Introduction

The 2022 Newcomb-Tulane College (NTC) Research & Idea Symposium represents the first joint poster session by the Office of Undergraduate Research and Center for Academic Equity. The symposium highlights the summer research and experiences of over 50 NTC students. NTC provided more than $100,000 in grant funding to support the unique and ambitious projects on display today.

Students from each of the five schools that make up NTC are included in the symposium. Projects include inquiries into the aging process for mice, the changemakers leading the fight against climate change, the effect of habitat on the general body condition of birds, and an exploration of Panamanian environmental policies harm to Indigenous communities.

Many of the research experiences occurred on the Tulane campus, but some students traveled as far as Ecuador, Senegal, and South Korea to complete their projects. Finally, this work would not be possible without the time and resources NTC faculty members spent mentoring our students on the incredible research and experiences contained herein.

To learn more about opportunities for undergraduate research and experiences at Tulane, please contact the Office of Undergraduate Research or the Center for Academic Equity.
<table>
<thead>
<tr>
<th>Page</th>
<th>Name</th>
<th>Page</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Ananya Anand</td>
<td>30</td>
<td>Marie Kaiser</td>
</tr>
<tr>
<td>5</td>
<td>Autumn Kranz</td>
<td>31</td>
<td>Marneisha Gilmore</td>
</tr>
<tr>
<td>6</td>
<td>Avery Franques</td>
<td>32</td>
<td>Mary Lorino and Isabella Kulstad</td>
</tr>
<tr>
<td>7</td>
<td>Blaine Martin</td>
<td>33</td>
<td>Maya Klapper</td>
</tr>
<tr>
<td>8</td>
<td>Camryn Jenkins</td>
<td>34</td>
<td>Michael Yang</td>
</tr>
<tr>
<td>9</td>
<td>Collin Dean</td>
<td>35</td>
<td>Naseem Azadi</td>
</tr>
<tr>
<td>10</td>
<td>Dora Pungan</td>
<td>36</td>
<td>Navya Murugesan</td>
</tr>
<tr>
<td>11</td>
<td>Dori Kaplan</td>
<td>37</td>
<td>Nigel Stiger</td>
</tr>
<tr>
<td>12</td>
<td>Dustin Vo</td>
<td>38</td>
<td>Ning Xi</td>
</tr>
<tr>
<td>13</td>
<td>Eshan Damle</td>
<td>39</td>
<td>Olufunke Adeleye</td>
</tr>
<tr>
<td>14</td>
<td>Gabrielle Bass</td>
<td>40</td>
<td>Olulabomi Osikoya</td>
</tr>
<tr>
<td>15</td>
<td>Grace Qian</td>
<td>41</td>
<td>Paige Mosley</td>
</tr>
<tr>
<td>16</td>
<td>Holly Casper</td>
<td>42</td>
<td>Robyn Sanders</td>
</tr>
<tr>
<td>17</td>
<td>Iker Rafael Yturralde</td>
<td>43</td>
<td>Rose Scott</td>
</tr>
<tr>
<td>18</td>
<td>Jack Cohn</td>
<td>44</td>
<td>Sara Hagstrom</td>
</tr>
<tr>
<td>19</td>
<td>Jasmine Kiley</td>
<td>45</td>
<td>Sarah Frances</td>
</tr>
<tr>
<td>20</td>
<td>Jaz Montes</td>
<td>46</td>
<td>Savannah Wasson</td>
</tr>
<tr>
<td>21</td>
<td>Jingzhi Yang</td>
<td>47</td>
<td>Sheccid Rodríguez</td>
</tr>
<tr>
<td>22</td>
<td>Joshua Siebeneicher</td>
<td>48</td>
<td>Stacey Li</td>
</tr>
<tr>
<td>23</td>
<td>Julia Klar</td>
<td>49</td>
<td>Wendy Yang</td>
</tr>
<tr>
<td>24</td>
<td>Kamryn Stargell</td>
<td>50</td>
<td>Wilfred Wright</td>
</tr>
<tr>
<td>25</td>
<td>Karlene Stanton</td>
<td>51</td>
<td>William Bai</td>
</tr>
<tr>
<td>26</td>
<td>Ki Finch</td>
<td>52</td>
<td>Winna Xia</td>
</tr>
<tr>
<td>27</td>
<td>Madison Khan</td>
<td>53</td>
<td>Y’vonne Antoine</td>
</tr>
<tr>
<td>28</td>
<td>Madison Wypyski</td>
<td>54</td>
<td>Zoe Yates</td>
</tr>
<tr>
<td>29</td>
<td>Malaika Stambler</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ECUADOR FIELD COURSE–SUMMER 2022

Abstract

La Fundación para la conservación de los Andes Tropicales (FCAT) is located in the Ecuadorian Choco. FCAT’s location in the Choco forest makes it home to various unique plant and animal species. During my two weeks at FCAT, I had amazing opportunities to explore the primary and secondary forests of FCAT. I was in the Printmaking and Income Diversification group led by Pippin Frisbie-Calder. For our project, we made accordion books that reflected the knowledge we learned over the two weeks at FCAT. One of the major goals of our team was to collect information from the locals about efforts for income diversification.
EFFECT OF HABITAT ON GENERAL BODY CONDITION OF BIRDS IN THE CHOCÓ RAINFOREST

Abstract

The Chocó Rainforest is located in a neotropical region of Northwest Ecuador that serves as a home to many endemic and endangered species of flora and fauna. This rainforest is threatened due to deforestation, caused by land conversion for palm oil and lumber production. In this study, the general body condition of birds, defined by body mass divided by tarsus length, was measured in patches of forest with varying levels of disturbance. The results of a Wilcoxon-rank sum test performed with continuity correction suggest the data of the study is significant: birds captured in the highly disturbed forest had lower body conditions than birds captured in the undisturbed forest. A possible conclusion that can be drawn from this data is that the health of the forest is declining in areas of disturbed forest, harming the overall health of the Chocó Rainforest. Disruption and forest decline could have devastating effects in terms of biodiversity in this ecologically important environment. This study calls for further research in the area to help advocate in the area and potentially bring about policy to further protect this area.
MEDIA OPTIMIZATION OF PRIMARY MURINE REPRODUCTIVE CELLS

Abstract

Those who have their first pregnancy at 35 have a 350% higher risk of obstetric injury compared to a person aged 25 years. Further, 9 times more people are delaying childbirth today than compared to 40 decades ago. While the etiology of these injuries is unknown, the remodeling of elastic fibers and the contractility of smooth muscle cells (SMCs) may contribute. Elastic fibers allow tissues to stretch and recoil in response to varying pressures. SMCs permit tissues to contract and are hypothesized to be aligned in the circumferential and axial directions. Elastic fibers and SMCs work together to allow the vagina, uterus, and cervix to perform their daily functions, and changes in elastic fiber and smooth muscle composition may occur in response to varying pressures and loads. To determine the microstructural remodeling, smooth muscle can be cultured, artificially injured, and then monitored to understand the cellular response. To culture smooth muscle, the optimal media for cell growth must be determined. Three media types, DMEM, RPMI, and mixed media (DMEM/F-12), were chosen due to their various nutrient compositions, specifically glucose levels. Axial and circumferential sections of the murine vagina, cervix, and uterus were cultured in each media type. Image analysis was conducted using Image J and CellProfiler to quantify differences in nuclear orientation, eccentricity, nuclear length, and nuclear geometry. In the future, the optimal media will be utilized in a wound healing scratch assay to understand the effects of maternal age on the remodeling of SMCs.
ROOTING SUBSTRATE AND SPATIAL EFFECT ON LIANA ENDOPHYTE COMMUNITIES

Abstract

Lianas play a major role in tropical forest structure and function by suppressing tree growth and creating new physical niches (1). Lianas can outcompete trees by growing in the dry season when tropical trees reduce their growth (1). With climate change and deforestation increasing temperatures and decreasing rainfall, it is important to understand the mechanism for liana survival. Lianas utilize aerial roots to sustain long distances from their initial rooting point (3). These aerial roots are very diverse in their morphology and function. The roots can use varying substrates such as water, soil, or even air. The microbiome of aerial roots is understudied even though fungal mutualists play a vital role in nutrient uptake and survival that could give lianas an edge in a tropical ecosystem (2). In this study, we analyzed aerial roots by substrate within five plots in four rivers (Juan Grande, Frijolito, La Seda, and Limbo) along Pipeline Road in Gamboa, Panama. Plots were 20m by 20m and separated by a distance of at least 100m. Community samples (2-4 individuals) of roots by substrate (water, aerial, and terrestrial) were taken at each plot. By utilizing microscopy and ITS DNA analysis, we can learn how fungal communities differ in community composition, structure, and diversity in each substrate type. With this knowledge, we can better understand the mechanism lianas use as they alter tropical forest structure and tree survival in response to climate change and deforestation.
MY JPMC SUMMER FELLOWSHIP EXPERIENCE

Abstract

Four fellows and I researched housing cooperatives logistics from across the United States to identify successful metrics. We also investigated housing affordability in Detroit, Michigan, and if housing cooperatives would fit the demographics. We created a 10-year implementation plan for best practices, target populations, and self-sufficient operations for co-ops in low-income Detroit neighborhoods. After creating and reviewing the plan, we presented our ideas to JP Morgan Chase and Co’s Minority Depository Institution (MDI) partner, First Independence Bank. During my research, I attended professional development meetings held by JP Morgan Chase and Co associates. The meetings taught house-buying tips, financial management, investing, and personal brand management. After the first three weeks of research and group work, I transitioned to the Corporate Consumer and General Management team. With this team, I worked with two programs: Chase Leadership and Development Program (CLDP) and the Corporate Analyst Development Program (CADP). While working with the CLDP team, I networked with 20+ analysts to draft ideas on improving financial education in low-income communities. While working with the CADP team, I networked with 20+ analysts to brainstorm ideas on improving the quality of work in the Columbus, Ohio office. During the final week of the fellowship, I attended two rounds of interviews for a potential return offer to the firm. In August 2022, I received my offer letter to return to JP Morgan Chase and Co as a CLDP intern for summer 2023 in Columbus, Ohio.
COLLIN DEAN

he/him
Finance and Management
Third Year

NORTHWESTERN MUTUAL INTERNSHIP

Abstract

As a finance major, I wanted to gain experience working in the finance field, therefore, I interned as a financial planner for three months at Northwestern Mutual this past summer.”This past summer, I interned as a financial planner for three months at Northwestern Mutual. I became certified to solicit life and disability insurance and attained Long-Term Care and Annuities licensing throughout my internship. Daily, I would attend 1-2 meetings with a development team and other interns to practice specific language to make myself more comfortable talking to clients. I ran multiple case studies, built realistic plans for prospective clients, and perfected pinpointing questions to expand my prospects past my warm market. Outside of scheduled meetings, I made calls throughout the day to set up, arrange, and schedule appointments with prospective clients to introduce myself. Following the introductions, I introduced my joint work and some of the top advisors of the branch to my clients not only to reassure them as they were trusting me with their financial picture but also to gain experience studying full-time advisors. As a result, I set and facilitated many meetings Independently while using the skills and tools acquired from the experienced advisors. I also received an award for having professional, confident language compared to all under 5-year representatives in the office. The hard work on the front end, making up to 10 calls a day while securing meetings, resulted in closing on plans with two clients. Most introductions build on trust and a self-sufficient work ethic as a financial planner. The opportunity gave me a perspective of essentially being my own boss with extreme delayed gratification.
SERUM ANTI-P JIROVECI GLUCANASE RESPONSES IN A PEDIATRIC COHORT

Abstract

Rationale: The PERCH study (Lancet, 2019) showed that P. jirovecii is the most common fungal pneumonia in HIV-negative children under five. However, due to the fact that the fungus cannot be grown in culture, there is limited seroprevalence data in human cohorts. Methods: To develop potential antigens that may be useful in seroprevalence studies, we performed broncho-alveolar lavage of infected immunodeficient mice and performed proteomics on cell-free BAL. In these samples, we identified PNEG_02704, a putative glucanase. We chose this antigen due to its high homology between P. murina and P. jirovecii of over 70% identity. We produced recombinant P. jirovecii in CHO cells and used this antigen to develop an ELISA assay. We analyzed IgG responses from serum samples of 52 pediatric patients seen at Children’s Hospital New Orleans ages 0-18+ years. Results and Conclusions: Anti-glucanase was detectable in the first month of life consistent with maternal IgG followed by a nadir at 1-3 months. This was followed by an increase over time, 78.85% of samples were positive (OD > 0.2). To determine if this was potentially due to Pneumocystis infection, we also assayed IgG responses to PNEG-01454 and we observed a high concordance of IgG responses to both antigens (r² = 0.5116). Conclusions: These data suggest that P. jirovecii glucanase may be a useful antigen for human seroprevalence studies to more accurately perform epidemiological studies of the incidence and prevalence of P. jirovecii infection. These data suggest that P. jirovecii glucanase may be a useful antigen for human seroprevalence studies to more accurately perform epidemiological studies of the incidence and prevalence of P. jirovecii infection inhibitors that block T1IFN signaling.
INSPIRING FUTURE RESEARCHERS AT ELECTRIC GIRLS

Abstract

Women are systematically discouraged from joining STEM which has huge implications for the future of research. Electric Girls is a local nonprofit that aims to change that by building up young girls’ skills and confidence in STEM. This summer, I interned with Electric Girls and helped run a summer camp curriculum for 8-13-year-old future scientists.
SOUTH KOREA AND AMERICA: A CULTURAL EXCHANGE

Abstract

By studying at one of the top universities in South Korea, Yonsei University, I was able to expand my perspective of Asia by being immersed within both the Korean language and culture of Seoul. Attending some of the various classes offered at Yonsei University, I was able to learn about the history, contemporary issues, and language of South Korea. After classes, I interacted with the general Korean population and some Yonsei students. Through these interactions, I was able to learn about some Korean cultural and societal norms. At this point, I would like to acknowledge that what I learned is only a fraction of the rich culture of South Korea. With the knowledge acquired, I can now cross-analyze and draw parallels to my previous knowledge of other Asian countries like Japan and Vietnam. This cross-analysis allows me to see the similarities and differences between Asian countries, the systems at play within each country, and the interaction between the countries within Asia and on a global scale. Although I could have acquired this knowledge while at Tulane, it would have been more difficult to achieve the same depth of understanding as the Asian Studies department is not able to offer Korean language classes, and there is a small Korean presence in New Orleans. I hope that my experience can help raise genuine interest in Asia on Tulane’s campus and help the Asian Studies department grow and offer more classes to help students gain a grander and more in-depth perspective of Asia.
CHARACTERIZING PHYSIOLOGIC RELEVANCE OF CELL MONOLAYERS CULTURED IN DYNAMIC MICROFLUIDIC ENVIRONMENTS

Abstract

Acute Respiratory Distress Syndrome (ARDS) is an acute condition resulting in pulmonary edema of the alveoli, preventing adequate gas exchange and often necessitating mechanical ventilation. While lifesaving, long-term mechanical ventilation may result in Ventilator-Induced Lung Injury (VILI) due to the mechanical stresses imposed during over-inflation (volutrauma) and repetitive recruitment and derecruitment (RD) of the air-liquid interface in the fluid-occluded airway (atelectrauma). In-vitro experiments in microfluidic cell culture devices with dimensions physiologically relevant to the respiratory bronchioles of the human lung experience challenges due to diffusion limitations imposed by the oxygen-impermeable nature of the culture channels. The goal of this study was to develop a method for analyzing cell culture conditions in microfluidic environments by way of structural evaluation of the resultant cell layers using phalloidin-based filamentous-actin staining and confocal laser scanning microscopy (CLSM). The developed protocol provided sufficient information to evaluate differences in cell layer topology and structure in the microchannel. Evaluation of the cross-sectional images yielded visual insights into the culturing conditions in the microchannel, which will allow for the establishment of a baseline from which the deleterious effects of atelectrauma can be studied. The demonstrated technique has proven to be a useful tool for the optimization of cell culture conditions within microchannels, allowing for more informed future in-vitro experimentation.
AN INVESTIGATION OF ANTHROPOGENIC PRESSURE ON RIVERS IN NORTHWESTERN ECUADOR

Abstract

The Mache-Chindul Reserve in Southeastern Ecuador protects 119,172 hectares of land, as well as important ecological features like the Cube Lagoon. The rivers that flow through and around this reserve are vital to local industries in addition to personal and household use by individuals living in the area. A team of five Tulane undergraduates led by two biologists from the University of San Francisco, Quito, sampled water from three sites in two rivers in and around the Mache-Chindul reserve. We asked: what is the quality of the water in these rivers, and how does it differ depending on the anthropogenic pressures at a given site? River health and water quality were assessed using a River Bank Quality index, Fluvial Habitat index, Biometric index, and AZTI’s Marine Biotic Index (AMBI). Water samples were also tested for E. coli and assessed based on Physical and Chemical characteristics. Anthropogenic pressures for each site were determined by interviewing local Ecuadorians who worked at the research station and lived nearby. Results showed that each measure of water quality and river health varied independently - river health did not necessarily correlate with other indices of water quality, although the presence of E. coli did correlate with anthropogenic pressure. This research shows that multiple indices are necessary to get a comprehensive evaluation of the water quality at a given site and that anthropogenic pressures near a river negatively impact the health of the river and the quality of the water for human use.
A MICROFLUIDIC MODEL OF MANNITOL-INDUCED BLOOD-BRAIN BARRIER DISRUPTION

Abstract

The blood-brain barrier (BBB) plays an important role in protecting the central nervous system (CNS), by tightly controlling the movement of molecules and cells between the blood and the brain. However, this highly restrictive barrier poses difficulties in the treatment of CNS diseases. More than 98% of small-molecule drugs cannot cross the BBB and enter the brain. As such, it is necessary to investigate methods of safely disrupting the BBB in order to allow therapeutic agents to be delivered into the CNS. One method used clinically is the intra-arterial injection of mannitol, followed by the injection of the desired treatment. Mannitol is a simple six-carbon sugar that causes the opening of tight junctions between endothelial cells, thus increasing the permeability of the BBB. This study evaluates the effect of mannitol on BBB permeability using a microfluidic blood-brain barrier model. The microfluidic device consists of three channels: the top channel has a Hep3B cell monolayer, the middle channel is filled with collagen gel, and the bottom channel contains media. The experimental wells were treated with either 0.5M or 1M mannitol solution. FITC-dextran solution was added to the top channel of each well. After 48 hours, 100μL of media was collected from the bottom channel. A plate reader was used to measure fluorescence values, which were compared to a standard curve to obtain FITC-dextran concentration values, which can be used to assess the permeability of the cell monolayer under each condition.

PREDATOR ODOR CONDITIONED PLACE AVERSION IN RATS

Abstract

7.7 million Americans are estimated to suffer from a traumatic stress disorder, such as posttraumatic stress disorder (PTSD). PTSD is a disorder in which a person experiences trauma, which has symptoms such as nightmares, flashbacks, and avoidance of a context associated with the traumatic event. One way to model the avoidance of traumatic contexts in rats is to expose them to a neutral context, introduce predator odor, and see if the rat then avoids the odor-paired context. Using a modified version of a previously tested model, results from previous studies were successfully replicated. This replication will aid the Tasker lab in its further investigation of how PTSD and alcohol consumption affects structures and systems of the brain.
A FUNGAL DIVERSITY GRADIENT WITHIN GUSTAVIA SUPERBA (LECYTHIDACEAE) SEEDS

Abstract

Gustavia superba is an abundant evergreen tree species that grows in northwestern South America and Central America. This study focuses on evaluating the fungal presence, colonization, and variation across Gustavia superba seeds. Studying the G. superba fungal community helps to identify pathogen-embryo interactions and natural fungal endophyte defenses. Therefore, the goal of this study was to identify the presence of fungal colonization and recognize trends in fungal distribution within individual seeds and trees. Thus, opening the door to future studies on the roles and workings of seed-fungi interactions in the tropics.
FRUGIVORE-MEDIATED SEED IN A TROPICAL RAINFOREST

Abstract

Seed movement by mammals facilitates the reproduction of tree species by allowing seeds to travel away from their parent, promoting colonization of new habitats and preventing pathogen spread within species (Comita et al., 2014; Escoboar et al., 2020), and disrupting this process can reduce the ability of trees to reproduce successfully. Palms are a dominant part of the flora in neotropical rainforests and play an essential role in supporting animal communities by providing keystone fruit resources (Rodrigo Cámara-Leret et al., 2014). Our team obtained palm density counts of six different hectare plots within the FCAT reserve in the Chocó rainforest by GPS marking and working with local experts to identify and count every palm species in the area. We then used the fruits of Pretoea palms to conduct our seed removal experiments. Before leaving FCAT, three complete trials were conducted for a total of 68 samples, but more is required for the entire fruiting season for any applicable analysis. At this time, any trend in the data is difficult to read. Still, it seems that more activity is happening in higher-density areas, without any analysis of the immediate surrounding densities of the parent palms themselves. The study of animal dispersal of local palm fruits in different palm densities will aid conservation efforts and help predict the most effective ways to support forest growth and ecological interactions.
PROBING THE INTRANUCLEAR ENVIRONMENT WITH FLUORESCENCE CORRELATION SPECTROSCOPY USING mEMERALD AS A TAG

Abstract

Chromatin remodeler complexes are essential for cellular processes such as gene expression and DNA replication. These protein complexes perform functions such as histone sliding and ejection to increase or decrease DNA accessibility, but the exact mechanism of each subunit during remodeling is currently unknown. The human BAF remodeling complexes can cause tumors when mutated, and their mutations are associated with 20% of human cancers. Characterization of the interaction dynamics of their subunits may contribute to a better understanding of the remodeler complex. Fluorescence correlation spectroscopy (FCS) is a single-molecule imaging technique that can be used to determine the diffusion constants and DNA-binding affinities of remodeler subunits by detecting photon emission from fluorescent dyes or proteins conjugated to the subunits. The green fluorescent protein variant mEmerald is an optimal tag for protein labeling in FCS measurements. Before conducting experiments where mEmerald is tagged to other proteins of interest, its diffusion in vivo and in vitro needs to be characterized. In this study, the mEmerald gene was successfully cloned in a bacterial vector and after gene expression, the soluble protein was purified using immobilized metal affinity chromatography (IMAC). Additionally, the diffusion constants of the mEmerald protein in vitro and in vivo in HeLa cells were successfully determined by FCS.
THE IMPACT OF A HIGH FAT DIET ON DENGUE VIRUS INFECTION OF HELZ2-KNOCKOUT MICE

Abstract

Infections caused by flaviviruses, such as dengue fever, are becoming more common across the world with over 100 million people infected every year. Dengue infection causes the creation of IFN alpha, a type 1 interferon that is one of the most powerful and broad-acting antivirals known. Dengue virus, on the other hand, subverts host IFN signaling during the early stages of IFN signal transduction. This subversion allows for unrestricted viral replication, which in turn induces the creation of IFN, which is then subverted once more. Although the initial goal of the research project was to examine how a high-fat diet affects the Wild Type mouse versus HELZ2-/-mouse infectivity, we needed to conclude a pilot study first to determine that the methods that we want to use for this high-fat diet study were effective in infecting the HELZ2-/-mice with a mouse-adapted strain of dengue virus called EDEN. Our findings revealed that the most effective method was infection using a concentrated virus that is injected intravenously through the tail vein. It was also found that the infectivity was highest when euthanasia was done 2-3 days post-infection. In the time that the research has continued to occur, we have been able to validate our results and hypotheses that the HFD would have an effect on infectivity. This research will help us collect better results when we move on to the high-fat diet study and comparative study of HELZ2-/-mice and wild-type infectivity on the diet.
MATHEMATICAL MODEL OF DRUG DIFFUSION

Abstract

This project studies different mathematical models to explain drug release kinetics. A deep understanding of drug release kinetics is crucial to any drug design as the effectiveness of any drug is dependent on the release. Developing a mathematical model in drug release can not only speed up the development of drug design but also reduce the experiment cost because theoretical study can provide guidance or at least eliminates impossible options ahead of time. However, mathematical models are also difficult to develop because drug delivery is a very complicated process. For example, some drugs require a slow release of their content while others require a rapid initial burst release and then maintained at a stable level. In addition, the release is controlled by multiple factors such as temperature, shape, and fluidity. This project focused on the influence of shape factors on drug release kinetics. The release profiles of slab, cylinder, and sphere-shaped particles were modeled using differential equations. Analytical solutions to the differential equations are derived using combination variables as well as the Laplace transform. The release profiles of different shapes were compared and their implication for the drug design was explored.
RETINAL MICROVASCULATURE ASSOCIATIONS WITH PEDIATRIC HEALTH: A SYSTEMATIC REVIEW

Abstract

The leading causes of death and disability worldwide, including heart disease, diabetes, dementia, and obesity, are closely tied to alterations in the central and peripheral vasculature. Images of the retinal microvasculature offer a unique, non-invasive window into the cerebral vascular system. Specific measurements of the retinal microvasculature are hypothesized to be non-invasive biomarkers of elevated disease risk for multiple outcomes. Given the non-invasive nature of obtaining these images, and the interest in prevention and early detection, an increasing number of studies have evaluated retinal microvasculature in pediatric populations. To better understand the strength of the existing literature, and to enhance the scientific rigor of the field with particular attention to reporting guidelines, accuracy, and repeatability of the measurements, we conducted a systematic review of the pediatric retinal vasculature studies published from 1997 to 2021. Increasing BMI measurements are negatively associated with CRAE and positively associated with CRVE. Further examination is required to complete the analysis for all 14 health outcomes and exposures measured in this systematic review.
QUANTIFICATION OF CRH AND SOM NEURONAL PROJECTIONS FROM THE CENTRAL NUCLEUS OF AMYGDALA

Abstract

Over the summer of 2022, I worked at the Tulane University Brain Institute facilitating and researching neuronal pathways for fear under Principal Investigator Dr. Jonathon Fadok and postdoctoral fellow Dr. Chandrashekhar Borkar. I worked closely with Dr. Borkar to understand specific, fear-based neuronal pathways.

With the intention of contributing to treatments for anxiety disorders based on the belief that they stem from maladaptive high-fear responses engrained in our brains, we studied, and are continuing to study, specific neuronal pathways projecting from the central nucleus of the amygdala (CeA) to the midbrain region, retrorubral field (RRF), along with other brain regions. We used past research from the Fadok lab that focused on the neurobiological mechanisms of fear scaling (low to high) as well as the role of somatostatin (SOM) and corticotropin-releasing hormone (CRH) neurons in regulating freezing and flight as mutual inhibitory in the CeA. These mechanisms allow the brain to quickly select from a battery of defensive responses necessary for survival, including freeze-flight.

When animals, including mice, are exposed to threats, they express fear through passive freezing and active flight defensive behaviors. How CeA conveys the fear response to downstream brain nuclei for execution, is not yet known. We looked at the possibilities of finding neuronal connections between CeA with other regions of the brain to address this specific gap in knowledge. We used specific Cre mice strains (SOM-IRES-Cre and CRH-IRES-Cre) with viral injections to trace the neuronal connections to quantify the neuronal innervation from CeA and their involvement in the defensive action execution. Next, perfused the mice, transcardially, and following brain isolation, sliced the brain and collected sections of CeA and RRF. We imaged the brain using confocal microscopy and quantified Cre-expressing neuronal terminals using green fluorescent protein. Lastly, we used data analysis to compute the number of neuronal projections (CRH vs SOM) in different brain regions involved in fear response processing. This research is continuing successfully.
AMID THE COVID-19 PANDEMIC, INSTRUCTOR EVALUATION DECISIONS ARE GUIDED BY EQUITY AND INCLUSIVENESS

Abstract

With little notice, the coronavirus (COVID-19) outbreak forced a quick switch to online classrooms. Previous research on the effects of this abrupt change showed that it significantly impacted not only students but teachers as well. The specifics of the instructor’s assessment decisions at this time, meanwhile, are less noticeable. In the spring of 2020, during the sudden switch to remote instruction, we asked teachers to consider their adjustments to their evaluations of students’ learning and whether equity concerns had prompted any future changes. Additionally, we asked professors to outline the evaluation modifications they planned to use in subsequent semesters. Through quantitative and qualitative assessments, we discovered that instructors changed how tests were graded and involved students in class activities more frequently than they added new assessment components. The decision-making processes of the instructors were observed to be influenced by equity considerations, with a focus on the student’s access to learning resources. Many of the instructors’ adjustments in response to COVID-19 were said to be retained by the instructors. According to our research, the pandemic significantly changed how instructors grade biology students. Still, one good thing for future students could be equity-based decisions that result in long-lasting change.
MECHANISM AND PROGRESSION OF AGE-RELATED MOTOR SEIZURE BEHAVIOR IN ALPHA-1AKO MICE INVESTIGATED THROUGH C-Fos EXPRESSION

Abstract

Alpha-1A receptors are noradrenergic receptors that bind norepinephrine (NE). NE is a potent neuromodulator during stress and enhances emotional memories, attention, and arousal (Berridge et al., Res Rev., 2008). Alpha-1A receptors are located on GABAergic inhibitory interneurons and are an important factor in the brain’s excitatory and inhibitory balance. Alpha-1AKO mice lack this receptor and exhibit dysfunctional inhibitory transmission. (Braga et al. Neuropsychopharmacology., 2006). As a result, these mice display motor seizure behavior in response to stress; however, these seizure behaviors are not observed until the mice are 5.75–6 months old. This project aims to understand where in the brain the seizure activity starts, how it kindles and progresses throughout the rest of the brain, and why the seizures only begin after 6 months of development. Overall, this project investigates the relationship between alpha-1A receptor dysfunction and the development of motor seizures with age.
A NOVEL MULTIPURPOSE PROTEIN CRYSTAL ASSAY

Abstract

In recent decades, protein crystallization has risen in popularity, and the process of crystallizing protein has been streamlined. Due to the nature of how proteins crystallize, there are often gaps in the protein crystal structure that are filled by water. These gaps allow for the flow of small organic molecules, which is what we are trying to utilize in probing proteins for binding compounds, or substrates. This approach for finding compounds that bind crystals is quite common. However, herein we try to utilize thermodynamics to narrow the search for compounds.

Most frequently, one might expect to probe protein crystals against thousands of compounds, from a compound library, and subsequently find themselves with months worth of data to analyze. We attempt to solve this by soaking crystals with a solvent, dimethyl sulfoxide (DMSO), that favorably interacts with protein crystals to resolublize the protein. This ultimately destroys the crystal, but we have shown in some cases that binding compounds dissolved in the DMSO can protect the protein crystals from DMSO dissolution.

Therefore, many protein crystals that survive a soaking with a DMSO-compound solution contain a compound that binds well to the protein. These compounds are identified and their presence is confirmed in the protein crystal structure via x-ray diffraction. The compound structures can then help identify the binding pocket of the protein as well as the crucial interactions needed to make a compound that binds better than the protein’s normal substrate. In other words, it helps identify potential drug structures.
HISTORY IN CONTEXT: TULANE SUMMER IN PARIS

Abstract

This summer, I studied in France for a month with Tulane’s Summer in Paris program. I chose this program because I wanted to have a study abroad experience in the country where I have studied. I have taken two French history courses at Tulane, and they have been some of my favorite courses here. I have also taken four semesters of French at Tulane, so I have gained a strong understanding of French history, culture, and politics through my studies, and I was interested in experiencing these for myself. In France, I took a French literature course as well as an anthropology course; these courses were designed to get students into the city and interact with their surroundings. The anthropology class included a mini ethnography project that had students examining an aspect of French culture. I chose to study how the French celebrate their national holiday, Bastille Day, as I was in Paris for the holiday. I looked at how their celebrations of Bastille Day compared to American celebrations of the Fourth of July, as both holidays celebrate their country’s independence and freedom.

My favorite part of the trip was exploring museums on my own, like the museum of French military history and the Louvre. This summer, I was able to see many places that I have only ever read about for my classes, and being able to go to French museums about French history and culture was a learning experience very different from classrooms in New Orleans.
CHARACTERIZATION OF BACTERIAL BIOFILMS IN RESPONSE TO THERMAL STRESS

Abstract

A biofilm is a three-dimensional structure, consisting of microbes enclosed in a matrix of mostly polysaccharides that amalgamates on a surface or between surfaces. Understanding the formation and characterizing the growth of medically-relevant microbial biofilms is a critical step in formulating novel antimicrobial techniques and therapeutics, as well as proposing mechanisms of action for these organisms within the human body. The purpose of this study is to characterize microbial biofilms of organisms, including L. rhamnosus and E. coli, at the following temperatures: 37 C°, 39 C°, and 40 C°, and incubation lengths: 24 h and 48 h, to determine optimal growth protocols for future experiments. This includes the exploration of novel antimicrobial techniques and cell permeability assays. These data demonstrate that L. rhamnosus biofilms in MRS media formed best at all temperatures after a 48 h incubation and adherent biomass was greater at 37 C° and 39 C° than 40 C°.
THE CHANGEMAKERS PILOT EPISODE: GLASS HALF FULL

Abstract

This summer, I worked with professor Casey Beck, Producer Mary Cardaras, and fellow research grant recipient Sara Hagstrom in the production of the Pilot TV episode of Beck’s series, The Changemakers. We followed Fran Trautman and Max Steitz, founders of Glass Half Full, and documented their stories within and apart from their business of restoring the Louisiana coastline with sand made from recycled glass. Sara and I were production assistants on set, as well as researchers and assistant editors for the production.
CHARACTERIZING THE ROLE OF Ga13 IN THE REGULATION OF BONE RESORPTION USING MOUSE MODELS

Abstract

The protein Ga13 has been found to play a role in the regulation of bone resorption by osteoclasts. Using live mouse models, differences in bone density between loss-of-function and gain-of-function trials pave the way for a greater understanding of osteoporosis and potential treatment.

MARIE KAISER
she/her
Cell & Molecular Biology
Fourth Year
SENEGAL FOR THE CULTURE!

Abstract

This past summer, I had the opportunity to study abroad in Senegal. As an African American, going to Senegal was a dream as Africa is often referred to as the ‘Motherland.’ Thanks to the center for academic equity, this dream became a reality for me. In addition, one of my primary interests in going to Senegal was to explore connections between New Orleans and Senegal due to the Transatlantic Slave Trade, since two-thirds of slaves were brought to New Orleans from the Senegambia region. As a native of New Orleans, I valued the first-hand perspective of learning about the cultural similarities and differences between the two regions. Some of the similarities included: how fishing is a huge source of income for many families and the Senegalese government, how many of the meals are served with rice, how the exterior of many buildings was similar to those on Bourbon street, how family time at dinner was very important in their culture and I think that reinforces the whole idea in New Orleans about dinner time being family time, especially on Sundays. Although I was initially nervous about attending this trip, the opportunity to participate in the Senegal Cultural Immersion Summer Trip allowed me to explore Senegalese culture while also exploring the cultural connections to the city of New Orleans.
THE ROLE OF ZMIZ1 IN CORTICAL DEVELOPMENT

Abstract

ZMIZ1 is a transcriptional coactivator that has been found to be linked to a syndromic neurodevelopmental disorder similar to Autism Spectrum Disorder (ASD). Common clinical associations with ZMIZ1 disorders include intellectual disability, motor and speech impairments, and other developmental delays. The Galazo Lab has confirmed that the loss of ZMIZ1 in the cortex disrupts corpus callosum formation and callosal wiring. This project focuses on identifying if dysgenesis in the corpus callosum due to ZMIZ1 knockout is associated with a particular behavioral phenotype and if this phenotype is similar to the common behavioral markers observed in ASD patients. The behavioral battery composed for this study includes 8 assessments that measure changes in anxiety, locomotion, communication, compulsion, and sociability between control mice and ZMIZ1 knockout mice. Thus far, four cohorts of mice have undergone the behavioral battery. Preliminary results have shown that in comparison to controls, ZMIZ1 mutants have exhibited increased anxiety states, decreased startle responses to auditory stimuli, greater compulsive tendencies, and an increased tendency to explore novel objects. When this project is complete, the tissue from the mice that have completed the battery will be collected via transcardial perfusion and stained for axon fibers and brain structures. The structures will be analyzed to compare the corpus callosum density to the behavioral battery results.
MAYA KLAPPER

she/her
Anthropology and International Relations
Fourth Year

KNOSOS LEGACY ARCHAEOLOGICAL SUSTAINABILITY PROJECT

Abstract

Through Tulane University, I was able to travel to Greece with my professor to assist with the Knossos Legacy Archaeological Sustainability Project. This project aims to discover the activities that took place in the ancient palace of Knossos on the island of Crete. Working with a team with my professor and two other students, we each served a crucial role in the project. My main job was to develop a database system of cataloging information about the pottery found on site, as no database previously existed as a catalog of the research materials found on site. Additionally, I was responsible for analyzing the material found on site by creating graphs to visually synthesize the types of materials found to determine the function of different rooms at Knossos.

Because of this incredible opportunity, I strengthened my prior knowledge from the classroom with hands-on work on an archaeological site and participated in reconstructing the activities that took place at the palace of Knossos during different historical periods. I was able to create a template for different database spreadsheets and technology guides that can be used by future researchers and archaeologists on site to keep track of materials excavated and to conduct further analysis. This will enable future students and researchers to quickly and efficiently organize information.
Programmed cell death, also known as “cellular suicide,” is a biological process that helps remove unwanted cells from the body. Apoptosis is the most common and well-understood type of cellular suicide, but many other forms of programmed cell death exist, such as “ferroptosis.” Ferroptosis refers to a form of regulated cell death dependent on iron that is characterized by the accumulation of lipid peroxides, resulting in cell death. Cellular senescence is a mechanism that results in an irreversible state of cell-cycle arrest, but not cell death. Since these “non-functional” cells remain in the body without positive function, senescent cells have been identified as an aging marker that contributes to diseases like atherosclerosis, Alzheimers, and cancer. In this study, the ferroptosis pathway was studied in senescent cells and healthy retinal pigment epithelium (RPE) cells. In the experimental group, RPE cells were treated with cigarette smoke condensate (CSC) to induce cellular senescence. The experimental and control group were then treated with RSL3, a ferroptosis pathway inducer. Cell viability was then determined to study how programmed cell death potentially affects healthy and senescent RPE cells.
Abstract

This past summer, I had the opportunity to assist on a project in Dr. Jonathan Fadok’s laboratory under the mentorship of postdoctoral fellow Dr. Claire Stelly. My project ultimately focuses on the neurobiological underpinnings of hyperarousal resulting from post-traumatic stress disorder (PTSD), which is a group of symptoms that develop as a response to intense psychological distress. Hyperarousal, a key physiological and behavioral component of PTSD, consists of elevated heart rate, hypervigilance, exaggerated threat responses, insomnia, and irritability. The Nucleus of the Solitary Tract (NTS) is a norepinephrine brainstem region that receives body state information from the vagus nerve and is a key brain region in understanding how interoceptive input influences behavioral responses. My specific involvement in Dr. Stelly’s research project was to optimize the parameters of a new behavioral protocol called auditory looming to trigger innate defense behavior and analyze the quantity of freezing responses from the stimuli. My data and contributions to this project will be used to evaluate the effectiveness of using naturalistic, unconditioned auditory cues to evoke defense behavior in mice. Our ultimate goal for Dr. Stelly’s future experiments is to test if body-state information from the NTS can be targeted to alleviate hyperarousal symptoms.

In this protocol, an increasingly loud sound mimicking an approaching predator causes the mouse to flee to safety. These behavioral tests were performed on seven mice individually in an open field with a speaker positioned opposite a shelter for three of the mice, and without a shelter for the other four mice. The mouse’s behavior was recorded by a camera mounted above the testing box during each trial, and freezing behavior was evaluated and scored based on using software called CinePlex Behavioral Research System by Plexon.

My involvement in this project allowed me to understand how to set up the specific field for auditory looming experiments, as well as how to use computer software to accurately analyze, score, and collect data from the behavioral responses of the mice. Ultimately, these tasks allowed me to build strong research skills in the design, implementation, and analysis of data, basic bench skills in a laboratory, and critical thinking. This project also further enhanced my grasp on underlying neuronal mechanisms in behavior in a way that is unachievable in a typical classroom setting.
DEFINING A SET OF OUTCOME MEASURES FOR PRAGMATIC CLINICAL TRIALS OF CHILDREN WITH AXIAL SPONDYLOARTHRITIS

Abstract

Juvenile spondyloarthritis (JSpA) is a rheumatic disease that accounts for approximately one-third of all juvenile arthritis cases. Children with JSpA are at higher risk of progression of fusion of joints, functional impairment, and longitudinal psychological impact into adulthood. Currently, there is a lack of effective therapy mechanisms for JSpA and less than 20% of children with this condition achieve remission within five years of diagnosis. A major impediment in advancing the care of children with JSpA and axial arthritis (arthritis of the spine or sacroiliac joints) is the absence of randomized clinical trials despite an increasing number of potential therapies. With comprehensive and easily utilizable disease classification criteria alongside well-researched outcome criteria, clinical trials for the JSpA population can be successfully implemented. Historically, algorithms and measures used in adult rheumatology clinical trials have been adopted in pediatric rheumatology trials, but these measures are inadequate for children due to the rarity of back pain as a prominent clinical symptom in children. Furthermore, the inability to classify axial involvement presents a significant barrier in evaluating therapy effectiveness and efficacy. Thus, the aim of this project was to collect physician and patient-reported measures and disease activity measures through a series of RedCap quality-of-life questionnaires and imaging biomarkers in a spectrum of children with JSpA and axial disease across four tertiary care centers before and after three months on clinically-proven antirheumatic medication treatment. Ultimately, analysis using RedCap and descriptive statistical methods in Stata revealed changes in the health status of enrolled children.
FIDELITY BANK INTERNSHIP

Abstract

This summer, I was fortunate to intern at Fidelity Bank within the Veterans Branch located in Metairie, Louisiana. Fidelity Bank is a bank located throughout the southern parts of Louisiana. Fidelity Bank is unique because it is a mutual savings bank meaning that the bank is owned by the people who have accounts rather than it being owned by shareholders. Throughout the internship, I learned lots of viable skills that I would not have understood without the internship. I learned how important it is to have checks and balances in a business, specifically in environments where large amounts of money are involved. I also learned the different roles people have in banks, such as underwriting, the role that human resources play in the banking world, and how third-party companies interact and operate inside retail banking. Most importantly, I learned the importance of creating a relationship with the people you are working with and the clients that come in every day. At the end of my internship, I did more cash handling operations and learned how to use applications like Horizon and Horizon XE; I also learned how to use a cash recycler. Overall, this internship allowed me to see real-life examples of topics that I had been introduced to in my classes at Tulane University such as Management Communication and Intro to Financial Accounting.
THE EDUCATION OF UKRAINIAN REFUGEES IN POLAND

Abstract

The Russian invasion of Ukraine has created the largest refugee crisis in Europe since the end of World War II. The country that is currently hosting the most Ukrainian refugees is Poland, where over 1.4 million refugees have officially been registered. It is fair to say that both the Polish political leaders and ordinary citizens have done a great deal to ensure that the Ukrainians experience a warm and generous welcome. Official government policies and personal anecdotes will attest to that.

One of the sectors of Polish society that has been greatly affected by the flow of refugees is the school system where 185,000 school-aged Ukrainians are enrolled. While the Ukrainian schoolchildren have been happily welcomed and supported by their Polish teachers and classmates, integrating them into the schools comes with quite a few challenges. Some challenges are the language barrier, increased class sizes, adjusting to a new and different curriculum, mental health support and resources being needed due to many of the Ukrainian children potentially having trauma from war and displacement, the ongoing teacher shortage in Poland, and the influence of the government-approved nationalistic version of Polish history in classrooms.

This gives the popular narrative of a uniquely ideal response to a refugee crisis based on compassion and empathy more nuance. More accurate analysis factors in both the heartfelt solidarity Poles have towards Ukrainians and the usual and expected factors of self-interest, nationalism, and identity, and the practical difficulties of large-scale integration.
MY SUMMER IN STOCKHOLM

Abstract

During the summer of 2022, I spent four weeks in Stockholm, Sweden with Tulane University’s Summer in Stockholm study abroad program. The purpose of my study abroad experience was to experience a country and a culture that was new to me from the lens of a person living and learning in that country. I took two classes, Behavioral Endocrinology and General Physics 1, with other Tulane students and both classes were taught by Tulane. My learning was also engaged through guest speakers, museum experiences, and various excursions in nature.

I learned a lot about myself and my interests while studying abroad in Sweden. I reaffirmed my passion for traveling and experiencing new cultures. I discovered a new interest in hormones and how they affect behavior. I recognized that living abroad is an option that I am open to considering in the future. I learned how important the ability to communicate is, especially when you are trying to immerse yourself in a new culture. I was able to have discussions on various aspects of Sweden’s healthcare system and I learned about different political issues in Sweden. Lastly, I discovered that I am not a big fan of hikes, but I love nature. I had an amazing experience studying abroad in Sweden and the only thing I wish I could have changed is getting to spend more time in Sweden.
OLULABOMI OSIKOYA

he/him
Finance and Gender Studies
Third Year

JP MORGAN INVESTMENT BANKING FELLOW

Abstract

During the months of June-August of 2022, I interned at JP Morgan Chase in the Corporate Investment Bank sector. During these three months, we looked at various parts of the bank that included: corporate banking, investment banking, payments, securities, markets, and risk management, and how they all coexist with each other. I decided to go forward with interning at JP Morgan because I was accepted into the Advancing Black Pathways program, an EDI initiative to bring more African Americans into the realm of corporate finance. During these few weeks, I learned how to understand the markets, different forms of payments and how payments will change in the world, and learned about mergers and acquisitions transactions and how they affect the average consumer. We had many big projects during the duration of the internship. The first project we did was creating a marketing strategy for a Black-owned bank to fund a cooperative housing corporation in Detroit. Our research included many different analyses on the function of co-ops in Detroit and whether or not the bank, First Independence Bank, would be able to fund this project. This presentation inevitably led First Independence Bank to fund the project fully. The next project we did was a mock merger and acquisition to present to the managing directors of the bank. This presentation went very well, which resulted in us planning to intern at JP Morgan again for the upcoming summer.
PAIGE MOSLEY
Business
Third Year

MY SUMMER EXPERIENCE AT SPEARS GROUP: MARKETING JUNIOR ASSOCIATE

Abstract

This summer, I had the opportunity to intern with the Spears Group as their Marketing and Public Relations Junior Associate. The Spears Group is full-service communication, marketing, and advertising agency, headquartered in New Orleans, offering a wide variety of services in the marketing field. The purpose of this internship was to narrow in on the type of marketing I am most interested in and gain experience in it, diversify my resume from social media marketing and obtain skills and experience that will distinguish me as a competitive candidate for top internships entering my junior year.

During my internship, I gained experience in communication strategy by producing materials for press conferences, such as talking points, run of shows, press releases, media advisories, creative intake forms, and holding statements for Spears’ clients. Furthermore, I assisted the Spears’ team in the promotion of their four-city wine and music festival tour, Celebrez en Rose, which totaled over 21,000 attendees. My main focus was acting as customer support on the festival’s social media platforms to showcase consumer empathy when or if problems arise, while also creating promotional reels on Instagram and TikTok, maintaining influencer databases, and supporting the email marketing campaigns. Lastly, I was able to gain experience in writing radio scripts, developing recap reports, curating shot lists, and drafting keywords for search engine optimization marketing promotions.

From this experience, I found my passion for public relations and was awarded the amazing opportunity of being able to continue the internship throughout the Fall semester and assist in the production and return of the National Fried Chicken Festival to New Orleans.
**IN-PERSON RECRUITMENT WITHIN HARD TO REACH POPULATIONS**

**Abstract**

With COVID-19 finally coming to an end in sight, what are the best practices and materials to use for in-person recruitment for patient studies?
POMPEII I.14 PROJECT

Abstract

During the summer 2022 excavation at Pompeii, Italy, specifically Insula I.14 of the Pompeii Archaeological Park, I learned first-hand the methods of archaeological excavation and uncovered artifacts unseen for thousands of years. This included the use of a trowel, LiDAR, 3-D modeling, soil sampling, flotation, and stratigraphic unit forms and drawings. This excavation led to an abundance of artifacts and knowledge of the ancient past, pre the 79 AD Vesuvius eruption. The overall research area contained multiple rooms, a suspected latrine, and a spacious garden. I excavated at the front of the building, focusing solely on trenches 1000, 4000, 5000, and 7000. I learned the techniques of digging, sifting, flotation, and pottery washing within the proper archaeological context. Throughout the project, we were able to locate a center of human occupation and go as far as to discover bronze age activity. Collectively, the most commonly found artifacts included ceramic/pottery pieces, bones, charcoal, shells, and metal. Less commonly found artifacts included bronze coins, glass playing pieces, ancient oil lamps, a bone pendant, bronze tweezers, and a Roman golden coin. In trench 4000, a clay-lined pit was unearthed which was shocking due to the lack of clay native to Pompeii. Various examples of “trash” appear, revealing great insight into how the area was used. Ongoing research is continuing, as this project will extend multiple years, led by Professor Allison Emmerson and Tulane’s Classical Studies Department.
THE CHANGEMAKERS: EPISODE 1 – THE GLASS HALF FULL

Abstract

Learning starts with information and is enhanced by experience. While the knowledge instilled in the classroom is valuable, the insight gained through experience is indispensable. To discover the reality of a career in the film industry, aspiring filmmakers (Sara Hagstrom and Malaika Stambler) conducted experiential research by interning in future documentary series, The Changemakers, under the guidance of a professional in the industry. The Changemakers is an upcoming documentary series, directed by Casey Beck, that focuses on young climate activists who have taken on the challenge of the climate crisis. The first episode follows Fran Trautmann and Max Steitz, the founders of Glass Half Full: the only glass recycling plant in New Orleans. Through working on set as production assistants, on the post-production team as assistant editors, and shadowing the director by researching and pitching subjects for potential episodes, we were able to gain valuable insight into what working in the film industry can entail. Our experiences this summer helped us to identify our own strengths and weaknesses and equipped us with a broader, stronger foundation of knowledge and skills for us to apply to our future projects and endeavors as filmmakers.

SARA HAGSTROM
she/her
History and Digital Media Practices
Third Year
THE EXPRESSION OF AUTISM GENE FOXG1 IN THE ZEBRA FINCH BRAIN DURING VOCAL DEVELOPMENT

Abstract

Rett syndrome (RTT) is an X-linked neurodevelopmental disorder classified as an autism spectrum disorder. It typically affects young females and causes progressive impairment and loss of motor skills and language. The zebra finch bird is an optimal research model as its song-learning process mimics language development in children. Similar to speech in humans, zebra finch song learning happens during a critical developmental period. The song-learning circuitry of the zebra finch includes Area X, a basal ganglia nucleus within the anterior forebrain pathway (AFP). Studying vocal learning in the zebra finch will provide insight into human neurodevelopmental disorders.

Mutations in the methyl-CpG-binding protein 2 (MeCP2) gene cause Rett syndrome. Although there is little known about the relationship between the forkhead box protein G1 (FOXG1) gene and RTT, the FOXG1 gene is thought to be involved in the song-learning circuitry. FOXG1 gene mutations are said to cause FOXG1 syndrome, which overlaps with Rett syndrome symptoms. Children with FOXG1 syndrome have severe physical and cognitive disabilities such as intractable seizures, movement disorders, cortical vision impairment, and language difficulties. The similarity in symptoms suggests potential interactions between FOXG1 and MeCP2 genes. This project serves as a first step to studying the interactions between these two genes by investigating the expression patterns of FOXG1 and MeCP2 genes in the songbird brain during vocal development.
EFFECT OF DIET ON SMALL INTESTINAL BARRIER INTEGRITY IN A RAT MODEL

Abstract

The gut microbiome is a key player in various aspects of health and disease. One growing area of interest is the relationship between gut microbiota and the brain, specifically as it relates to neurodegenerative disease. Mild cognitive impairment (MCI) is a decline in cognitive function greater than what can be attributed to normal aging, and growing research is pointing to gut dysbiosis as contributing to the development of MCI. Gut microbiota is modulated by diet. Specifically, a diet high in fiber such as the Mediterranean diet (MeDi) is thought to maintain homeostasis and barrier integrity in the gut, while a diet high in sugar and processed foods, such as the Western diet (WD) is believed to cause gut dysbiosis. We hypothesized that a MeDi-modulated gut microbiota maintains small intestinal barrier integrity, exhibited by: longer and thinner villi, shorter crypts, and thicker submucosa and muscularis layers. Sprague Dawley rats (n=42) were fed either a WD or MeDi, and sacrificed at the end of 21 weeks. The distal small intestine was collected and stained with hematoxylin and eosin for analysis. Measurements were collected by 2 separate scorers and then averaged, and data showed a lack of significant results between WD and MeDi groups. This data could be limited by the quantitative measurements that were taken. Future studies should look at more qualitative analyses of intestinal integrity, such as villi blunting and ulceration, and consider how the large intestine or proximal small intestine may play a role.
AN EXPLORATION OF PANAMANIAN ENVIRONMENTAL POLICIES’ HARM TO INDIGENOUS COMMUNITIES

Abstract

This project highlights how the experiences of Panamanian indigenous communities are impacted by environmental policies within the country through a mixture of in-person interactions and outside research. A scheduled excursion took me to the Embera Village in Chagres National Park, located in the center of Panama. Discussions allowed insight into what life is like in the village, along with how the establishment of the surrounding national park affects residents’ livelihood. After returning from my visit to the Embera Village, I completed a case study on another indigenous community in Panama, the Naso-Tjer Di, in addition to research on the recent history of the development of Panamanian environmental policies. Although, it is important to note that further analysis is needed to see the extent of these policies and the ways other historical factors have contributed. Overall, environmental policies in Panama harm indigenous communities due to the lack of proper policy development that fails to benefit the environment and the community equally.
ROLE OF EGFR SIGNALING IN AUTOPHAGY-DEFICIENT LIVER

Abstract

Epidermal growth factor receptor (EGFR) is a transmembrane receptor tyrosine kinase highly expressed in liver cells, particularly hepatocytes and activated hepatic stellate cells. Upon its activation by ligand binding, it forms homo or heterodimers with other members of the ErbB family, ultimately resulting in a series of downstream signaling cascades that induce multiple biological effects. Most traditionally, EGFR plays a functional role in regulating cell growth, proliferation, migration, and differentiation, although it seems to have emerging roles in apoptosis, cell death signaling, hepatic lipid metabolism, hepatocellular injury, liver fibrosis and cirrhosis, and eventual hepatocellular carcinogenesis.

The rationale of this project lies in our observation that EGFR expression is downregulated in liver injury murine models (Atg7-/-, Atg5-/-, DDC) where autophagy is deficient. Contradicting this is the observation that these mice retain the development of hepatomegaly, or enlarged liver, as part of disease progression. Although the expression of this growth factor is reduced in liver injury, the liver continues to grow to an abnormal size, suggesting a novel anomaly related to this receptor.

This project aimed to provide insight into why this physiological observation is the case. Preliminary data suggests that one particular downstream pathway, PLCγ1-PKC, may play a role in EGFR phosphorylation and eventual internal trafficking of EGFR. We are currently analyzing proteins downstream of PKCa as well as interrelated signaling pathways.

Additionally, we observed that EGFR expression seems to robustly elevate in older autophagy-deficient mice with tumors in both the membrane and cytosol. It’s possible that EGFR may play a subcellular role in liver pathobiology.

STACEY LI
she/her
Cell & Molecular Biology and Public Health
Third Year
CAN SHORT LINEAR BLOCK COPOLYMERS STABILIZE VERTICAL LAMELLAE IN LINEAR-CYCLIC BLOCK COPOLYMER BLEND FILMS?

Abstract

In the semiconductor industry, block copolymer (BCP) based nanolithography can be used for patterning nanoscale features. We use dissipative particle dynamics (DPD) simulations to study the relative stability of vertical (versus horizontal or mixed) orientation for linear BCPs to that of cyclic BCPs.
The government discriminates against the majority of Indigenous peoples in Panamá. Pregnant indigenous women experience many difficulties while expecting, and indigenous families are uprooted due to the lack of documentation of land ownership. While there is a continuous fight and rebellion for their needs, the government refused adequate resources for indigenous peoples in Panamá. “Due to the terrain and geological distance from the city, it is difficult for indigenous women, including pregnant women in Ngäbe and Buglé communities, to receive equitable resources for themselves and their babies. Powerful means of resistance led by Indigenous families included boycotting by blocking roads so that officials are physically confronted with communities’ need for support. Not only are pregnant women in these communities, but everyone in the community is affected. Land ownership is an essential topic in Panamá, and with the influx of tourism, Panamanians are losing their land to retired non-Panamanians and the tourist industry. Years ago, Panamanians were not required to have documentation stating that they owned land; the only requirement was that their family had been on the land for more than 100 years, which many of them were. Upheaving these forms of generational acknowledgment and land rights targets these communities that do not adhere to governmental documentation. Indigenous peoples in Panamá are citizens of the country and shall be treated as such.
EVALUATING BIOMARKER CANDIDATES OF VACCINE EFFICACY FOR THE MUCOSAL ADJUVANT dmLT

Abstract

The mucosal vaccine adjuvant dmLT, or LT (R192G/L211A), is a detoxified double mutant of the heat-labile enterotoxin of E. coli. dmLT is being pursued for the intradermal dmLT-adjuvanted fractional inactivated polio vaccine (fIPV-dmLT). However, there remain gaps in the current understanding of key molecular mechanisms of adjuvanticity in dmLT. Here, we uncovered genetic, transcriptional, and metabolic biomarkers associated with dmLT-adjuvanted vaccination outcomes using clinical data and a THP-1 monocyte model, which could help explain the functional significance of dmLT.

THP-1 cells were cultured to dmLT for either 24 or 72 hours, and gene expression was compared using mean fluorescence intensity from flow cytometry analysis. Suppressors of cytokine signaling 3 (SOCS3) and Cyclin-dependent kinase inhibitor 1C (CDKN1C) were found to be downregulated after 24 hours of dmLT exposure but not at 72 hours. This suggests that dmLT may temporarily inhibit negative regulators of cytokine signaling and enhance a tumor suppressor. Further, Aquaporin 1 (AQP1) and Human Leukocyte Antigen – DR isotype (HLA-DR) were upregulated at both 24 and 72-hour time points. These results confirm these 4 proteins as biomarkers of dmLT adjuvant.

Data from a recent fIPV-dmLT clinical study, including serum neutralizing antibody (SNA) titers and transcriptomics were analyzed using JMP Pro 16 and Python 3.9. Lasso regression in JMP Pro 16 between SNA titers and transcriptomics data suggests Telomerase RNA component (TERC), chemokine C-C motif ligand 8 (CCL8), and matrix metalloproteinase-9 (MMP9) predict vaccine outcomes to polio vaccination with dmLT adjuvant. These may suggest new biomarkers and new mechanisms of immune activation.

Crothers, Jessica W et al. “Intradermal fractional-dose inactivated polio vaccine (fIPV) adjuvanted with double mutant Enterotoxigenic Escherichia coli heat labile toxin (dmLT) is well-tolerated and augments a systemic immune response to all three poliovirus serotypes in a randomized placebo-controlled trial.” Vaccine vol. 40,19 (2022): 2705-2713. doi:10.1016/j.vaccine.2022.03.056
STUDY OF MICROGLIA METABOLISM AFTER TRAUMATIC BRAIN INJURY IN MICE

Abstract

Sudden trauma to the brain is a significant cause of death and disability worldwide. According to 2014 CDC data, there were approximately 2.53 million TBI-related emergency department visits and 288,000 TBI-related hospitalizations, and 56,800 TBI-related deaths (Capizzi et. al 2020). Our hypothesis is that traumatic brain injury triggers early microglia metabolic reprogramming from mitochondrial OXPHOS to glycolysis, via the fine-tuning of several key metabolic-controlling enzymes, and leads to the activation of pro-inflammatory type microglia that exacerbates the brain injury.
Y’VONNE ANTOINE
she/her
Communication on the Pre-Medical Track
Fourth Year

GEORGETOWN MEDICAL SCHOOL CORE FELLOWSHIP

Abstract

Shaping Outreach and Uplifting Lives was created by a dedicated group of women, sponsored by the CORE Program at Georgetown University School of Medicine. We were charged with the task of providing solutions for those within the intersection of mental illness and incarceration. We created S.O.U.L because we believe that an individual’s time and energy are precious. Our goal was to find a space where we could incubate a positive change for those within this community. This positive change consists of advocating for legislation that increases access to care for inmates experiencing mental illness, educating clinicians and policymakers on the importance of preventative therapy, and providing education and outreach for those in need. In addition, S.O.U.L’s website included mental health resources for all 50 states.
OCUPAÇÃO - THE RIGHT TO HOUSING

Abstract

I spent six weeks of the summer in the city of Sao Paulo, Brazil developing my Portuguese language skills and learning about Brazilian contemporary social issues. Over the course of the program, we discussed and visited cultural museums and sites of resistance to the Social Movement of Black Brazilians and the adequate housing movement. Up until recently, it was widely accepted by Brazilian society that racial democracy in Brazil was a reality, which is the belief that Brazil does not have racism and that Brazilians don’t have racial prejudice over each other because the country never legalized racial discrimination. This theory is a myth and Black Brazilians and Afro-Brazilians face racism and racial violence to this day. This myth has allowed hate and prejudice against Black Brazilians to flourish and has created an erasure of Black Brazilians struggles and oppression that they continue to face. This is a form of violence and is intentional and acts as a form of Black genocide. Today the realities of racism have been awakened with the help of media and organizations like the Social Movement of Black Brazilians which illuminate the hate crimes, police violence, and systemic racism that Black Brazilians face every day. An adequate housing movement is a form of protest against the homeless crisis that is happening in big cities like Sao Paulo. Since 2001 Brazilian citizens are constitutionally guaranteed the right to housing through a law called the City Statute (Cities Alliance 2021). This established all property as needing to have a social function that’s either residential or commercial. An abandoned building would not serve a social function, and by law, citizens have the right to occupy that building to make it serve a residential function as is their right to housing. Yet, the government does not consistently support its marginalized citizens in need of a home and chooses to favor the owner of the abandoned property and evict their citizens from their occupation of that building and push them back into homelessness. These two issues of the Social Movement of Black Brazilians and the adequate housing movement are resistance against current systems that are not protecting their rights as citizens of Brazil. If current fundamental rights are colliding with historical rights these historic rights will typically be favored in the Brazilian justice system. For social movements to establish their protected rights, extensive institutional reform is required.


ZOE YATES
she/her
LATAM Studies and International Development
Second Year