a Texas state policy that mandates universal mental health screenings for students in 3rd, 7th and 10th grade using the BESS and BASC-3 to identify students with mental health conditions and provide individualized accommodations. Funding for these screenings will come from seven sources, including the millions in penalty funds Texas owes to the OSEP for under-identifying students. Identifying and aiding all students with EDs would lead to better academic and long-term life outcomes.

Student Experiences with Egg Donation: A Qualitative Study on Agency, Mental Health, and Financial Circumstance

Ashley Fitzpatrick - ***Shapiro Showcase Presenter***

As rates of infertility are on the rise, demand for assisted reproductive technologies, including egg donation, grows. Egg donation relies on the commodification of women's reproductive potential and has become a lucrative opportunity for students to finance their tuition or loans. Throughout the donation process, egg donors are subjected to serious physical and emotional risks—risks that are often glossed over by agencies and justified by the students' financial dependency. My research relies on a variety of qualitative research methods including interviews, digital ethnography via social media, and autoethnography to catalog and analyze the student donor experience. I have categorized my findings chronologically, from donor recruitment and screening to the physical donation cycle to post-donation reflections. My findings reveal common themes amongst student donors including financial motivations, discrimination based on mental health diagnoses, and diminished agency due to lack of resources and information. My research aims to elevate the stories of egg donors, centering donor safety and agency to empower women to make more informed decisions about their bodies.

The Immigrant Utility Huersitic: Latin American Immigrants as a Voting Bloc in the United States

Lila Greiner – Poster Session A 186

Latinos are the largest and fastest-growing minority group in the United States, and over the past few election cycles, politicians from both parties have sought to tap into this block of potential voters. However, the data clearly shows that Latinos do not behave like a voting block, due in part to the vast diversity within this racialized group. As Latin American immigrants are a subset of the Latino population, focusing on this group may mitigate the effect of confounding variables that cloud the relationship between being Latino and how one votes, revealing an immigrant voting block. By looking into what factors impact the Latin American immigrant vote, politicians and political scientists would have a better understanding of how the Latino vote is influenced and would develop knowledge of a previously under-researched demographic. The research will expand on that research by asking: with the Latin American immigrant community's assumed perceptions of linked fate and group consciousness, will these perceptions have a significant impact on their voting patterns, and, if so, how?

Generic-You as a Linguistic Mechanism of Psychological Distancing

Charlotte Hirsch - ***Shapiro Showcase Presenter***

In addition to serving as a second-person pronoun, "you" can also represent a collective subject (i.e. "You win some, you lose some"), allowing people to reflect on a deeply personal event from a generalized perspective (Orvell, 2017). This study examined how usage of generic-you while reflecting on a distressing personal memory affects negative affect and emotional reactivity. Participants (n=122) underwent three sessions in which they wrote about a highly-distressing memory. The subjects were trained to use generic-you, spatial/temporal distancing, or first-person perspective (control) in their expressive writing. The results were as follows: 1) Spatial/temporal distancing led to lower emotional reactivity at session 2 compared to the control or generic-you groups, suggesting it may be the most effective and trainable strategy. 2) Negative affect was not significantly predicted by group, session, or their interaction. 3) Participants did not continue using distancing strategies at the follow-up session. Future studies will examine training strategies for adaptive longer-term implementation of distancing and generic-you.

Examining Emotion Regulation Training During the COVID-19 Pandemic

Ridwana Islam – Poster Session A 187

The COVID-19 pandemic is associated with high stress levels worldwide. Based on recent observational results that suggested that psychological distancing was effective in reducing pandemic-related stress, we were motivated to examine the effects of longitudinal training in two cognitive reappraisal tactics: distancing and reinterpretation. Distancing is objectively appraising a situation, while reinterpretation is imagining that an outcome is not as bad as it first seemed. We recruited 75 adults through Prolific.co who were randomly assigned to either distancing or reinterpretation. Participants were trained on their assigned strategy and completed five picture-viewing tasks and five emotion-rating surveys over 11 days. Our results showed a main effect of training on negative affect during the task, with lower negative affect over time, for both groups. We also found that trained emotion regulation did not lead to a decrease in COVID-related stress. However, a caveat is that we observed a significant difference in baseline depressive symptoms between the groups despite randomization. Future work may include randomization to group after stratifying for depressive symptom scores.

The Cheerleading Choice: Attractiveness Ratings In Group Settings

Kourtney Kanja, Ashley Chung, Trey Chamberlain, Cynthia Gonzalez, Teddi Yoo – Poster Session A 188

Our study investigates the Cheerleader effect–the tendency for faces to be rated as more attractive when presented in a group setting–on Rice Undergraduate students. We believe that we will observe an increase in attractiveness ratings when target faces are presented in a group setting versus alone, regardless of the gender of the target faces. Six male and six female target faces were selected from the Chicago Face Database with varied attractiveness ratings, all who were estimated to be in their 20s. Participants were then randomly assigned to the group or alone condition and asked to rate the physical attractiveness of each face on a scale of 1-10. Gender, sexual orientation, and romantic interest demographics were measured on a sliding scale. Current relationship status data was also collected. We expect our hypothesis to be confirmed: the presence of the Cheerleader effect in male and female target faces. Our findings would support existing evidence that our perception of others is influenced by social context. In terms of real life application, this suggests that having group pictures on your dating and personal profiles may be socially beneficial.

An Update on Real World Intravenous Ketamine Clinical Practices

Ashna Karpe – Poster Session B 289

Wilkinson et al. (2017) reported on practice patterns of providers offering intravenous (IV) ketamine as a treatment for treatment-resistant depression (TRD). Since then, there has been a rapid growth of IV ketamine as a treatment for psychiatric disorders. We conducted a study to provide an updated characterization, inviting providers from 154 clinics to complete a web-based survey. Respondents reported treating major depressive disorder, anxiety disorders, post-traumatic stress disorder, and pain disorders. Most clinics reported titrating infusion dose over the course of acute treatment and prescribing twice or thrice weekly infusions. Almost all clinics reported using validated self-report scales to assess baseline symptoms and treatment response over time. Community clinic protocols for the acute phase of treatment are similar to protocols followed in controlled research trials. However, most providers were likely to titrate dosage, reflecting patient-specific treatment planning for complex, real-world patients. Future directions include consolidating data on treatment outcomes to investigate clinical outcomes among a large representative sample of real-world patients.

Impact of TikTok on Cognitive Functions

Joanne Kim, Addie Armistead, Max McWilliams, Joanna Quan, Reed Myers – Poster Session A 189

As TikTok is a relatively new but increasingly popular app with minimal studies to date, little is known about the impact its short-video format may have on cognitive functions. Our research aims to investigate the effects of TikTok usage on cognitive functions like attention span. We plan to administer a campus-wide survey. First, participants will take a self-report survey on TikTok usage, followed by a pre-survey on attention span. Participants will learn a set of fake English grammar rules and then be randomly assigned to one of two groups, where one group uses TikTok for 5 minutes and the other group rests for 5 minutes. A brief performance test will then be administered to gauge ability to apply the rules from memory, followed by an attention span post-survey. We expect our results to show that TikTok usage has a negative effect on attention span, memory, and learning. This study intends to expand and clarify conflicting research on social media. Future work on this topic could lead to further knowledge on the potential impact TikTok specifically has on cognitive functions long-term.

Mapping Money: Estimating the Economic Power of Sex Workers in Progressive Era Houston

Grace Kneidel – Poster Session B 290

When many Americans think of red-light districts, they think of cities like Amsterdam where sex work is legal and regulated. But what few people know is that Houston once had its own red-light district– at least three, in fact. One such district, Happy Hollow, was located downtown until a 1908 City ordinance relocated it to Freedmantown, an area of the 4th Ward home to mostly Black residents. This new red-light district came to be known as the Reservation. My project uses ArcGIS software to map how land ownership by race in the Reservation changed in response to this policy decision using real estate deeds and Census data, including the Census of Manufactures. As we discover more about the land holdings of sex workers, we can estimate their economic power by comparing their properties with those of their neighbors. Since completing historic data sets is a puzzle within itself, this project is ongoing: so far, blocks 8 and 27 are complete. The Reservation was outlawed in 1917, and these 9 years of Houston history provide a compelling opportunity to study the economic lives of sex workers within the United States.

Educational Outcomes for Immigrants in Texas and California

Nina Kumar, Veda Kumar, Victoria Lee, Nora Maerean – Poster Session A 190

We want to explore and compare the educational outcomes for immigrant groups in the state of Texas and California. We will be tracking data on educational attainment by observing high school and college graduation rates for each population in the study. Our study aims to answer the following question: How do educational outcomes vary among immigrant children in Texas and in California? We hope that this project can shed light on the effects of structural barriers on different immigrant groups and help contribute to a greater understanding of immigrant experiences.

The Potential of Racial, Insurance, and SES-Related Bias in Pediatric Hearing Loss Diagnosis

Jonathan Najman – Poster Session B 291

Despite findings of higher rates of pediatric hearing loss in Hispanic and African American communities (Mehra et al., 2009), racial and ethnic background are significant predictors of access to and performance with cochlear implants (Liu et al., 2020; Dornhoffer et al., 2020). Furthermore, using public insurance to pursue cochlear implants critically delays children's surgery and post-operative speech performance (Liu et al., 2020; Tolan et al., 2017; Armstrong et al., 2013). This study experimentally examines the contribution of physician bias on diagnosis and recommendations. A group of 135 physicians, 61% of whom worked in the targeted field, completed an anonymous survey diagnosing a fictitious patient. Although we were not able to receive enough participants to draw a definitive conclusion, preliminary data suggests an interaction between race and insurance status that predicted physician affect toward the patient. Further research will be required to validate this effect and inform future interventions to reduce the disparities mentioned above.

Materialism and Self-Worth: How Social Media Connects the Two

Carly Ngo, Ananya Srivastava, Kaylah Cantu, Fabiola Flores-Salazar – Poster Session B 292

Capitalism encourages materialistic values. However, research suggests that a materialistic value orientation, or the view of possessions as a source of happiness and success (Richins, 1992), relates to the self-stigma of seeking psychological help, which involves the fear that seeking help would reduce one's self-worth (Tucker, 2013). This study extends work by Bible et al. (2021) by investigating the impact of social media use on the relationship between materialistic value orientation and self-stigma in help-seeking behavior. Undergraduate students from a private southern university will complete an online survey via Qualtrics and their responses will be analyzed using the PROCESS Macro in SPSS (Hayes, 2018). We expect social media use to mediate the relationship more on platforms that emphasize social image (Facebook, Instagram) compared to platforms that focus less on image (Snapchat, TikTok). Results will provide insight into potential interventions to reduce self-stigma of help-seeking behaviors among those who score higher on materialism.

Like a Good Neighbor, Nonprofits Are (Sometimes) There: Neighborhood Transformation and Nonprofit Organizations

Dylan Nguyen - ***Shapiro Showcase Presenter***

A large body of research has established that neighborhoods play an influential role in shaping individuals' life outcomes. Furthermore, the importance of nonprofit organizations in mediating neighborhood experiences has heightened in an era of shrinking social support programs. However, research has yet to fully explore how neighborhoods and nonprofits interact with each other, especially over time. Leveraging census measures and administrative data from the National Center for Charitable Statistics (NCCS), I ask whether nonprofit organizations help explain neighborhood change and, if so, what direction of change are they associated with? I first apply latent class analysis to broadly describe types of transformations Houston area-neighborhoods underwent from 1990 to 2019, then use multinomial logistic regression models to identify what factors are most predictive of cluster membership. I find that nonprofits are strongly associated with socioeconomic growth. The more nonprofits per 1,000 residents a neighborhood had, the more likely they were to have experienced rapid increases in factors such as household income. On the other hand, chronically disadvantaged communities did not have access to many nonprofits, demonstrating an inequitable distribution of resources that exacerbates place-based inequality.

Community Variations in Out-of-Hospital Cardiac Arrest Care and Outcomes in Texas

Peter Nikonowicz – Poster Session B 293

We characterized racial/ethnic and socioeconomic disparities in out-of-hospital cardiac arrest (OHCA) care and outcomes. Data representing 18,488 OHCAs were obtained from the 2014–2018 Texas-Cardiac Arrest Registry to Enhance Survival. Using census tracts, we defined white, black, and Latino neighborhoods which were further stratified by above/below median household income, employment rate, and high school graduation rate. We compared bystander CPR rates, AED use, and survival to hospital discharge. Relative to white neighborhoods, black neighborhoods had lower rates of AED use (OR 0.3, CI 0.2–0.4). Latino neighborhoods had lower rates of AED use (OR 0.4, CI 0.3–0.6), CPR (OR 0.7, CI 0.6–0.8), and survival (OR 0.8, CI 0.7–0.8). Lower income was associated with lower AED use (OR 0.5, CI 0.4–0.8), CPR (OR 0.8, CI 0.7–0.8), and survival (OR 0.9, CI 0.9–0.98). Lower high school graduation was associated with lower AED use (OR 0.6, CI 0.4–0.9) and CPR (OR 0.8, CI 0.7–0.9); and higher unemployment with lower AED use (OR 0.7, CI 0.5–0.99) and CPR (OR 0.9, CI 0.8–0.94). The results indicate significant disparities in OHCA Care Outcomes related to race/ethnicity and socioeconomic status.

Emphasis on Education: A Comparative Analysis of the Relationship Between Civic Education and Democracy

Claire Noel – Poster Session A 191

In light of the growing unrest and democratic backsliding in countries throughout the world, policymakers are increasingly turning toward civic education as a way to bolster faltering democracies. Previous studies have shown that civic education programs in schools can increase civic knowledge and political interest. However, these studies have failed to evaluate a link between national civic education requirements and the quality of a country's democracy. This study seeks to fill this gap and evaluate the relationship between national civic education structure and national democratic strength. This study uses data from the 2009 International Civic and Citizenship Education Study and from the Freedom House freedom scores to assesses this relationship in 38 countries throughout Europe, Latin America, and Asia. Through a two-part analysis, this study both assesses the direct relationship between civic education structure and democratic strength and the relationship between civic education structure and the various mechanisms through which civic education is theorized to promote democratic behavior.

English Proficiency of Children of Immigrants Based on Geographical Location

Jiwon Park, Helena Leal, Mia Jones, Piper Harris, Star Han – Poster Session A 192

We will investigate how children of immigrants exhibit differing levels of English proficiency depending on their geographical location. We will be looking at data from a state located near the border, such as Texas, versus a state located in the center of the US, such as Colorado or Illinois, and categorizing their English proficiency by limited English proficiency, bilingual, or English monolingual. Upon initial research it appears that there is more linguistic isolation in Texas than the other states, meaning that these children live in a household in which all members speak a language other than English and do not have very good English proficiency. This is an expected result based on Texas being a border state with more immigrants, and thus potential greater linguistically isolated communities than Midwestern states. We will also be able to analyze if there are differences based on citizenship statuses of the immigrant parents. More data will be gathered from the Urban Institute to draw conclusions about geographic trends of children of immigrant's English proficiency in the United States.

An Age-Old Team Sports Rivalry: Masculinity vs. Help-Seeking

Sarah Roberts, LeGrand Dudley, Jason Bugg – Poster Session A 193

From a young age, men are exposed to normative masculinity in contemporary American society. Male athletes are particularly prone to this pressure, as shown in recent findings of undergraduate college men athletes conforming to masculine norms and holding negative attitudes towards help-seeking (McDermott et al., 2018). The present study replicates Wasylkiw and Clairo's (2018) research supporting the relationship between conformity to masculine norms and attitudes toward help-seeking behaviors of male undergraduate college athletes. The present study surveys male undergraduate college students at a private, Southern university and organizes them into two groups: men involved in team sports and men uninvolved. A survey measures self-stigma towards help-seeking, conformity to masculine norms, leisure-exercise time, self-compassion, and depression. Using PROCESS Macro in SPSS (Hayes, 2018) to run a moderated-mediation analysis, anticipated results suggest increased conformity to masculinity and negative attitudes towards help-seeking services within men involved in team-sports. This research may lead to greater awareness of male students' attitudes towards help-seeking behaviors.

Air pollution, cognitive function, and depression: Does socioeconomic status matter?

Tomas Russo – Poster Session B 294

Research suggests that air pollution is related to negative health and psychological outcomes. Moreover, those lower in socioeconomic status (SES) are more likely to be affected by air pollution. However, sparse research has investigated the interaction between SES and air pollution on these outcomes. This study investigates whether SES moderates the relationship between air pollution and cognitive function and between air pollution and depression. Using data on fine particulate matter and ozone air pollution from the US Environmental Protection Agency and cognitive function and depression data from the Health and Retirement Study, I analyzed the effects of air pollution on cognitive function and depression as well as the moderating effect of SES on those relationships (N = 8,175). Results suggest that fine particulate matter exposure was negatively related to cognitive function and depression and that ozone exposure was negatively related to depression when controlling for other factors. SES did not significantly moderate these relationships. This study adds nuance to research connecting air quality with cognitive decline and depression in older US adults.

The Effects of Gratitude Interventions on School Burnout Experienced by Undergraduate College Students

Chloe Hur, McKenna Tanner, Victor Alvarez – Poster Session A 194

Undergraduate students are vulnerable to academic burnout, and the challenges brought on by the COVID-19 pandemic have weakened existing supports, putting students at greater risk of negative mental health outcomes. The purpose of this study is to test whether a gratitude intervention could alleviate students' negative affect and symptoms of burnout. We aim to trigger an upward spiral, as described in Fredrickson's broaden-and-build theory of positive emotions, in order to bolster student well-being. Rice undergraduate students will complete measures of affect and academic burnout before and after completing either a gratitude reflection exercise or a control exercise. We expect the results to show that a gratitude exercise, compared to neutral tasks, improved burnout symptoms in undergraduate students. This will especially be the case 72 hours after the exercise. Through this study, we hope to examine gratitude exercises and their application in undergraduate situations. Ultimately, these gratitude tasks can be implemented by students regularly to help alleviate and prevent symptoms of burnout.

Empirical Analysis of Emissions Permit Auctions

Lucas Tyler – Poster Session B 296

According to the IPCC, if warming were to continue to rise at the same rate, it would have adverse effects on global temperatures, sea levels, biodiversity, and ocean acidity, all of which would lead to risks to health, food security, water supply, and more. As such, we all need to contribute to emissions abatement. Cap and trade schemes are a way of achieving the maximal amount of emissions abatement at the lowest cost by establishing a market for emissions permits. These permits can either be given away for free or auctioned off by the government. Auctioning forces the polluter to pay for their right to pollute, and also gives the government a good additional revenue stream. Given that a large number of permits would be auctioned off, these auctions would take the form of a share auction. My work is innovative in that it is the first real use of empirical emissions permit auction data, uses a new equilibrium in the private value case and uses auction summary statistics to learn information about demand for emissions permits in different parts of the world as opposed to using the standard bid level data.

Measuring Obsessive-Compulsive Symptom Severity in Youth with Autism Spectrum Disorder (ASD)

Mbonobong Usua, Michelle Yang – Poster Session A 195

Fundamental research on the reptilian reproductive system has long been neglected. The brown anole (Anolis sagrei) is quickly emerging as a useful research organism in multiple fields of biology, including genetics, especially after the recent success of CRISPR/Cas-9 gene-editing in this species. The gene-editing technique requires direct manipulation of the ovarian follicles. Thus, a more extensive base of knowledge on the reproductive organs and development would help advance the field of reptile genetics. A. sagrei lay a single egg at a time and the side on which the egg develops alternates. The growth of more follicles is thought to do the same. Here, I present 3-D models of maturing A. sagrei ovarian follicles from two different individuals, generated from micro-computed tomography scans and segmentation (digital dissection) software. I show how the volume and orientation of the follicles differ between sides of the reproductive system and between the two specimens. These studies could indicate whether there is a specific order to the development of ovarian follicles in A. sagrei and whether that order is consistent between individuals.

The Effect of Current Perceived Stress on Emotional Memory

Rishi Vas – Poster Session A 196

Stress can negatively impact one's memory. The hippocampus, a brain region involved in memory, performs a key computation called pattern separation which is our brain's mechanism of distinguishing between similar events. Previous research has examined the impact of stress on pattern separation by inducing stress in the laboratory or examining chronic stress (i.e. depression); however, little is known about how natural variation in current perceived stress levels impact memory. This study examined the impact of perceived current stress on emotional memory using a task that taxes pattern separation. Participants reported their current level of perceived stress using a modified version of the Perceived Stress Scale, which we used to split participants into low and high stress groups. We found impaired pattern separation in the high stress group, especially for positive images. We also found a negative relationship between perceived current stress and emotional memory, where higher levels of stress were associated with worse emotional memory. These results suggest current perceived stress greatly impacts emotional memory, especially for positive experiences.

Healthcare Attitudes and Access for Families of Children of Immigrants

Aaron Vaughan, Sofia Flores-Rojas, Chrystal Hughes, Ivany Patel, Jesus Solorzano – Poster Session A 197

The current study addresses how families of children of immigrants engage with health insurance, how they utilize these systems (for instance, number of visits to Primary Care Providers), and their attitudes towards healthcare. More specifically, the study focuses on whether or not families of children of immigrants interact with healthcare systems differently from other families, analyzing data from existing studies on the topic. In our initial analysis we found that there is no large demographic trend with state-by-state medical insurance coverage of Hispanic children. However, when accounting solely for Medicaid coverage we see that in non-Medicaid expansion states, there is a higher rate of uninsured Hispanic children. Non-citizen children had the highest rate of uninsurance while the next highest was citizen children with a non-citizen parent. Our goal for this study is to understand how these families interact with the healthcare system, what discrepancies are present, and how this could affect their attitudes about seeking healthcare and ultimately about their own health. This project is done in conjunction with PSYC 480: Children of Immigrants, taught by Dr. Ozge Gürcanlı.

Architecture Presentations

Material Optimization for the Mahama Refugee Camp

Bay Fujimoto, Charlotte Cohen - ***Shapiro Showcase Presenters***

We designed a system of modular shelters to be used as schools at the Mahama Refugee Camp in Rwanda, rooted in a study of plywood's materiality. The project is influenced by the 1950's DIY stitch-and-glue kayak, in which flat sheets of plywood are cut in specific profiles, curved, and sewn edge-to-edge with sinew cord to form inhabitable space. We focused on the potential of this technology, increasing the scale and accommodating for Rwanda's temperate climate. The work is composed entirely of 4' by 8' industry-standard sheets of plywood, pre-glued and CNC-milled into larger panels intended for a standard sized shipping container. This highly optimized material approach arrives on site packed as flats and can be assembled by residents of Mahama, Rwanda.

Music Presentations

Creating new solo violin works inspired by the Brazilian roots of Darius Milhaud's Le Boeuf sur le Toit

Connor Chaikowsky - ***Shapiro Showcase Presenter***

Presenting the history of the piece Le Boeuf sur le Toit Cinéma Fantasie for Violin and Orchestra by Darius Milhaud, the lesser known Brazilian popular melodies that Milhaud sourced for the piece, and how it culminated in a musical project of commissioned violin works based on the Brazilian melodies. These commissioned pieces, which I will demonstrate, recontextualize the rich cultural melodies Milhaud used and put forth diverse and creative new interpretations of them.

Exhibition Presentations

It's About Dignity and Justice

Zooming in on Telehealth: An Investigation of Psychotherapy's Effectiveness and Racial/Ethnic Ramifications

Phillis Range – Session A1

With COVID-19, many previously face-to-face health services migrated to virtual platforms, offering virtual, or "telehealth" services, to maintain safety through social distancing. However, the effectiveness of telehealth has only been minimally investigated, particularly with respect to potential racialized disparities in outcomes. This study will focus on children diagnosed with anxiety and obsessive-compulsive disorders (OCD) who received intervention through outpatient telehealth services, in-person services, or a hybrid combination of both treatment modalities. Investigating treatment effectiveness and potential racial/ethnic differences based on the Clinical Global Impression scales of patients at a large children's hospital seen in the outpatient OCD and Anxiety Disorders Program will contribute to a better understanding of behavioral intervention provided through telehealth.

The Trophy Leader: How Phenotypic Stereotypicality Influences Leadership Prestige

Dillon Stewart – Session A1

This research explores the physical traits associated with leaders–specifically how phenotypic stereotypicality (PS), the extent to which an individual possesses the physical characteristics that are thought to be prototypical of their race, relates to professional outcomes. In contrast to past work that focuses mainly on between-group comparison and often centers on Whiteness, we look at within-group comparisons for multiple marginalized groups. Additionally, we contribute to the limited work on intersectionality by examining how outcomes may differ by both race and gender. Using a sample of 1870 Asian, Black, and Latine leaders, we investigate how PS relates to job prestige and professional network size. We find that those with high PS had higher prestige positions but smaller professional networks. These relationships differed by the interaction of race and gender (Hall et al., 2018): Asian women and Latine men had higher prestige than their male and female counterparts, respectively, whereas Black men and women did not significantly differ in their prestige. These findings allude to the impact of both PS and intersectionality in leadership outcomes.

At All Costs: Financial Inclusion of South Asian Survivors of Violence

Krithika Shamanna – Session A1

The South Asian community in the US experiences one of the highest rates of interpersonal violence (IPV) in the country. As of 2017, the API-GBV fact sheet revealed that interpersonal violence rates in various South Asian communities were between 21% and 96%. Non-profit organizations specializing in interpersonal violence support have often used financial training and literacy as methods of empowering survivors, highlighting a recurring quest for financial independence. However, due to language, cultural, religious, and immigration-related barriers, South Asian survivors face a unique struggle when it comes to financial inclusion. This project attempts to craft a comprehensive analysis of the landscape of financial wellness efforts to support South Asian survivors of IPV. Drawing on postcolonial feminist theory, I analyze the history and logic behind financial "empowerment" and dissect what it means to financially support South Asian survivors on their terms. Additionally, to theorize policy solutions, I contextualize community-based and informal networks of support for South Asian survivors with non-profit-led formal "economic empowerment" initiatives.

Being Gay, Doing Time: Representations of Queerness in Prison Media

Sarah Swackhamer – Session A1

Although mass incarceration is a serious problem in America today, a significant number of privileged people remain distanced from the experience of imprisonment. Much of these penal spectators' understanding of the carceral state comes from popular media about the prison, including news, television, and film. A growing body of research investigates how popular prison media perpetuates ideologies of crime and punishment that undergird the extant carceral state. However, little work has investigated how queer sexuality manifests in these stories: a significant gap, as perhaps the most common pop cultural reference to prison is the homophobic prison rape joke. In my project, I question the ideas that the penal spectator has internalized through "queer" portrayals of prison, from prison rape jokes to women-in-prison films like Caged to contemporary television programs like Orange is the New Black and Oz. By attending to queer representation in these narratives, I hope to disentangle dominant understandings of queerness as criminal and criminal as pathological, and to ultimately stimulate a larger discussion of how penal ideologies are woven into our everyday cultural surroundings.

America's Ghosts: Blackness, History, and Mythmaking in American Horror

Laura Fagbemi – Session A2

From the earliest days of the slave trade, American notions of horror have been framed by ideas of difference and anti-Blackness. This project analyzes how the racialization of American horror has historically served two divergent social purposes. A rhetoric of terror and monstrosity emerges as a technology for the dissemination of harmful racial propaganda that ties white fear to Black difference. The same rhetoric is a vehicle for empathy through which Black Americans process and communicate otherwise incomprehensible suffering. Via a cross-historical analysis, I unveil how figures of horror - from the zombie to the "superpredator" - have been leveraged to construct Blackness as the cultural "Other" against which whiteness asserts supremacy and normativity. Concurrently, I draw a throughline from Douglass and Jacobs to Wright, Morrison, and Peele, tracking the African American tradition of coopting the tropes of the Gothic to communicate the horrors of slavery and Jim Crow, and, more recently, police brutality and mass incarceration. I argue that the language of American horror is a double-edged sword, shaping the contours of both racial oppression and Black liberation.

Casting New Spells: Blackness, Whiteness, Gender, & Magic in the Modern Fairy Tale

Kendall Vining – Session A2

The classic Western fairy tale has always been a powerful mirror to a culture's ideas, values, and concerns. The last few decades have seen a resurgence of the fairy tale, and while traditional fairy tales have often been used to celebrate or uphold problematic beliefs, modern or "updated" fairy tales often operate in opposition to that instinct. They have offered contemporary writers an important new form through which to critically question and productively subvert representations of Blackness, idealized Whiteness, and gender stereotypes. This particular senior thesis project is a collection of fairy tales that seeks, in part, to center Black characters in a space traditionally reserved for White subjects. Additionally, the collection attempts to recast the female protagonists' relationship to magic, and accordingly, to power. The project has a correlating research component, involving critical examinations of fairy tales in shows, film, and text.

Post-2020 Election Survey of Harris County Voters

Debi Saha, Chidimma Alilonu – Session A2

The 2020 Presidential election produced the highest voter turnout in over a century. This occurred despite a worldwide pandemic and an unprecedented attack on the institution of mail assisted voting by an incumbent President and his party. The 2020 Presidential election in Harris County also saw drive-thru voting (DTV) utilized as a new convenient method of voting for the first time. In our survey research this summer, we designed a survey to ask voters about their voting experience, what they valued as convenient when it came to voting, and their support for Texas Senate Bill 1. Texas SB1 has since been passed, but at the time of the survey, the bill called for banning 24-hour voting and banning DTV, alongside other election reforms. We found many interesting descriptive results regarding the popularity of drive-thru voting and partisan divides for the support or opposition to drive-thru voting. Overall, our survey provides an excellent basis for more quantitative analysis on the 2020 Presidential election in Harris County.

Racial and Ethnic Disparities in Clinical Decision-Making: A Demographic Study of Pediatric Ethics Consults

Summer Nguyen, Ishaan Rischie – Session A2

Hospital ethics committees resolve ethical, cultural, and moral disputes between physicians, patients, and patient families. The decisions made by these committees have widespread impacts on patient care and health outcomes. Despite this influential role, few studies have investigated the relationships between ethics committees and sociodemographic disparities in healthcare. However, recent literature suggests that racial, ethnic, and language discordance between patients and physicians leads to poorer health outcomes and greater conflict due to the presence of implicit biases. Consequently, ethics committees may play a larger decision-making role in cases with racial/ethnic minority patients. Our study addresses these concerns by conducting a demographic analysis of ethics committee consults at Texas Children's Hospital (TCH). Racial/ethnic data from these consults were compared to the demographic breakdown of the overall patient population at TCH in order to identify minority groups that are overrepresented in ethics consults. By doing so, this study aims to inform future efforts for reducing conflicts in care and for protecting the decision-making autonomy of minority patients.

Chinese Women's Barriers to Divorce

Wenbo (Selena) Shi – Session C1

Compared to China's rapid economic reforms, Chinese women's right to divorce is slow to change–it shrinks rather than expand. Generational and gender conflicts intensify as young educated Chinese women become increasingly aware of their lack of exit options in marriages. Topics regarding marriage and divorce constantly hit trending boards on the internet, reflecting their anxiety. Combining personal narratives, analysis of literary and cinematic representations, journalistic reports, case studies, and statistical and historical research in my essays, my project investigates reasons behind the difficulty to divorce through a wide range of perspectives. A key source from my project is a court verdict showing a victim of human trafficking get denied of a divorce. My study reveals that China's traditionally patriarchal value, an emphasis on family unity and social stability, biases against divorced women, and a flawed system of marriage law all contribute to preventing victims of abuse from leaving their marriages. A systematic reform in ritual and legal practices need to happen to promote exit options for women in abusive relationships.

The Labor of Nursing

Priya Trakru – Session C1

In the midst of the COVID-19 pandemic, the need for healthcare workers became blatantly obvious. The pandemic placed a spotlight on healthcare workers — nurses in particular. Despite the initial appreciation for nursing, attention quickly became toxic. Nurses were attacked for demanding hazard pay, and hesitation to work without adequate compensation or reliable safety measures was deemed selfish. The emotional coercion of nurses to work in the pandemic is just one of many examples that raises the subject of how nursing is regarded in the healthcare industry, especially compared to other professions that it might answer to. Despite being one of the most demanded labor forces, the view of nursing as a subservient profession has persisted, and nurses are consistently denied adequate bargaining power. If professionalization is characterized by autonomy in labor and certification, why is nursing not seen as "as professional" or "prestigious" as other jobs in the medical field and from where do these associations stem? This project seeks to review popular analyses of experiences and discriminations that nurses have faced as they relate to the establishment of the nursing profession.

The Coming of Race Narrative and Global Blackness

Savannah Stowers – Session C1

Global discussions on Blackness and the Black experience often seek to define Black identity. In my project, I study how this identity develops across nations and histories, and how literature communicates this experience. I depend on a phrase I have developed called the "coming of race genre" to discuss the conventions of Black coming of age stories with a particular focus on female narratives.

This topic is important because the coming of race genre, I argue, is male-driven. To interpret expressions of Black identity within the genre, I utilize W.E.B. Du Bois' concept of double consciousness, which theorizes how Black Americans view themselves through the eyes of white society.To integrate female narratives, I use the term "triple consciousness," which shows how Black women must also view themselves through male society. Through this critical framework, I analyze coming of race stories and argue that Black women utilize different generic conventions to express this unique relationship to Blackness. I am interested in the concept of frames and borders as a way to think through implications of a distinct Black women's coming of race story within expressions of global Black identity.

The Baltimore Housing Mobility Program: The Effects of Social Relationships on the Transition to Suburban School Districts

Maria Alejandra Mora– Session C1

Through the analysis of longitudinal in-depth interviews with parents and youth, I conducted a qualitative analysis of the experiences of participants of the Baltimore Housing Mobility Program (BHMP). Stemming from a lawsuit where the US Department of Housing and Urban Development was found in violation of fair housing law, BHMP was designed to reduce barriers to geographic mobility across the Baltimore metropolitan area and provide access to more racially and economically diverse communities where subsidized housing had been largely, and intentionally, unavailable.

During the interviews, youth were asked questions that allowed interviewers to gather consistent information about their residential and school trajectory and compare their experiences. While mobility to suburban school districts has been found to be positive because it is typically a move into lower poverty schools, it is also incredibly disruptive to move schools. Thus, I focused on the role social relationships play in the transition to suburban school districts. Social relationships, especially the peer-teacher relationship had a large impact on how youth viewed school, learning, and continued education."

Health of the Mind and Body

Acceptance and Commitment Therapy (ACT) to Improve Re-engagement in Care of Hospitalized Persons with HIV: A Review of ACT in Hospitalized Patients

Arnav Amruth – Session B1

Poor retention in HIV care worsens health outcomes and exacerbates health disparities among persons with HIV (PWH). PWH who are out of care and hospitalized for co-occurring conditions present an important target for intervention. These patients tend to experience stigma and mental health difficulties and often engage in avoidant coping strategies. Acceptance and Commitment Therapy (ACT) is a transdiagnostic behavioral intervention that targets avoidant coping and helps with mental and physical health difficulties. Delivering psychotherapeutic interventions to hospitalized patients is challenging and as a result, it is vital to understand how and whether ACT can be successfully implemented in a hospitalized population. I present a review of literature on ACT in hospitalized patients regardless of disease or condition. I identified 17 studies that implemented ACT in hospitalized patients experiencing psychiatric and/or medical problems. Twelve of the 17 studies evidenced significant improvements in their primary outcome measures. However, only two studies compared ACT to other behavioral therapy interventions, and four studies had no control treatment at all.

Uses of Electronic Health Records in Patient Education

Sriya Kakarla – Session B1

Although 89 percent of physicians have adopted electronic health records (EHRs) in their offices, only 10 percent of patients with online access to healthcare have accessed them. However, EHRs have great potential for patient education. They enable patients to track trends in their health, track appointments, communicate with their physicians, and give patients more autonomy in seeking medical care. Literature reviews indicate barriers in patient EHR usage, such as a lack of awareness and user-friendly interfaces, discourage patients from accessing their health records. Further literature review and patient narratives will provide a better understanding of these barriers and elucidate gaps in current EHR development. This investigation enables the creation of guidelines for physicians and policymakers to maximize the benefits of EHRs to patients.

Engineering Antioxidant and Oxygen-Releasing Lignin Hydrogel Composites to Accelerate Wound Healing

Tanuj J. Prajapati – Session B1

Impaired wound healing has far-reaching socioeconomic effects. Excessive reactive oxygen species (ROS) slow healing by hampering vascularization & promoting inflammatory response causing more inflammation. We hypothesize the application of novel antioxidant lignin-based composites w/ ROS-scavenging & O2-releasing properties will promote wound healing. We crosslinked thiolated lignosulfonate (TLS) in methacrylated-gelatin (GelMA). We developed CaO2(CPO)-incorporated lignosulfonate microparticles in the gels. Stented 6mm skin wounds in wild-type mice were divided into 4 groups: UNTX, GelMA-TLS, GelMA-TLS w/ carriers w/ or w/o O2 release capacity(CPOc,CPO). Morphometric wound analysis showed treated wounds had more granulating tissue w/ marked increase in CPO. Notably, the CPO matrix showed integration w/ granulating tissue. Both CPOc&CPO wounds had greater vessel density. The CPOc & CPO wounds had less macrophages. Our data shows the synergistic antioxidation & oxygen production capacity of lignin composites improved wound healing associated w/ reduced inflammation & enhanced neovascularization, representing potential therapeutics for attenuating fibrosis & improving wound healing.

The Combination of Visible-Light-Induced Homolysis with Ligand-to-Metal Charge Transfer for Direct C(sp3)-H Chlorination

Xiaowei Chen – Session B1

Site-selective C(sp3)-H functionalization increases efficiency and reduces waste when preparing organic molecules for application in pharmaceutical industry and total synthesis of natural products. Metal-to-Ligand Charge Transfer involves the facile generation of halogen radicals, competent as Hydrogen-Atom-Transfer reagent, from expensive heavy transitional metal under light excitation, thereby forming alkyl radicals that are trapped to make desired products. Replacing heavy transitional metal catalysts with cheap and accessible first-row transition metals would be attempted in this study. Although photocatalysts based on 3d transition metals exist in pico- to nanoseconds, they have generally a high degree of ligand-substitution liability that could provide a new photocatalytic mechanism named Visible-Light-Induced Homolysis. This study uses Visible-Light-Induced Homolysis of iron to generate alkyl radicals and use metal-to-ligand charge transfer to deliver Cl from metal chlorides onto alkyl radicals, featuring ancillary-ligand-free catalysis with inexpensive metal salts and catalysis relying on aerobic oxidation.

Care in the Time of COVID-19: Analyzing COVID-19 Vaccine Mandates from an Ethics of Care Framework

Sally Yan – Session B1

During the COVID-19 pandemic, vaccine hesitancy has emerged as a major barrier to effectively controlling the disease in the U.S. Amidst this hesitancy, the federal government has issued several legally contested vaccine mandates. Other than medical exemptions, religious exemptions are the only other commonly accepted exception to these mandates. However, it is difficult for employers to determine what constitutes a legitimate religious exemption. Most scholarship on religious exemptions draws from the perspective of jurisprudence rather than ethics. Using the framework of the ethics of care, I bring the discussion of religious exemptions to vaccine mandates away from the conventional dichotomy of individual rights and societal benefit. Instead, I argue that that the acknowledgment of the interdependence of members of society obligates the institution of vaccine mandates. However, religious exemptions should be allowed to adequately care for the needs of others such as religious fulfillment. Furthermore, I propose discourse-based educational counseling as a method to determine the legitimacy of religious exemptions.

Wireless Pulse Sensor Integrated Thromboresistant Vascular Graft for the Real-time Monitoring of Acute Thrombosis and Occlusion

Shreya Majeti – Session C2

Occlusive vascular diseases are the leading cause of mortality worldwide. The narrowed or damaged vessels are often surgically bypassed with autologous or synthetic vascular grafts. However, 20-40% of these procedures fail within an year due to acute thrombosis, early occlusion, and neointimal hyperplasia. Considering that acute thrombosis and early stenotic events occur within the first 3 weeks of graft implantation, early detection of failing grafts will provide sufficient time to plan early countermeasures to prevent potential adverse events. In this project, a flexible pulsation sensors integrated vascular graft will be developed by 3D-fabrication that can constantly monitor the changes in blood flow through it in real-time. The wireless pulse microsensor integrated nanofibrous smart graft will be fabricated by electrospinning technology and evaluate its ability to measure the real-time flow velocity and pressure by circulating liquids and whole blood. Completion of this study will yield a self-charging microsensor integrated smart graft that enables to measure the real-time blood flow and patency of the smart graft implanted in rats for up to 12 weeks.

“I’m Anxious But I Don’t Have Anxiety!”: How Stigma Exacerbates the Effect of Anxiety Disorders in the Workplace

Eli Mendoza – Session C2

Anxiety disorders are the most common mental illness around the world and in the U.S., impacting around 284 million people worldwide and about 40 million U.S. adults each year. As more organizations start to emphasize employee well-being, honest conversations on how to accommodate those with anxiety disorders and other mental health issues in the workplace are often barred due to the stigma surrounding them. This research examines how different anxiety disorders impact job performance, the stigmas surrounding mental illness that serve as barriers to optimal job performance, and individual, ally, and organizational level interventions that have been researched to treat anxiety and/or reduce mental illness stigma. The culmination of this research is presented in a proposed model showing how anxiety symptomatology and stigma impact job performance, through cognitive interference and self-regulatory processes, and how individual, ally, and organizational level interventions can help improve outcomes for employees with anxiety disorders.

Do Drivers Respond to Lead Vehicles Gradually or Suddenly?

Howard Qian – Session C2

The aim of the current study was to determine whether drivers’ responses to stopped and slow-moving lead vehicles transition gradually in phases, each associated with a distinct optical expansion rate. We also examined whether results were affected by a cell phone conversation and expectancy. We used a driving simulator to assess six response inputs of (1) begins to release the accelerator, (2) releases accelerator completely, (3) starts to press brake (4) comfort-level braking(5) unanticipated-level braking and (6) brake pedal pressed more than 90 percent. Optical expansion rate differed among the first four inputs (the fifth and sixth did not occur enough to analyze), meaning drivers respond to lead vehicles in phases. When drivers were not engaged in a cell phone conversation, optical expansion rate for the perceptual event preceding unanticipated braking was greater when the lead vehicle was stopped compared to slowed. Expectancy did not affect optical expansion rates.

Evolution of *Enterococci* in Bovine Serum Using a Microfluidic Platform

Sarah Kong – Session C2

Multidrug-resistant Enterococci, which can cause bacteremia as well as infective endocarditis, present a major public health threat as effective antibiotics become increasingly unavailable. In vitro experiments studying the evolution of antibiotic resistance in Enterococci typically utilize growth media such as BHI, which significantly differ in chemical makeup from the human bloodstream. While human and/or bovine serum are available to model the bloodstream, large amounts are needed for flask transfer evolution experiments and are costly. A microfluidic platform generates microdroplets that spatially segregate bacteria, allowing for abundant evolutionary trajectories while requiring less serum. This project aims to study the evolution of antibiotic resistance in Enterococci with bovine serum using a microfluidic platform. It is hypothesized that the spatial segregation of microdroplets and bovine serum provide a closer environment to in vivo, allowing for evolutionary trajectories with greater clinical relevance. Completion of this project will allow for a greater understanding of environmental factors in the establishment of antibiotic resistance.

Public Memory in Places of Worship and its Relationship with Healthcare

Vedha Penmetcha – Session C2

Religion is often considered as intangible, however, this can be challenged by the notion that it shapes spaces of spiritual value and the individual experiences within them. Public memory is the ideology that objects, places, events, or leaders all carry a meaning that surpasses time and location. For example, even an individual born after 2001 “remembers” events like 9/11 and the emotions and chaos that surmised the crisis. In this project, I analyze how religious spaces hold meaning because of the emotions and stories that are commemorated within them. In clinical settings, patients and visitors may find spiritual spaces cathartic because of the relationship they have with the religion they practice. Understanding the variations in patient experiences and perceptions of their diagnosis and treatment procedures could offer an insight into how medical facilities cater to individual needs. Therefore, this knowledge could propel context on how cultural competence could be increased from an architectural standpoint for populations consisting of diverse backgrounds to promote more equitable and quality patient care because of the close relations between spirituality and healing.

Climate and the Environment

Challenging Development: The Red River Gorge Dam Controversy in Appalachia from 1962 to 1975.

Kamil Cook – Session C3

In 1962, Congress approved the building of a dam on the Red River in Eastern Kentucky because of recurring floods affecting Powell County, Kentucky. This dam threatened a beautiful and ecologically unique part of the Red River, and, in response, in 1967 a group of environmental activists formed to challenge the building of this dam. After a long battle involving the Corps, environmental activists, politicians, and local people, the dam eventually was never built. Along with chronicling this controversy, my thesis explores the changing conceptions of the environment through the 1960s and 1970s and illustrates that Appalachian environmental activism not only existed, but was contemporary with national movements. I do this with the support of newspapers, letters, legal records, bureaucratic reports and more gathered from the Red River Gorge archive at the University of Kentucky and an online newspaper database.

Ecofeminist Critique and Speculative Fiction

Kathryn Wall – Session C3

Ecofeminist critics study the often intimate connections between exploitations of women and the environment. My project analyzes these connections within the genre of speculative fiction through comparative essays of four texts: The Left Hand of Darkness by Ursula K. Le Guin, The Broken Earth trilogy by N.K. Jemisin, The Imperial Radch trilogy by Ann Leckie, and Rachel Hartman's duology Tess of the Road/In the Serpent's Wake. Each comparative piece reveals how these novelists weave core ecofeminist investments into other topics, including imperialism, non-binary gender identities, the legal rights of land, and the concept of scientific neutrality. The stakes of this project are epistemological, and the goal is to investigate how different fictional conceptions of gender and the environment can lead down paths of destruction or towards solutions that might arise from rethinking how we frame the world we live in. These texts do not exist in isolation. Examining how they present solutions for their climate crises can provide real world theories on how to solve our own.

Removing Hydrocarbons/Organic Contaminants from Water Using a Novel Ultrahydrophobic/Oleophilic Self-Cleaning Polypropylene Material

Abduallah Alsinan – Session C3

The widespread use of petrochemicals leads to substance spills in aquatic environments, resulting in catastrophic pollution and economical loss. According to the International Tanker Owners Pollution Federation, over 7.3 billion liters of petrochemicals were lost from 1970 to 2018. Current separation methods are on average 60% efficient. This research aims on using hydrophobic functionalized polypropylene with WO3 and Multi Walled Carbon Nanotubes (MWCNT) in the separation of hydrocarbons/organic contaminants from water. The novel composite was synthesized by mixing MWCNT, WO3 and polypropylene homogenously. An Easy-load Masterflex Tubing Model was used to conduct the separation process. The final volume of both substances shows that the composite was able to achieve a high separation efficiency (99%). Each 100 grams of the composite successfully separated over 6,535 L/m2/h of petrochemicals from water without chemical altering. Regeneration was conducted on four hydrocarbons for 20-cycles/each component, which proved the composite's stability. A feasibility study indicated that the cost to manufacture the composite is significantly reduced compared to the conventional methods.

The role of Jasmonic Acid in *Arabidopsis thaliana cax1* Response to Anoxic and Herbivory stress

Vignesh Nalliah – Session C3

Cation/proton exchanger 1 (CAX1), a H+/Ca2+antiporter localized to the tonoplast, has a primary role in controlling and regulating calcium signaling. When CAX1 is knocked out in *Arabidopsis thaliana*, a substantial increase in submergence (flooding) and anoxic (zero oxygen environment) tolerance is observed. In addition *cax1* experiences significantly higher levels of Jasmonic Acid following anoxia compared to Colombia (Col) WT. Increased levels of Jasmonic Acid has been found to significantly increase submergence tolerance in *Arabidopsis thaliana*. *Cax1* has been crossed with *coi1*, a JA insensitive mutant, in order to test whether JA plays a prominent role in anoxia/submergence tolerance in *cax1*. In addition JA has an important positive role in defense response against herbivores. *Cax1* has shown poor tolerance to herbivory stress compared to Col-WT despite *cax1*'s superior ability to accumulate JA following stress. Such a result may demonstrate the inverse relationship between JA mediated abiotic stress response and JA mediated defense pathways.

Microbiome Comparison Between Endemic Anchialine Shrimp Found Across Caves in the Yucatan Peninsula

Sydney Rodman

Pollution due to tourism in the Yucatan peninsula (e.g., Cancun, Playa del Carmen, etc.) is threatening the enigmatic inhabiting fauna that could be studied to better our understanding of metazoan evolution in extreme environments. Anchialine cave systems are one of the most understudied and ambiguous ecosystems in the world and are generally characterized by having no light, low nutrient availability, high levels of endemism and two layers of water density-freshwater on the top and marine water on the bottom. T. pearsei are commonly observed in large groups at distinct areas of anchialine caves on the Yucatan Peninsula, yet the underlying reason and the energy source allowing this behavior is currently unknown. I hypothesize that when the caves were inundated with seawater millions of years ago, a marine population of Typhlatya was separated due to vicariance then evolved in semi-isolated anchialine caves. Here, I propose the first investigation into the associated bacterial communities of the endemic shrimp species Typhlatya pearsei to potentially provide key insight into their ecology and evolutionary biology.

Building Networks: How We Connect

The Effects of Mentorship on Teaching and Coaching

Luke Han – Session C4

The training of healthcare workers continues to rely on inter-professional training and mentorship to fill in the gaps in education and training left behind by classroom learning. The VA Quality Scholars program was created to address the desire to nurture the competency and professional development of existing healthcare professional. While research has been conducted on the training of healthcare professionals and their professional development throughout their career, there continues to be a lack of information related to the development of prospective educators in healthcare. Mentorship is an important part of a healthcare professional's career but the impact of mentorship and coaching, and their different forms, have yet to be identified. Prior research on the subject has identified several types of mentorships, which are mostly related to formal mentorship programs with clearly defined mentor and mentee roles. This paper focuses on understanding the effects of mentorship on the teaching and coaching abilities of healthcare professionals. While mentorship contributes positively to the perceived success of mentees, changes to mentorship will allow it to become more effective.

Elastic Doctors: How History, Culture, and Politics Influence the Physicians Career

Madison Zhao

During the Cultural Revolution, Chairman Mao ZeDong mobilized a group of half physicians and half farmers, commonly known as barefoot doctors, to improve rural healthcare in China. In 1965, my grandfather, Chun Lin Zhao, became one of the country's first barefoot doctors, marking the beginning of my family's relationship with medicine. Years later, my father also became a physician–first certified in China, then re-trained and certified in America. I hope to also become a doctor, extending my family's ties to physicianship into the next generation. However, growing up in America, I developed a drastically different perception of the medical field than that of my father and grandfather.

The output of my research takes the form of three chronological storylines that detail each of our motivations for going into medicine, our training, practice, and self reflection. Using my family's personal history as a launching point, I explore the fluidity of the medical profession. Through a combination of oral history, visual art, and poetry, I investigate how the significance and implications of the physician's role change with different times, cultures, and geographies.

Iconic Self-repetition in Harvey Oral Narratives on Record (HONOR)

Benjamin Murdoch – Session C4

This paper investigates iconic self-repetition in Harvey Oral Narratives on Record (a corpus consisting of 56 hours of oral history narratives from survivors of Hurricane Harvey). I define iconic self-repetition as successive identical occurrences of a linguistic form, uttered by one speaker, whose repeated form resembles some aspect of the meaning of the construction as a whole. Using MonoConc Pro 2.2, I generate a frequency list for the corpus, which guides my simple concordance queries for instances of iconic self-repetition. The iconic meanings of self-repetition vary by word class and lexical aspect: repeated nouns represent iteration and quantity; repeated verbs represent continuation, iteration, and intensity; and repeated adjectives and adverbials represent continuation, intensity, and iteration. For example, one interviewee says "cot cot cot cot cot" to describe the large number of cots they imagine at the main emergency shelter in Houston during Hurricane Harvey. Here, as opposed to saying "cots" alone, the speaker's multiple utterances of "cot" iconically correspond to the repetition construction's meaning of a heightened quantity of of cots at the shelter.

Russian Organized Crime and Its Infiltration into the U.S.

Lindsey Schirn – Session C4

The relationship between Russia and the United States, both before and after the demise of the Soviet Union, is uniquely conjoined. For half a century during the Cold War the USSR was viewed as the arch enemy of the United States, as such direct interactions between the two societies were limited. Since 1991, the bilateral relationship expanded and supporting Russia's quest for democracy has become a principal American foreign policy goal. That objective, however, has been hampered by rampant organized crime infiltrating the highest echelons of the state in Russia today (Finckenauer and Waring, 1998). The criminality of the Russian state apparatus in turn has left its imprint in U. S. society. This research will investigate that interrelated development by looking at the dramatic growth of Russian organized crime activities in the United States following the collapse of the Soviet Union, and its effects on U.S. diplomacy toward Russia.

Learning Strategies

Stephanie Martinez – Session C4

Learning is something we do from a very early age. We establish our own pattern for learning, and tend to adhere to that style. However, studies show that some of the most commonly used learning strategies are not the most effective. Additionally, since we are constantly changing throughout our lifetime, our learning styles should also change to best suit those age-related changes. This study was an attempt to examine what those age-related changes are, elaborate on the framework of the selection, optimization, and compensation model, and pairing those two topics together, discuss which learning strategies are best for working adults. Participants underwent a training session followed by practice tasks. This was done under a think aloud protocol where participants actively described their thinking process as they complete the tasks. Then, participants will be interviewed by the experimenter, so that we can figure out what kind of learning strategies they used. This research was conducted during summer 2021 under the mentorship of Dr. Margaret Beier. Data collection and analysis occurred after summer was over, once I no longer worked for the lab.

Multidisciplinary

El-Niño Southern Oscillation and the Asian Summer Monsoon: Paleoclimate Analysis

Grant Parajuli – Session C5

The Asian Summer Monsoon (ASM) is a supplier of freshwater for almost 4 billion people every year. One of its main predictors is the El Niño-Southern Oscillation (ENSO), but the link between ENSO and ASM indicates a large range of year-to-year variability. This project is preliminary research in using past climate data to reduce uncertainty in the ENSO-ASM relationship, contributing to fundamental building blocks of our climate system. Paleoclimate records like cave deposits, corals, and lake sediments are key for analyzing the ENSO-ASM relationship. These past archives extend the period of instrumental data, which only spans 3 to 4 cycles of decadal variability to characterize the ENSO-monsoon relationship. A better understanding of the linkage between ENSO and the ASM will provide insight into climate feedbacks like interactions between air and sea, while also advancing understanding on the effects of climate forcing factors like greenhouse gas emissions. Projections of the ASM also are crucial for national economies reliant on monsoon freshwater resources, including developing countries. Projections could result in practical applications like predicting Asian water security.

Reforming the 340B Drug Pricing Program

Andrew Sun, Alex Kornblum, Kathryn Phung – Session C5

The 340B Drug Pricing Program is a federal initiative established in 1992 that aims to expand healthcare access by offering discounted medications to healthcare providers that serve a large proportion of low-income or uninsured patients. 340B plays a crucial role in funding Houston's safety-net providers: the Harris Health System, local federally qualified health centers, as well as Ben Taub, Texas Children's, and Memorial Hermann Hospital all utilize the program. However, the program's rapid expansion in recent years has magnified its initial faults. Our research includes a review of relevant literature and legislation, as well as qualitative interviews with influential stakeholders in the program. We identify and characterize the consequences of four key issues in the 340B program: 1) the lack of standardized formularies for 340B medications, 2) the pervasiveness of discriminatory contracting by Pharmacy Benefit Managers, 3) the establishment of contract pharmacy limits, and 4) the exploitation of the orphan drug clause. From our findings, we also propose four policy recommendations to reform 340B in an effort to expand healthcare access in Houston.

Grief and Trauma: The Black Experience

Katimah Harper – Session C5

This project explores how Black culture informs the process of remembering, grieving, and ultimately healing from loss — particularly violent loss. For Black people in particular, learning how to process death can be especially difficult. Black grief is shaped by the disproportionate amount of Black deaths to violent means, the transgenerational trauma of slavery, and the ongoing struggle to create spaces for narratives about grief and trauma.

The poetic form is a powerful way to render the fragmented experience of losing a loved one and the difficult moments that shape the grieving process. The free-verse poems in this project are informed by conversations with Black individuals. In its entirety, this collection attempts to acknowledge how Black culture makes the process of mourning and healing both meaningful and difficult.

This project critically examines works like Black Aperture and The Art of Losing and analyzes the craft teachings of Black writers like Toi Derricotte, Claudia Rankine, and Patricia Smith to understand poetry's unique ability to engage in explorations of grief, death, and trauma.

Identification of Additive Manufacturing Defects in 3D-printed Functionally Graded Implant Lattices Using Micro-CT

Jason Ye – Session C5

Recent advances in metal additive manufacturing (or 3D-printing) have contributed to numerous medical applications, including orthopedic implants with architected micro-structures based on functionally graded lattices (FGLs). These porous implants with FGLs are believed to outperform solid implants since the material properties of FGLs can be designed to match human bone while enabling osseointegration of the implant via bony in-growth. However, whether the 3D-printed FGLs can achieve the intended performance is yet to be determined, considering the unavoidable defects produced by the 3D-printing process. In this study, samples of FGLs with tetrahedral unit cells of different densities were fabricated using the direct metal laser sintering method and examined using micro-computed tomography (micro-CT) imaging. The micro-CT data were then reconstructed and segmented to create 3D geometrical models. These 3D models made it possible to evaluate the discrepancies between the as-built samples and the designed geometries. Thus, the future designs for FGLs can be adjusted to compensate for the expected printing defects, producing FGLs that match the design goals more accurately.

Frames & Borders

Unproductive Care: An Anticapitalist Analysis of Care Work

Annabelle Crowe – Session D1

In the U.S. and other nations spearheading global capitalist accumulation, unwaged care work upholds production; simultaneously, productivism shapes what it means to care. The story of capital infiltrates our emotional lives and intimate relationships. Marxist feminists have long centered women's care work in anticapitalist politics. My project speaks to a silence in this body of theory: where is male caregiving? I analyze the stay-at-home dad as 21st-century reproductive worker, weaving Marxist theory with pop cultural texts, sociological studies on stay-at-home fathering, and my biography as the genderqueer child of a stay-at-home dad. Ultimately, I present unproductive care and collective empathy as twin concepts to restructure what we imagine love can mean. Unproductive care decouples production from caring, while collective empathy emerges as a felt responsibility to care for our communities beyond the privatized family. I also provoke my readers to question binary gender. Both collective empathy and unproductive care are impossible when we naturalize caregiving as the skill and responsibility of certain gendered bodies. Utopia is my goal—to build a more caring world.

The Other Progeny: *Frankenstein*'s Monstress

Corinna Murphy – Session D1

My piece investigates the female monster in Mary Shelley's Frankenstein. The Monstress occupies a unique intersectional niche within Frankenstein. Both a woman and a monster, she experiences more literary silencing than any other character in the novel. Much Frankenstein literary criticism and theory neglects the Monstress in favor of analyzing other characters and consequently overlooks the analytic depth, breadth, and nuance that she can supply. I begin to fill this gap by assessing Frankenstein literary criticism, using monster theory, political analysis, feminist approaches, and sexual studies to guide my investigation. My central research questions explore why the Monstress is depicted as she is, why she dies before she even comes to life, and why her dismemberment is so violent. By reframing the Monstress as the central figure of my text, I indicate that the Monstress has self-standing importance, and I provide better inroads for other researchers studying the Monstress. In addition, understanding the Monstress's importance to Frankenstein alters our perception of the novel's vast cultural capital by contextualizing its retellings and assessing the cultural work they perform.

Public Perception and the Press: An Analysis of Media Coverage of the Syrian Civil War

Ishani Kaul – Session D1

What is the first thing you think of when you hear the word "Syria?" The unfortunate reality is that most individuals will envision a war-torn country where terror and injustices abound. By no fault of their own, the majority of non-Syrian individuals have had their perceptions of the situation in Syria shaped entirely by a skewed media narrative. This project combines the concept of public memory with an analysis of media coverage from the Syrian Civil War as a commentary on the broader issue of identifying the media's role in shaping public perception. I investigate various sources of media including documentaries, major news network coverage, and research studies on public perception to determine how prevalent the issue is. To connect with the more expansive topic of public memory, I study existing literature on the relationship between journalistic methods and public perception. The synthesis of both concepts results in a rather dismal conclusion: as a principal agent of history, the media has not done enough to present varying perspectives on critical issues such as the Syrian Civil War.

The Lineage of Muhammad: Muslim Exegesis of the Book of Genesis

Eliza Jasani – Session D1

Muslim and Christian relations have been a central topic in the field of interfaith dialogue for centuries. Rightfully so, as this topic has been at the forefront of politics, culture, and society throughout history. Today, we tend to look at Muslim-Christian Dialogue only in the context of the modern world: referring to ideas such as terrorism, immigration, and social media. My research takes a step back to the root of this dialogue by comparing Muslim and Christian exegesis of a passage of the Bible. I examine the story of Abraham’s sons Isaac and Ishmael in the Book of Genesis to show how minor differences in semantics, translating errors, stylistic choices on the part of biblical authors, and possible corruption of the source can all lead to polar opposite interpretations. The Bible is usually understood to relate only to Christianity - creating a strict border that keeps us from fully understanding it. However, recognizing the importance of this other interpretation to Muslims throughout history and in the modern world can help us look at the Bible and interfaith relations in a new way. This is the first step towards blurring the lines of a strict border.

How Parents of Children with Dystonia Perceive Their Role & Obligations when Considering Pediatric Deep-Brain Stimulation (pDBS)

Charis Tang – Session D1

The use of pediatric deep-brain stimulation (pDBS) to treat refractory movement disorders in children <18 years is on the rise. As the primary caregivers and decision-makers, parents may feel uncertain about the optimal course of treatment for their child, given pDBS' experimental nature. There is limited discussion of parents' perspectives in the pDBS literature. We conducted thematic content analyses of interviews with parents, clinicians, and pediatric patients with dystonia who were offered pDBS to conceptualize how parents perceive their role and obligations to their children in this context. Preliminary findings suggest that parents' perceptions vary by parent gender and the parent-child dynamics. Emotions and temporal elements also mediated parental views. The results of our study allow us to better understand how parents make medical decisions for children with complex illnesses, specifically pDBS for dystonia, and may inform the development of a decision aid for caregivers considering pDBS.