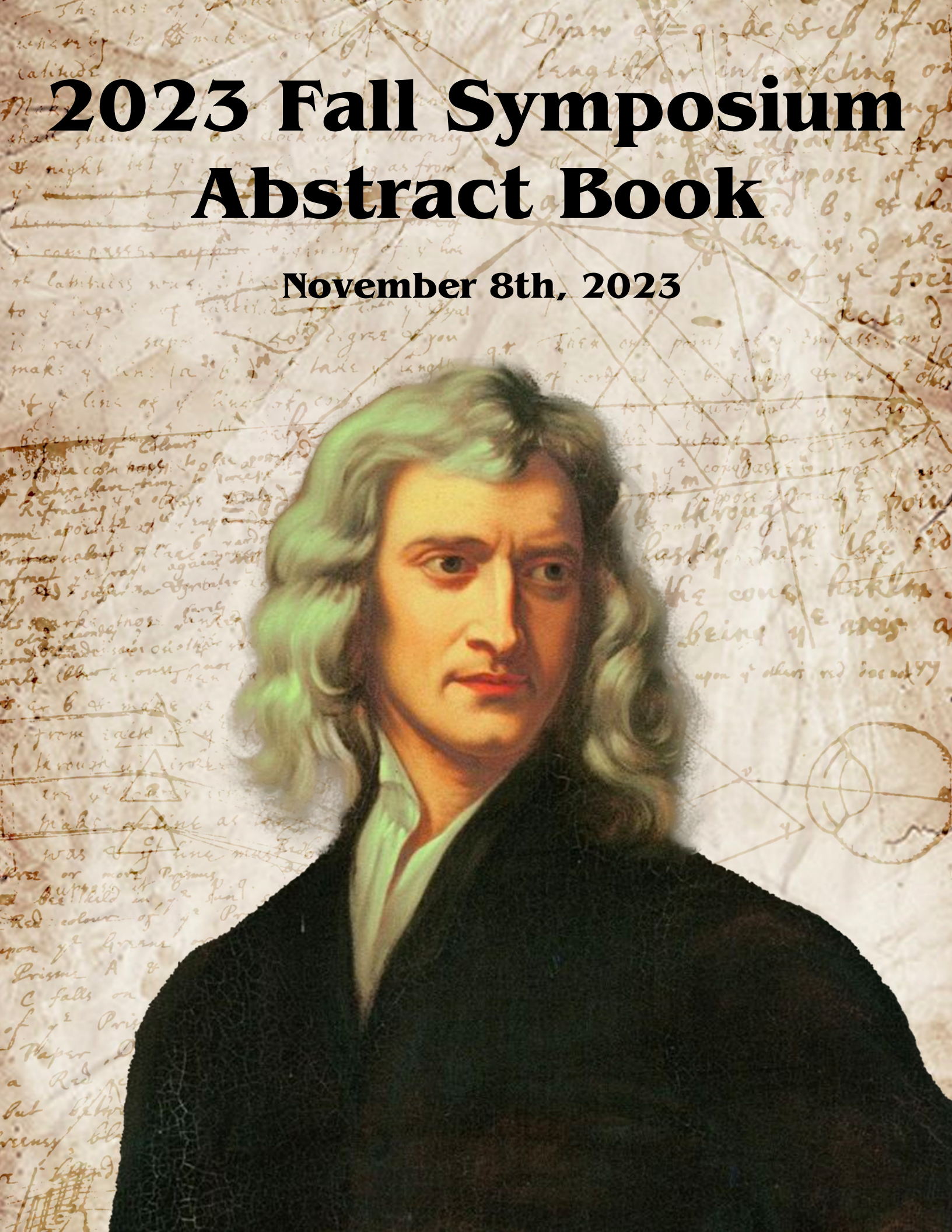
2023 Fall Symposium Abstract Book

November 8th, 2023



ARTIST STATEMENT

Sharad Patel

With his revolutionary discoveries, Isaac Newton—a name inscribed in the archives of scientific discovery—reshaped our conception of the physical universe. His principles of motion and universal gravity, well-known for his thought experiment involving an apple and a tree, served as the cornerstones that supported the disciplines of calculus, physics, engineering, and many other related fields of science. Through his relentless search for knowledge, Newton was able to decipher the mysteries of celestial physics and enable humanity to go further into space. His greatest work, Principia Mathematica, is proof of the boundaries of human knowledge regarding the motion of planets in space, the orbits of celestial bodies, and the gravitational forces that control the universe. Newton's revolutionary findings revolutionized engineering and mathematics in all of their forms and brought in a new age of scientific research. His legacy serves as a reminder that knowledge is a universal pursuit, whether it is in celestial space or complex working of motion itself.

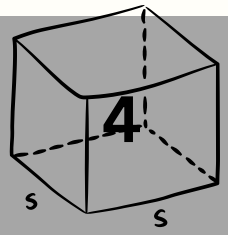
TABLE OF CONTENTS

Roles of Vacuolar Invertase Genes (Ivr1 & Ivr2) in the Pollination Biology of Maize

Authors: Katherine E. Gray, Jiahn-Chou Guan, Karen E. Koch

Invertases are essential to developing kernels and other tissues that depend on import of sucrose transported from leaves. These enzymes are pivotal to sucrose and catalyze the first step in its metabolism. In addition, vacuolar invertases can link sucrose import to cellular expansion in growing tissues. The Ivr1 invertase is expressed primarily in male plant parts (anthers and pollen), whereas Ivr2 localizes to female parts (silks) and root tips. Together they can markedly impact pollination success. The Ivr1 gene also shows a "domestication signature" suggesting a selective advantage during ancient breeding and emphasizing its biological significance. Our goal will be to determine the contributions by each of these invertases to pollination biology of maize. Genetic materials (knock-out mutants) have been developed that will allow individual roles to be tested. Four distinct lines with mutant alleles disrupting the Ivr genes at different sites have been confirmed, two disrupting the Ivr1 gene and two disrupting the Ivr2 gene. These provide a foundation for in-depth exploration. Specific objectives encompass quantifying the expression of both genes at crucial sites during pollination, analyzing phenotypic variations, testing segregation distortion, and comparing the germination and growth of ivr1, ivr2, and wildtype pollen. Molecular analyses by PCR and qPCR will parallel field studies to investigate the anthesis-silking interval, a pivotal factor in pollination success. In an era of growing demand for sustainable food production, understanding the intricate genetic underpinnings of yields from vital crop species like maize is essential. This research will help dissect complex genetic interactions that sustain a crop that feeds the world, with far-reaching implications for agricultural innovation and global food security.

Agricultural and Life Sciences

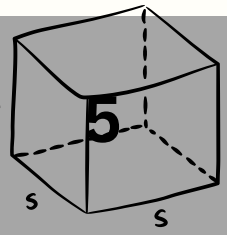


Quantifying the Synergies Between Human and Biodiversity Utility in Urban Greenspaces

Authors: Nataly G. Miguez, Brittany M. Mason, Jiangxiao Qiu, Corey T. Callaghan

Urban greenspaces are essential for both human well-being and biodiversity, with their importance continually growing in the face of increasing urbanization. However, the dual role of these spaces raises questions about how their planning and management can best serve the diverse needs of both people and biodiversity. This study aims to quantify the synergies and tradeoffs between human and biodiversity utility in urban greenspaces. Through a detailed inventory, I mapped 647 urban greenspaces throughout Broward County. I identified and categorized various attributes contributing to human utility, including playgrounds, athletic facilities, and picnic areas to quantify human utility. Concurrently, I assessed biodiversity utility by estimating species richness within an urban greenspace. The results reveal a positive correlation between human utility attributes such as playground, bodies of water, and nature preserves with biodiversity, indicating potential synergies rather than tradeoffs. This alignment between human and biodiversity benefits suggests that urban parks can effectively serve multiple values without sacrificing one for the other. Both human utility and biodiversity utility correlate with greenspace size, emphasizing the significance of larger greenspaces in accommodating diverse values. This study offers insights for optimizing planning and management of urban greenspaces to simultaneously benefit local communities and ecosystems, highlighting the potential for harmonizing human and biodiversity needs to foster a sustainable coexistence.

Agricultural and Life Sciences



Manganese Foliar Treatments Did Not Impact Peanut Yield in Central Florida

Authors: Emma Matcham

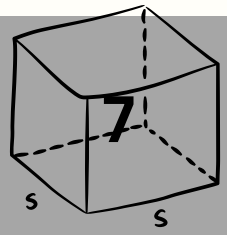
During the summer of 2022 in Citra, Florida, peanut plots were treated with different manganese fertilizer sources and rates. Manganese foliar fertilizers were applied using a backpack sprayer to determine how peanut plant nutrient levels and plot yields responded to varying rates and sources of manganese. Small plots were arranged in a randomized complete block design. Results of peanut plant yields were analyzed with an analysis of variance. Plot yield and peanut grade did not vary among treatments ($p = 0.664$ and $p = 0.879$, respectively). Manganese content in the peanut leaf tissue did vary among treatments ($p=0.0002$). While fertilizer treatments did influence the manganese content of the leaf tissue, there was not an effect found on plot yield, therefore it may decrease the profitability of using such treatments.

Investigating the efficacy of soil bacterial isolates from the Gainesville area against rice blast disease

Authors: Lainey Kemmerer, Timothy Johnson, Daniel Czyz, and Jessie Fernandez

Rice blast disease, caused by Magnaporthe oryzae, annually destroys between 10-30% of rice crops harvested worldwide. To combat this destructive pathogen, our research focuses on investigating the use of biological control agents as a mitigation strategy for this disease. This stems from the idea that plants often rely on the assistance of other organisms to fight off infection, and soil bacteria have demonstrated inhibition against various pathogens making them promising candidates for enhancing plant defenses. We initiated our investigation by testing twenty-four different soil isolates from the Gainesville region. Two additional bacterial samples (Bacillus subtilis and Pseudomonas chlororaphis strain EA105) were added as positive controls. To assess their inhibitory capabilities, we conducted an antagonistic assay by co-plating 5 mm cores of M. oryzae and 5 µl of bacterial suspension on opposite ends of a plate. Subsequently, we examined for signs of inhibition of fungal growth induced by the bacterial sample. The diameter of the fungal growth was measured on both control plates and experimental plates, enabling us to calculate the percentage of inhibition. Our findings revealed that several tested soil isolates exhibited effectiveness against M oryzae in plates. Notably, our two positive control samples showed an inhibitory effect against the fungus. One of the Gainesville area samples, TJ01, demonstrated promising inhibitory capacities in the presence of M. oryzae. Moving forward, we will continue characterizing these isolates by testing inhibition via volatile organic compounds and performing random mutagenesis studies to gain a deeper understanding into the genetic components that contribute to the efficacy of the bacteria in inhibiting fungal growth.

Agricultural and Life Sciences

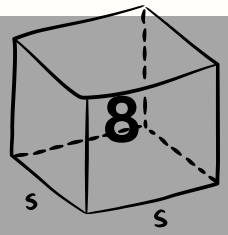


Evaluating grain size impact on occupancy dynamics in a Neotropical bird using community science data.

Authors: Matthew Shuler, Orlando Acevedo-Charry, Miguel A. Acevedo

Determining the most appropriate spatial grain size (i.e., scale) to model distributional dynamics is of particular emphasis in current biodiversity and ecological studies. Still, estimating this appropriate scale is increasingly difficult for many species mostly due to lack of large-scale datasets needed to perform this assessment. In this study, used community science data from eBird to conduct spatiotemporal sub-sampling across the Neotropical range of the Sayaca Tanager (Thraupis sayaca). To estimate the appropriate spatial grain size we, first, filtered the complete checklists, following stationary or traveling protocols, and a sampling effort of ≥ 5-hour checklist time and no farther than 5 km distance traveled. Then, we established a sampling period from 2012-2023, which serve as primary periods (t = 10) that allow estimation of colonization and extinction rates. To determine the secondary periods (the periods of assumed closed population), we relied on the detection frequency, selecting yearly Julian Day period between 1-181, January through June. We then compared ten different diameters (1-5-10-20-40-80-100-150-200-300 km) of hexagonal cell-grids to select randomly a checklist per cell per day. We used Akaike Information Criterion (AIC), to select the most parsimonious model. Previous research shows that finer grain size is more efficient for habitat specialists, and as our study species could be considered a generalist, widespread species across southeastern South America, a middle grain size of 40-km could well represent the spatial distribution dynamics.

Agricultural and Life Sciences

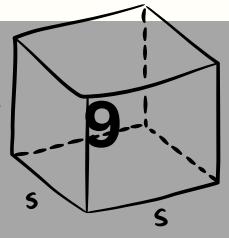


Quantifying Pollen Requirements in Southern Highbush Blueberry (Vaccinium corymbosum) to Improve Commercial Yield

Authors: Andrew Komatz, Juliana Cromie, Paul Adunola, Patricio Muñoz

Pollination is essential for optimal blueberry yield and fruit quality. Despite investments into seasonal honey bee hives, nearly 30% of growers report poor fruit-set, primarily due to pollen-limitation. This occurs when pollen deposited on the flower is below the necessary threshold for fruit development. A preliminary study revealed variation for the ripe fruit set achieved from different pollinator visitation levels between genotypes, suggesting pollination requirement may have a genetic component . Understanding the existing genotypic variability for pollination requirement can support breeding efforts for lowered pollination requirements, and ultimately offset pollination-associated yield loss. Towards this goal, we examined the effect of eight levels of pollen deposition treatments (0, 5, 10, 20, 30, 50, 75, 100, 150) on the fruit-set and quality of four southern highbush blueberry genotypes. Two-Way Analysis of Variance (ANOVA) and Tukey's Honest Significant Difference test were conducted to determine the effects of genotype, treatment, and their interaction on these fruit quality traits. Fruit-set was modeled via asymptotic regression and used to determine differences in pollination requirements between genotypes. ANOVA found significant differences between genotypes and treatment levels for seed set, berry diameter, and weight ($p < 0.01$). Post-hoc Tukey's HSD tests revealed fruit quality traits increased with pollen dosage. As for ripening time, statistically significant differences were only observed between pollen treatment levels ($p < 0.01$), with higher pollen dosage associated with shorter ripening time. Asymptotic regression and a likelihood-ratio test revealed significant differences in fruit-set between genotypes and treatments, however, genotype by treatment interaction was insignificant. Nevertheless, some variation in pollination requirement was discerned through asymptotic regression, with values ranging from 30 to 45. Notably, one genotype exhibited low levels of parthenocarpy. These findings underscore the pivotal role of pollinators in blueberry production; however, future work is needed to substantiate breeding efforts for decreased pollination requirements.

Agricultural and Life Sciences



Pythrethroid-treated Netting Against Solenopsis invicta Buren in the Prevention of Spreading in Nursery Stock

Authors: Michael Traweek, Rebecca Baldwin

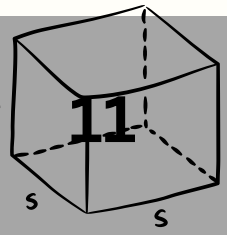
Imported red fire ants, Solenopsis invicta Buren, have been known to spread through nursery stock by the soil inside; this poses the risk of spreading the imported species from infested to non-infested areas. With their venomous sting and impact on agriculture, creating a preventative measure for nursery stock transportation is vital in preventing further spread of this imported ant. One such measure is the repurposing of a mosquito bed netting (Royal Guard) that uses a combination of active ingredients alpha-cypermethrin and pyriproxyfen. The combination of a Type 2 pyrethroid and a juvenile hormone could be used to prevent the imported fire ants from establishing themselves in nursery stock. We tested this netting against the fire ants in arenas as well as with a general screen netting. Both were provided a protein source on top of the corresponding netting square, carbohydrate source, and a nesting cell with larvae. Times of immobile mortality as well as a 24 h mortality rate were noted for the adult ants. For the experimental arenas, the ants were not significantly responsive within an hour (<1%); a similar statistic was found for the control arenas. Within both arenas, ants were found to have a near 100% mortality rate after 24 h. Both nettings could be further tested on nursery stock replicas to determine if this statistic is consistent across arenas. The use of a netting overall has the potential to prevent further spread of the imported fire ant in nursery stock and improve current management practices.

Investigating how leaf age impacts cuticular conductance rates in blueberry plants

Authors: Ana S. Acosta, Gerardo H. Nunez

Plants control water loss using their stomata, closing them in the presence of hot and windy conditions to prevent drying out. However, plants also lose water from their epidermal cells through their cuticle (cuticular conductance), a process which plants cannot control. Cuticular conductance is an important factor in the growth of blueberry plants in Florida, where environmental conditions exacerbate water loss. However, no prior research has been done to quantify cuticular conductance in blueberry plants. We hypothesized that cuticular conductance rates are higher for young leaves than mature leaves. We placed 14 young and 14 mature leaves from southern highbush blueberry plants (Vaccinium corymbosum interspecific hybrids variety 'Colossus') in a dark dehydration chamber to measure water loss when stomata remain closed. We periodically weighed the leaves as they lost water through their cuticle. Young leaves exhibited a higher rate of water loss and their fresh weight plateaued earlier than mature leaves, indicating a significant relationship between leaf age and cuticular conductance rates in this variety. Preliminary data indicates this relationship may vary considerably across different blueberry varieties. Understanding the role cuticular conductance plays in plant success will inform current and future blueberry cultivation practices.

Agricultural and Life Sciences



Role of Initiator Methionine Processing of Ribosomal Proteins on Translation Fidelity

Authors: Carver Freeburg, Dagiana Scarpetta, Saumya Sahay, and Kotaro Fujii

Accurate gene expression is critical to maintain functional proteome, however mRNA translation has the highest error rate compared to RNA transcription and DNA replication. Mistranslated proteins are prone to be unfolded, which can lead to protein aggregation and neurodegenerative diseases such as Alzhemier's. Our previous research revealed that the eukaryote-specific ribosome domain has an important role to increase translational fidelity by recruiting methionine aminopeptidases (MetAPs), to the ribosome. MetAPs co-translationally cleave off initiator methionine (iMet) from 70% of nascent proteins. Although the majority of protein synthesis starts with iMet, it is unknown how iMet processing impacts translational fidelity. Our unpublished data showed that MetAP-deficient cells increase iMet retention on ribosome proteins (RPs), and ribosomes containing iMet-retained RPs (iMet-RPs) had increased translational errors. Therefore, we hypothesized that iMet retention on the specific RPs distorts the ribosomal structure thereby affecting ribosomal activity and fidelity. To test this hypothesis, this project is designed to identify which iMet-RPs increase translational errors. Given that MetAP could not process iMets with large second amino acids (AA), we cloned RPs from both subunits by substituting the second AA to forcefully retain iMet on the RPs and identify the impact of each iMet-RP on translational fidelity. Since the ribosome consists of 80 RPs, multiple iMet-RPs in a single ribosome may synergistically contribute to increased translational errors. To further screen such synergistic impact, we overexpressed each iMet-RP and partially inhibited MetAP with inhibitor, bengamide. Currently, we have identified several iMet-RPs that increase translational errors by themselves or synergistically, which is the first direct evidence that iMet retention on the RPs affects translational fidelity. We will further discuss the position of iMet-RPs in the ribosomes, which will provide molecular mechanism details of increasing translational fidelity through iMet processing.

Variation in response to bitter-tasting prey between jumping spider species

Authors: Kenna Stone, Aditi Persad, Laurel Lietzenmayer, and Lisa Taylor

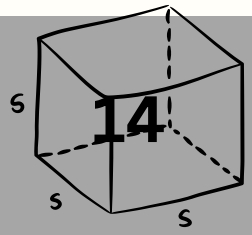
Many generalist predators avoid toxic prey by recognizing the bitter taste often associated with chemical defense and rejecting the potentially harmful species. However, susceptibility to these toxins can vary widely among closely related predators. As such, not all predators interact with bitter, potentially toxic, prey in the same way. Past research indicates that when comparing two jumping spider species, Habronattus trimaculatus is more susceptible to prey toxins than Phidippus regius. Consequently, we expect H. trimaculatus to be more likely to avoid consuming bitter prey than P. regius. We tested this prediction by giving spiders of both species a choice test in which they were offered two termites simultaneously: one treated with a bittering agent (Bitrex) and one sham-treated with water. We recorded the spiders' predatory responses to the termites for two hours to quantify each species' aversion to bitrex. Both species showed an aversion to the bitrex-treated termites in comparison with the sham-treated termites. However, as expected, this aversion was stronger in H. trimaculatus than in P. regius. Our research supports the idea that susceptibility to toxins may impact the predator's choice of prey consumption by making them more averse to consuming bitter tasting prey. Moreover, it sheds light on a potential reason for the evolution of color vision in specific jumping spider lineages, as many toxic prey use color to warn predators that they are toxic. Our results also support the idea that Bitrex can be used to modify jumping spider behavior for future experiments.

Scenario analysis for invasive species management: a new web app for evaluating the social-ecological networks that determine regional management success

Authors: R. W. McCoy, A. Adhikari, M. Choudhary, B. E. Etherton, R. A. Mouafo-Tchinda, A. I. Plex Sula, J. Robledo, and K. A. Garrett

Impact network analysis (INA) is an R package used for analyzing the simultaneous spread of (a) invasive species such as pathogens and (b) information about management options, within a geographic network (https://besjournals.onlinelibrary.wiley.com/doi/10.1111/2041-210X.13655). Previously the tool was only accessible to those who are proficient in the R programming language. To increase the accessibility of INA, this project introduces ScINArio, a Shiny graphical user interface (GUI) wrapper for INA. This project has made five major improvements. First, ScINArio explicitly names model inputs and organizes them into semantically related groups, to increase parameter comprehensibility. Second, it embeds documentation directly in the GUI. Third, it performs input verification in real-time, and notifies the user of invalid parameters. Fourth, it offers several convenient visualizations of INA inputs and outputs, to add visual intuition to model development. Finally, ScINArio enhances communication about parameters and results between researchers, by using an internal standardized and easily exchangeable file format. These features will extend the range of potential users to increase its utility for invasive species management. We provide illustrations of scINArio use in case studies for plant disease management. .

Agricultural and Life Sciences



How Much Do Pines Sweat?

Authors: Emily E. Perry, Marylou Mantova, Raiza Castillo-Argaez, Eric C. Torres, Cross J. Heintzelman, Dylan J. Clark, Herve Cochard, Timothy A. Martin, Gary F. Peter, Gerard Sapes, Jose M. Torres-Ruiz, William M. Hammond

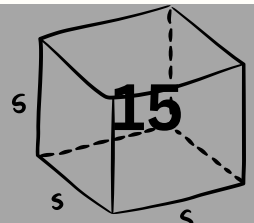
---

Forests worldwide are under threat as the effects of climate change continue to permeate every facet of nature. Loblolly pine (Pinus taeda L.) -, one of the most economically important tree species in the US, is in danger as its native range continues to experience more frequent droughts and heatwaves due to climate change. As a result, the growth and survival of loblolly pine have been drastically reduced. Our study aimed to understand the suite of physiological traits that confer climate resilience to growth and survival across genotypes of loblolly pines.

We sampled 50 genotypes from provenances encompassing the entire species' geographic distribution and climatic range in a common garden of loblolly pine located in Gainesville, FL. We quantified the residual water loss after stomata closure (gres), a survival trait that determines the time to lethal dehydration, at two different temperatures, 30°C and 40°C, using an instrument known as the BATLbox (Beyond Air Thermal Limits).

Our results reveal a high variability in gres across genotypes and temperatures. Gres at 30°C varied from 1.67 mmol m -2 s -1 to 73.81 mmol m -2 s -1, while Gres at 40°C ranged from 3.05 to 39.68. These results suggest differential tolerance to climate-induced stress in loblolly pine provenances with the potential to find resilience in extant genotypes.

Agricultural and Life Sciences

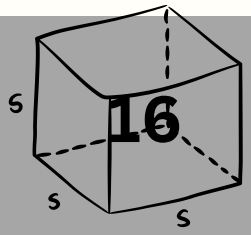


Developing a novel communal coping cardiovascular risk reduction intervention supporting dietary adherence among African American cancer survivors

Authors: Esha Chakraborti, Melissa Vilaro, PhD

Cardiovascular Disease (CVD) is one of the most prevalent concerns for American cancer survivors, with 54% of survivors experiencing heart failure in their lifetime. One popular approach to addressing CVD is the DASH Diet, which uses balanced, heart-healthy food to reduce hypertension, inflammation, and mortality. However, adherence to dietary guidelines for cancer survivors is often hard, especially for African Americans (AA) who face a higher burden of disease. One theory of how to increase adherence to CVD treatment guidelines is through “communal coping” strategies. In this project, we are studying the correlation between communal coping and adherence behaviors among AA colorectal cancer survivors, with a focus on dietary and medication adherence. Data collected from focus groups and interviews will be analyzed to explore insights of cancer survivors, their family members, cardiologists, and oncologists on several topics including communal coping strategies, adherence, and the challenges of managing CVD as patients and physicians. Data collection is ongoing, however, we have preliminary findings from the physician interviews and patient focus groups which will be analyzed to see the degree that physicians and patients feel empowered to continue cardiac surveillance during survivorship. This project will provide valuable strategies to address racial health disparities in cardio-oncology outcomes.

Agricultural and Life Sciences

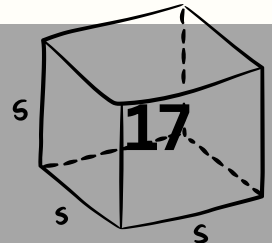


Impacts of Nitrate Pollution In Florida Freshwater On Aquatic Insect Populations

Authors: Annie Haupt & Masanori Fujimoto

Nitrate fertilizers are known to be highly leachable and can easily contribute to water pollution. Aquatic insect populations have previously served as accurate indicators of the relative water quality of streams and creeks due to their response to various sources of pollution, which can result in lowered levels of measurable diversity. Previous studies have measured insect diversity in northern Florida, but have not yet specifically compared these measurements against concentrations of nitrate. This project aims to measure levels of nitrate in a variety of rural and urban Gainesville creeks, then to evaluate the presence and relative population sizes of aquatic insects and assess the existence of a possible link between nitrate levels and aquatic insects. A total of five sites were selected in the Gainesville, Florida area, and both water and aquatic invertebrate samples were taken at each location. The water samples were tested colorimetrically for nitrate concentration, and the insect samples were individually sorted and counted to obtain measurements of the diversity and abundance. Negative correlations were found for nitrate concentrations with taxa richness and total observed insects, and the proportion of insects belonging to the chironomid group was found to be negatively correlated to taxa richness. These findings indicate that lower insect diversity can demonstrate that an area may be experiencing anthropogenic pollution. These results have the potential to influence local water management policy and may inspire efforts to further educate Gainesville residents on the use of fertilizers and their hazards.

Agricultural and Life Sciences

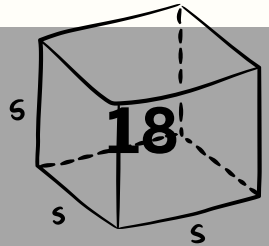


The impacts of megaherbivores on the savanna ecosystem in Southern Africa

Authors: Charisse Sproha, Curtis Greene, Logan Davis, Rob Fletcher

Megaherbivores are large mammalian herbivores that have recently been lost in the ongoing defaunation crisis. The loss of megaherbivores in a landscape drastically alters ecosystem processes and biodiversity through direct effects on nutrient cycling, vegetation structure, and trophic cascades. This study sought to analyze the impacts of elephants on seed and germinant predation, ungulate fear-based behavior, and rodent parasite biodiversity. The experimental design for two parts of the study included five treatments: large herbivore exclosures, simulated megaherbivore behavior, habitat, and behavior-habitat effects, along with control plots within Mlawula Game Reserve, Eswatini. To determine the impacts of elephants on germinant and seed predation, we focused on cryptic herbivores and investigated the roles of these cryptic herbivores on the plant demography of the knobthorn tree, Senegalia nigrescens. We used a nested exclusion experimental approach using S. nigrescens seeds and germinants that were placed in a series of 1x1m wire exclosures in both the absence and simulated presence of megaherbivores. To determine parasite biodiversity, we live-trapped rodents and analyzed how elephants can affect disease transmission via the transfer of endoparasites within their populations. Feces samples were taken from each individual,which was used to determine parasite loads. To determine the effects of elephants on ungulate behavior, twelve Automated Behavioral Response systems (ABRs) were deployed within the Hlane, Mbuluzi, and Mlawula conservation sites. They consisted of a motion-detecting camera, speakers, and an ABR programming device that was set to randomize megaherbivore vocalizations as animals passed by. We identified behavioral responses to treatment calls for mid-sized herbivores observed in videos, and identified whether the prevalence of fleeing and vigilance behavior differed across treatment. We concluded that the presence of elephants on the landscape has a disproportionate effect on rodent endoparasite diversity, ungulate behavior and seed predation.

Agricultural and Life Sciences



Investigating the Relationship between Prescribed Burn and Herbicide Treatment and Snail Kite (Rostrhamus sociabilis plumbeus) Nest Initiation at Lake Okeechobee

Authors: Samantha Hinsz, Meghan A. Beatty, Robert J. Fletcher Jr.

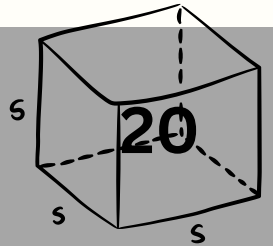
Understanding factors that drive nesting in endangered species is essential for guiding management aimed at species recovery. The Everglade snail kite, Rostrhamus sociabilis plumbeus, is a federally endangered raptor that inhabits flooded freshwater wetlands and shallow lakes in Florida. They are an extreme dietary specialist and feed almost exclusively on apple snails (Pomacea spp.). Snail kite nest abundance is limited by available habitat and vegetation structure, each of which influence the availability of apple snails and suitable nesting substrate. Two management strategies that affect wetland habitat structure are prescribed burns and herbicide treatments. Our objective was to determine if prescribed burn and herbicide treatments explained variation in snail kite nest initiation (i.e., the number of nests initiated inside a treatment area per month) in Lake Okeechobee between 2013 and 2023. Lake Okeechobee is at the center of the snail kites' range and represents a critical stopover point for snail kites moving between wetlands. We used 11 years of management and nest initiation data, including five burns and twelve herbicide treatments. Treatments had a mean size of 3,254 acres. Time since treatment and size of treatment had explained snail kite nest initiation rates, with nest initiation decreasing as time since treatment increased and increasing number of nests with increasing treatment size. These results can help inform future management decisions in coordination with snail kite conservation efforts.

Evaluating the utility of detached leaf assay for studying Thielaviopsis – palm interaction

Authors: Avril Rosano, Seemanti Chakrabarti, Braham Dhillon

Thielaviopsis paradoxa is a fungal pathogen that causes both bud (heart) and trunk rot of palms. It is a soil borne pathogen that infects all plant parts, i.e., roots, stem, leaves, and fruit, of primarily monocot hosts like banana, sugarcane, and pineapple. In the subtropical regions in southern US, T. paradoxa causes disease on landscape palms known as trunk rot. This fungus uses fresh wounds as infection court to infect and invade palm tissue (Elliott 2018). Even though there is limited knowledge about the biology of T. paradoxa, very little is known about how Thielaviopsis causes disease on palms. The objective of this study was to optimize a method to study the host-pathogen interaction in the palm – Thielaviopsis pathosystem. A detached leaf assay was established and used to test the pathogenicity of the T. paradoxa isolates on palms. Foxtail palm leaflets were cut to 6 inch in length, surface sterilized, and inoculated using different inoculum sources and wounding methods. The inoculum consisted of either a spore suspension or T. paradoxa colonized agar plugs. Leaflets were wounded with either a sharpened edge of a spatula, or a custom made seven-needle prong. Lesion size was measured quantitatively and used as a proxy to assess virulence of the fungal isolates. Wounding the leaf was found to promote lesion development, and disease symptoms on whole plants were similar to those observed on detached leaves. This detached leaf assay would facilitate dissection of the Thielaviopsis – palm interaction and as well as accelerate screening of palm germplasm repositories to identify sources of resistance to Thielaviopsis.

Agricultural and Life Sciences

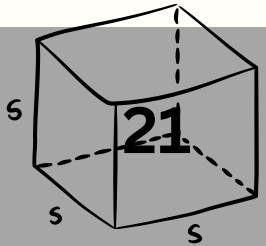


Bovine Breed Composition Influences Horn Fly Load in Beef Cattle

Authors:Ellie Shannon, Luana Alvares, Julia Uvalle, Alyssa Pham, Alessio Casamento, Nicole Blake, Castle Cavender, Emily Awtrey, Jessica Arcaya, Nicole Valencia, Giovanni Ladeira, Fernanda Rezende

Horn fly (Haematobia irritans irritans) is a blood-sucking fly found mainly in cattle, which leads to economic losses due to impaired production and decreased animal welfare. Breed composition has been suggested to be related to horn fly abundance in animals. Here, we investigated the effect of breed composition on fly load in the UF purebred Brahman and Multibreed Angus-Brahman crossbred beef cattle populations. A total of 638 calves were evaluated at weaning using a GoPro camera mounted on top of the chute. Video recordings were made, and individual images were extracted and analyzed using the software ImageJ. Subsequently, fly load phenotype was determined as the average number of flies counted from 5 images for each animal. Breed groups (BG) were determined based on the percentage of Brahman breed, with BG1 ranging from 0-19%, BG2 from 20-39%, BG3 from 40-59%, BG4 from 60-79%, BG5 from 80-99%, BG6 representing purebred Brahmans. Analysis of variance was performed by fitting a linear model including collection date, skin color, coat color, breed group, and weaning weight as fixed effects, and residual as a random effect. Breed group had a significant effect on susceptibility to horn flies. Animals with a higher proportion of Brahman breed were less susceptible to horn flies than animals with a higher proportion of Angus breed. Considerable variability in fly load was observed within purebred Brahmans, indicating that additional genetic factors influence cattle resistance to flies. Therefore, more studies are needed to understand the genetic mechanisms of horn fly resistance in cattle.

Agricultural and Life Sciences



Competition Removal Increases Growth and Reproduction of a Dominant Understory Bunchgrass, Aristida beyrichiana

Authors: Debriana Love, Jennifer Fill, April Zee, Sarah Tevlin, Hector Perez, Rae Crandall

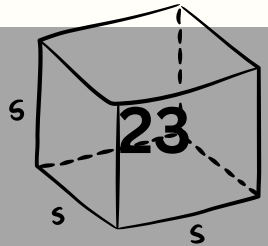
Understory bunchgrasses, such as wiregrass or Aristida beyrichiana, are often used for restoring southeastern U.S. pine savannas. There is a need to understand factors that affect their early establishment from seed and increase the success of restoration projects. Some research indicates that wiregrass seeds should be planted in an environment analogous to the one from which it was sourced. Alternatively, there is evidence from past studies that wiregrass is negatively influenced by competition from neighboring vegetation, especially during early establishment. Our experiment aimed to test the main and interactive effects of seed source, soil type, and competition removal on wiregrass density, size, and reproduction. We found that competition removal via weeding resulted in significantly larger plant sizes and a greater proportion of reproductive plants with more culms. Seeds sourced from a mesic site resulted in more plants per plot than seeds from a xeric site, likely due to differences in germination rate. On a large scale, manually weeding restoration plots may prove impractical and potentially detrimental, as it can lead to the loss of biodiversity and have cascading effects on the ecosystem. However, competition removal could be feasible on a smaller-scale restoration project to help start wiregrass populations.

Analyzing Florida Manatee Vocalizations Through the Lens of Music Theory Principles

Authors: McKayla Keels

The goal of this study is to utilize music theory principles to increase the effectiveness of existing manatee detection software, reducing boat collisions and manatee fatalities. The hypothesis states that if at least one music theory principle, including pitch, harmonic, and melodic content is utilized, then the effectiveness of the theoretical detection software will increase. The methods included recorded vocalizations being isolated in 90-second clips and processed into volume and pitch visualizers. Data from visualizations was used to simulate detection algorithms, the effectiveness of which was measured and compared. The hypothesis was correct, as the study found that manatee detection algorithms designed to assess audio on the basis of pitch, specifically noises in octave 8 and above, are most effective, more so even than the standard practice of detection by volume in dB. Therefore, detection by pitch identification algorithm is more effective than detection on the basis of volume in dB.

Agricultural and Life Sciences



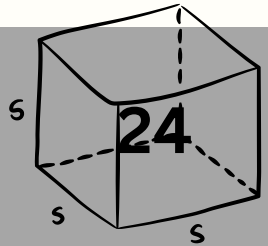
Optimization of Haloferax volcanii for the expression and purification of poly-histidine tagged halophilic proteins

Authors:Manasa Addagarla, Karol Sanchez, Julie Maupin-Furlow

Haloferax volcanii has emerged as a promising platform for the production of halophilic proteins. However, a challenge in the purification process of histidine-tagged proteins arises from the interference caused by the Nickel Insertion Protein (NIP, 52 kDa), particularly when dealing with proteins of similar size. The utilization of nickel columns and resins for the rapid purification of recombinant histidine-tagged proteins inadvertently leads to the co-purification of NIP due to the presence of its natural histidine tag—a phenomenon notably observed in cell lysates from minimal media.

In this study, we address this issue by genetically deleting the Nickel Insertion Protein gene, resulting in the creation of an optimized strain that can be used for protein purification without interference. This innovation not only offers a solution to the co-purification challenge but also enables the selective purification of the specific polyhistidine-tagged proteins. Consequently, this advancement serves to enhance the utility of H. volcanii for both basic scientific research and diverse biotechnological applications.

Agricultural and Life Sciences

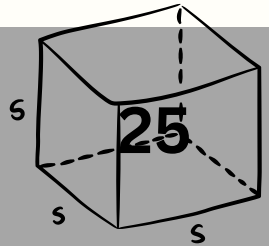


Efficient Farming with AI: The Economic Advantages of Strawberry Mite Detection

Authors:Valentina Oropeza, Congliang Zhou, Won Suk Lee, Zijing Huang

Efficient pest management is crucial for the sustainability and economic viability of agriculture, with traditional methods often proving labor-intensive and reactive. This paper examines an innovative approach using artificial intelligence (AI) for mite detection in strawberry farming, specifically targeting the two-spotted spider mite (TSSM) and predatory mites. Utilizing both a single-camera platform and a six-camera imaging system, strawberry leaf images were captured and analyzed using the YOLOv4 deep learning model, trained to identify TSSM motile, TSSM eggs, and predatory mites (Neoseiulus californicus and Phytoseiulus persimilis). Given that the US strawberry industry boasted an estimated value of $3.42 billion in 2021 (Zhou, 2023) and faces significant threats from TSSM infestations, there's an urgent need for optimized pest management. Traditional approaches, reliant on chemical pesticides, have led to increased costs and environmental implications. The introduction of AI-driven mite detection promises tangible economic benefits such as reduced chemical usage, enhanced crop yields, and curtailed labor expenses. More importantly, it allows targeted treatments, optimizing resource allocation for more sustainable and profitable strawberry farming. In summation, the integration of AI in mite detection and management can revolutionize strawberry farming, providing an efficient, cost-effective, and sustainable solution, especially pivotal during peak seasons marked by labor shortages.

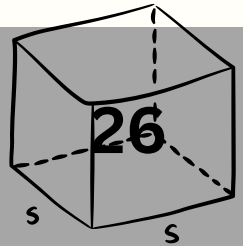
Agricultural and Life Sciences



Target Site Resistance to Organophosphates in Culex quinquefasciatus

Authors: Primrose Tanachaiwiwat, Neil Sanscrainte, Alden Estep

Insecticide resistance in Culex quinquefasciatus (Cxq) may be a major factor in the continued transmission of vector-borne diseases such as West Nile Virus, other encephalitides, and filariasis. In Miami-Dade County, where 20% of vector-borne diseases are transmitted by Culex, effective vector control is a primary concern and recent surveillance efforts have shown widespread resistance to pyrethroids. Notably, these same studies found that resistance to organophosphates (OP), like malathion, varied by population. Acetylcholinesterase long-read transcript sequencing from susceptible and OP resistant Miami-Dade Cxq populations revealed a single nucleotide polymorphism (SNP) present in the most resistant strains, which may confer target site resistance to organophosphates. This mutation, which results in a glycine to serine change, may have significant operational implications. We subsequently developed a competitive melt curve assay, using unpurified mosquito homogenate, to identify this mutation and found a strong correlation between population SNP frequency and malathion resistance intensity. This study provides a toxicogenomic marker of OP resistance in Cxq and provides an additional integrated vector management tool that can be used to rapidly identify populations likely to be poorly controlled by OPs.

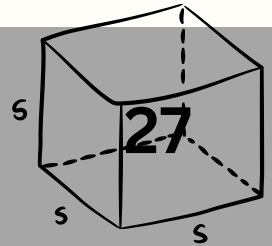


Testing the Effects of Amending Xeric Soil on Wiregrass Growth

Authors: Adele Kimball, April Zee, Debriana Love, Victoria Lopez, Jennifer Fill, Carolina Baruzzi, Elena Karlsen-Ayala, Raelene Crandall

Wiregrass (Aristida beyrichiana) is a native, dominant bunchgrass instrumental in restoring the fire regime within pine savannas of the southeastern United States. One potentially limiting factor to wiregrass growth and establishment is the absence of beneficial mycorrhizal fungi in the soil. We assessed wiregrass performance in 4 treatments: degraded soils typical of early restoration, unaltered soils from undisturbed habitat, degraded soils inoculated with a small amount of unaltered soil, and degraded soils inoculated with commercial inoculum. Plants were grown from seed in an incubator, then transported to a mist bench in a commercial hoop house. We found that after six months, wiregrass grown in unaltered soils had significantly lower total biomass than other soil treatments. Additionally, degraded and inoculated soils had significantly higher mycorrhizal spore counts than the mixed and unaltered soils. Our results indicate that the microbial environment of degraded soils can support wiregrass growth even in early restoration. The microbial conditions in unaltered soils might represent a state more typical of old-growth pine savannas, which might be suited more to wiregrass survival than to its establishment.

Agricultural and Life Sciences

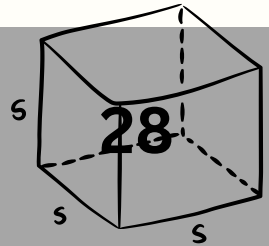


DUF1119 family membrane peptidase gene hvo_1107 and its impact on growth of Haloferax volcanii

Authors: Kelsey Cooper, Daniel Gal, Julie Maupin-Furlow

Haloferax volcanii is a halophilic archaeon that is used as a model organism given its ability to be easily grown and genetically modified. In this project, growth of an H. volcanii mutant strain featuring deletion of the DUF1119 family membrane protease gene hvo_1107 was examined. Deletion of this gene was observed to affect growth relative to the parent strain in minimal media with glycerol as the carbon source. Future plans are to complement the gene in the deletion mutant to confirm the effect is a result of the loss of the gene of interest. Additional experiments will test the effects of this mutation on growth of the organism in different environmental conditions including carbon sources and stresses. This project will further our understanding of how halophilic archaea, such as H. volcanii, interact with their environment and available nutrients.

Agricultural and Life Sciences



The Effects of Offshore Wind Energy Development on Biodiversity in the Gulf of Mexico

Authors: Isaac Coleman, Venessa Hull

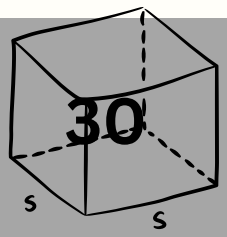
Investing in clean energy through the deployment of offshore wind farms (OWF) is a current priority for the United States Department of Interior (DOI). There is, however, relatively little known on how such projects may affect wildlife biodiversity throughout future lease areas. Part of the DOI future windmill development area lies off the coast of Texas and Louisiana. This area of the Gulf of Mexico serves as the location for numerous migrating species of birds, mammals, and reptiles and is home to many more benthic organisms. However, research on predicted impacts of OWF on biodiversity in the Gulf is in its infancy. Here we take a Coupled Human and Natural Systems approach to examining key impacts and feedbacks between biodiversity and offshore wind energy in the Gulf of Mexico. We examine the spatial extent in overlap between planned wind energy and key migratory bird pathways and delve into tradeoffs and synergisms between biodiversity protection and offshore wind industry. Our findings show that there are opportunities for offshore wind planning to better account for biodiversity, particularly with respect to the distribution of marine protected areas. We discuss recommendations for the path forward in interdisciplinary analysis of this issue and highlight the need for data sharing with all stakeholders to build an agreed-upon framework for long-term biodiversity impact assessment.

Lessons Learned: Recruitment and Retention of Participants in a Double-Blind Randomized Controlled Study

Authors: Isabella Simonpietri and Dr. Jeanette Andrade.

Chronic kidney disease leads to several micronutrient deficiencies such as vitamin D due to the inability for the kidneys to activate vitamin D. A double-blind randomized controlled study was conducted to investigate the effect of consuming almond milk with or without 4000 IUs of nanoencapsulated vitamin D on vitamin D status during a 3-week period. At baseline, participants completed a vitamin D food/beverage intake questionnaire and had blood drawn for analysis of vitamin D, calcium, and parathyroid hormone. Participants were then instructed to consume 130 mL of almond milk daily and at the end of each week obtained another blood draw and completed the vitamin D questionnaire. Participants received a total of $80.00 for completion of the study. Based on sample size calculations, a total of 25 participants were anticipated to be recruited. Techniques to recruit included calling individuals based on a listserv obtained through Integrated Data Repository at UF, flyers posted on various nephrology clinics, and UF Health listings. Less than 5 participants or 2.3% responded to UF Health listings and through flyers posted. From the phone calls, 17 out of 597 potential participants committed to the study. Challenges faced included not answering the phone or transportation issues. Of the 30 participants who initially expressed interest, 8 dropped due to time and perceived the study to be different. Thus, 22 participants currently remain in the study. By identifying and evaluating challenges faced, strategies to improve recruitment and retention of participants is a must when advancing science.

Agricultural and Life Sciences



Skin and Coat Colors Influence on Horn Fly Load in Beef Cattle

Authors: Julia Uvalle, Luana Alvares, Ellie Shannon, Alyssa Pham, Alessio Casamento, Nicole Blake, Castle Cavender, Emily Awtrey, Jessica Arcaya, Nicole Valencia, Giovanni Ladeira, Fernanda Rezende

Horn flies (Haematobia irritans irritans) harm cattle production and health, leading to annual economic losses of $700 million to $1 billion in the U.S. Current solutions, such as ear tags or topical insecticides, have a negative impact on the environment and are not effective as the flies can adapt and become resistant. Animal coat color has been reported to influence cattle susceptibility to horn flies; Holstein cows with greater proportion of white coloration seems to attract fewer flies than those that were mostly black. Our hypothesis is that coat color and skin color influence the fly burden in beef cattle. Skin and coat colors information was collected from 638 purebred Brahman and crossbred Angus-Brahman UF calves. A GoPro camera was used to record animals in the squeeze chute during regular weaning handling. Later, videos were processed to extract longitudinal images from the withers to the tail insertion of each calf. Fly counts were performed using ImageJ software and the fly load phenotype was determined as the average fly count from 5 images per animal. Analysis of variance (ANOVA) was performed by fitting a linear model that included collection date, skin color, coat color, breed group, and weaning weight as fixed effects, and residual as a random effect. Coat color was significantly associated with susceptibility to horn flies, with black and brown coat colors being preferred over others. The lowest susceptibility was observed for tan and red hide colors, followed by brindle and white. These results corroborate the visual orientation of many Diptera fly species searching for dark animal form, avoiding stripes patterns and inability to see red. No significant effect of skin color on fly abundance was detected. Therefore, coat color must be taken into consideration when investigating the genetic factors underlying horn fly resistance in beef cattle.

Rice & Risk: Charting Pathogen Pathways in Nepal and Beyond

Authors: A. Adhikari, K. Alcock, R. Fontan, T. J. Stronkowsky, IV, K. A. Garrett

Nepal is a developing, landlocked country and rice serves as a major stable crop. Rice accounts for approximately 40% of the country's caloric intake (Neupane et al. 2021), contributing 51.6% of the total grain production (MOAD 2017) and influencing nearly 20% of its AGDP (Dhungal and Acharya 2017). Protecting rice production depends on limiting the spread of crop pathogens and pests. For this study, our objectives were to evaluate rice cropland connectivity (CC) and trade networks to understand the potential spread of pathogens and pests within Nepal and in the surrounding region and to identify key locations have risk of disease epidemic. CC evaluates the degree to each location plays a potential role as a hub or bridge for pathogen spread (Xing et al. 2020). Incorporating CC risk with other risk factors for pathogen buildup can improve methods for detecting and mitigating the spread of current and emerging pathogens. Based on CC analysis in Nepal and the larger Southeast Asian region, we identified high-risk areas that are candidate priorities for risk mitigation procedures. Trade network analysis addresses how the movement of goods contributes to the spread of pathogens. We evaluated trade networks in terms of the potential movement of multiple pathogens, including Magnaporthe oryzae and Ustilaginoidea virens, to identify highly connected countries with the potential for pathogen movement if there are not sufficient phytosanitary controls in place. These analyses help guide prioritization for rice health management, and are a baseline for new collaborations between UF, IRRI and Nepali scientists.

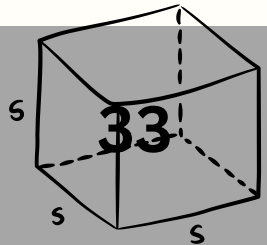
Investigating the function of LsORE15 in leaf development and senescence in lettuce (Lactuca sativa)

Authors: Gabriella Perez, Kathryn Chase, Jiang Tao, Alfred Huo, Chiwah Tesung, Kevin Begcy, Tie Liu

Leaf structure plays a significant role in determining how well lettuce retains moisture, nutrients, and overall quality during storage. Understanding leaf development can provide insights into the arrangement of cells, tissues, and cuticle layers that influence moisture retention and resistance to wilting. Leaf development is the process by which leaf primordia mature into functional leaves responsible for photosynthesis, gas exchange, and water movement. Additionally, leaf development is closely tied to the onset of senescence (aging) in lettuce leaves. Identifying and characterizing genes in lettuce that regulate leaf development has important implications for agriculture and crop science and could be applied to other leafy greens. ORE15 is a transcription factor that has been linked to longer leaf life, larger leaves, and delayed senescence. Previous studies have shown a higher level of ORE15 expression in younger leaves that decreases as the tissues mature.

In this study, we aimed to characterize the LsORE15 gene and its role in the early leaf development and senescence of lettuce (Lactuca sativa). We have successfully generated LsORE15 mutant in lettuce using CRISPR/Cas9 gene editing technology. In the T1 generation, we observed dwarf plants with severe up-curling phenotypes. We are examining the T2 lines and evaluating their expression patterns compared to wild type. Additionally, LsORE15 overexpression line will be generated to further characterize the role of LsORE15 in lettuce. RNA sequencing of the mutant plants will also be conducted to identify the potential targets of LsORE15 during leaf development and senescence.

Agricultural and Life Sciences

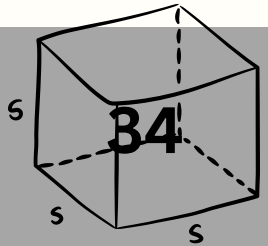


Why Give at Work? Exploring Motivations for Giving to a Workplace Fundraising Campaign in Higher Education across Three Donor Profiles

Authors: Mark Motsch, Maeve Barger, Dr. Tracy Johns

Many nonprofit organizations solicit philanthropic donations to accomplish their mission. Examining donor habits and values can help these organizations target their communication to specific donor groups to encourage donor participation and ultimately to reach their mission-related goals. This targeted communication strategy is also possible for workplace fundraising campaigns, or federated campaigns, such as those frequently run by United Way. This qualitative study examines differences in donors' giving motivations and patterns in a workplace fundraising campaign at a large public university located in the southeastern United States. Semi-structured interviews were conducted with 45 participants, each from a different cluster of donors as identified by a factor analysis in a previous study (female faculty, male faculty, and a mix-gendered group of hourly employees). Interview questions inquired about motivations for giving, volunteering patterns, and changes in giving. Responses were collected and compared between clusters to identify variations in donor motivation and tendencies that might support marketing efforts. Several consistencies were observed across the clusters, such as a favorable perception of the ease of payroll deduction option offered by the campaign. Differences become apparent as well, since individuals from the mixed-gendered cluster of hourly employees tended to donate smaller amounts than the male faculty cluster, but to causes closely aligned with their personal values. By understanding giving patterns and motivations, such as these, the charitable giving campaign can align its communications with donors' giving and involvement goals, furthering their ability to receive valuable funds

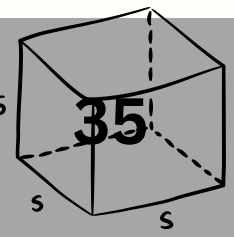
Agricultural and Life Sciences



Root Measurement and Observation Methods in Blueberry.

Authors:Madelyn Greathouse Bartchlett, Cecilia Rubert Heller, & Gerardo H. Nunez

A crucial part of plant science is understanding root systems. The underground presents unique challenges when working to collect quantifiable data. While there are several methods that can be utilized to measure and observe root systems, they are imperfect. The objective of this study was to investigate the relationship between two commonly employed methods for assessing blueberry root systems: the destructive method of measuring total dry weight and the non-destructive method of root scanning and tracing. Dry weight measurements consist in collecting the plant's entire root system, removing the soil around it and oven-drying until a constant weight is achieved. It requires less labor input over time, but the plant cannot be studied further. Root tracings involve the use of a mini-rhizotron scanner to acquire underground images. It allows continuous research, but also requires a massive labor input to manually trace the roots. In blueberries, this is particularly challenging due to the blurring between fine, brown roots and brown pine bark. To study this, eight blueberry plants were measured using both the destructive dry weight method and non-destructive root tracing. The results of this research indicate a striking lack of correlation between these two data collection methods. The weak correlation between dry weight and root length data prompts a reevaluation of the methodologies and assumptions typically employed in blueberry root research. This finding highlights the complexity of root systems and their response to environmental factors, which might affect these two measurement methods differently. It is essential for researchers and practitioners to consider the unique characteristics of their study systems when choosing the most appropriate method for blueberry root data collection. This study contributes to the evolving understanding of root biology in blueberries and encourages a more informed and nuanced approach to future research and cultivation practices.



Innovative Grafting to Improve Dwarf Tomato Production

Authors: Andrew Raffenberg, Zachary Ray, and Xin Zhao

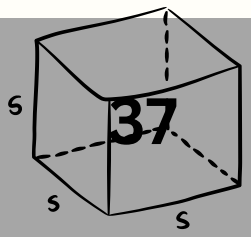
Grafting is a technique used in commercial tomato (Solanum lycopersicum) production to manage soil-borne diseases and improve fruit yield. However, little is known about the growth response of dwarf tomato types to grafting. Dwarf tomato cultivars are commercially desirable for their small stature and ability to grow without trellising when growing space is limited. This work aimed to assess the effects of grafting on dwarf tomatoes to test the viability of the wild type ‘Everglades’ tomato (Solanum pimpinellifolium) as a rootstock. Miniature dwarf tomato scion cultivars including ‘Micro-Tom’, ‘Red Robin’, ‘Florida Lanai’, and ‘Yellow Choice’ were grafted onto the ‘Everglades’ tomato rootstock and grown in a research greenhouse, with non-grafted tomato scions as the control. Biometric parameters including relative chlorophyll content, NDVI, and plant height were monitored, and fruit yield was determined at 145 DAT (days after transplanting). Grafted ‘Red Robin’ demonstrated a decrease in height while maintaining significantly higher relative chlorophyll content, NDVI value, and fruit number per plant, compared to the non-grafted control. Results were inconclusive among other dwarf tomato cultivars due to poor graft survival; this suggests possible graft incompatibility when using ‘Everglades’ as a potential tomato rootstock and introduces an area of further research.

US Nitrogen Deposition: Are Urban Areas Underrepresented in the N Deposition Monitoring Network?

Authors: Tanya Charan, Mary Lusk

Nitrogen (N) serves as one of the vital building blocks to make life possible on Earth. However, N deposition, or the input of reactive N from the atmosphere into the biosphere, can be a concern for both the environment and agricultural specialists, since N in excess of ecosystem needs encourages soil acidification, algal blooms in aquatic systems, and the depletion of vital nutrients from the soil. The National Atmospheric Deposition Program (NADP) has 250 National Trends Network (NTN) monitoring sites which collect data about major ions in precipitation. These sites are mostly located in rural areas and are not fully representative of the N deposition concentrations in urban settings. Due to a high concentration of both stationary and mobile N sources in urban areas, we argue that more monitoring sites for atmospheric N deposition should be in urban contexts and hypothesize that the current national data on N deposition does not adequately capture trends for urban areas. In this study, we accessed N deposition data from the NTN to compare N concentration readings from the sites and their distance to the nearest urban area. This was accomplished by using NH4 and NO3 site readings using 2021 data. We also used GIS tools to determine the distance from each NTN monitoring site to the nearest urban area (defined as having 5,000 people or more) and the number of urban areas within a 50 km radius of each monitoring site. We found that more than 90% of NTN monitoring sites are > 20 km from an urban area, showing how urbanized locations are underrepresented in the national monitoring data of atmospheric N deposition. This presentation shows N deposition trends vary in rural versus urban monitoring sites and will discuss implications of urban sites being underrepresented in national N deposition data.

Agricultural and Life Sciences



Enhancing Agricultural Water Safety Against Norovirus Through the Utilization of Hypochlorite-Based Sanitizer

Authors: Mya Maybank, Sarah Johnson, Razieh Sadat Mirmahdi, Naim Montazeri

Human norovirus remains the predominant cause of foodborne illnesses in the United States, posing a substantial threat to food safety and public health. This study investigates the effectiveness of a widely used calcium hypochlorite-based sanitizer in deactivating norovirus in agricultural water. Two irrigation water samples, denoted as Ag1 and Ag2, were collected from Florida farms and subjected to varying contact times and sanitizer concentrations. Samples were inoculated with 6 log10 PFU/mL, followed by the addition of the sanitizer at concentrations ranging from 2 to 40 ppm free chlorine. Experimental conditions were conducted (three replicates) at 5- and 10-minute contact times. After treatment, the samples were neutralized, then infectious virus particles were quantified using a plaque assay on MK2 monolayer cells. Preliminary experiments conducted with deionized water, as opposed to agricultural water, demonstrated a 2.6 log10 PFU/mL reduction following a 5- min exposure to 2 ppm free chlorine. However, in the case of irrigation water samples, significant reductions ($p<0.05$), were not achieved until the free chlorine concentration was increased to 20 and 10 ppm for Ag2 and Ag1 samples, respectively. In both sample sets, a 30-ppm of free chlorine resulted in near-complete to complete inactivation of TuV within 5 min, exceeding a 4.3-log10 PFU/mL reduction. Furthermore, the results of our study demonstrated that increasing contact time from 5 to 10 min did not significantly enhance the efficacy of chlorine in any of the samples ($p>0.05$). This research, conducted with actual water samples and a commonly used sanitizer, provides practical insights for mitigating norovirus contamination in agricultural water. Future studies will explore the efficacy of chlorine inactivation using clinical human norovirus.

The Effectiveness of Alpha-Cypermethrin and Pyriproxyfen Treated Long-lasting Insecticidal Netting on Flying Insects.

Authors:Jamie Beach and Philip Koehler

A novel mosquito net (Royal Guard) uses a combination of active ingredients (alpha-cypermethrin and pyriproxyfen), This combination of a Type 2 pyrethroid and a juvenile hormone analog has the potential of overcoming insecticide resistance in mosquitoes and house flies, but it is unknown whether the two insecticides are compatible to provide insect kill. We tested the effectiveness of the netting against mosquitoes (Aedes aegypti, Orlando susceptible strain, the vector for yellow fever and many other diseases) as well as house flies (Musca domestica, Gainesville field strain) in test chambers alongside control chambers with untreated netting. The times for the insects to become moribund (incapable of flight) and 24 h mortality (unresponsive to probing) were determined. Within the experimental chambers, mosquitoes were morbid within 5-10 min, and flies were moribund within 10 - 15 minutes. Both flies and mosquitoes in test chambers were dead at 24 h, while untreated control insects had <5% mortality. Alpha-cypermethrin and pyriproxyfen have the potential to be incorporated into other long-lasting insecticidal netting, as alpha-cypermthrin is a long lasting pyrethroid insecticide that provides contact kill, and pyriproxyfen is known to prevent insect egg hatch. The combination of these active ingredients has the potential of providing better mosquito and fly control and may encourage the donation of longer-lasting insecticidal nets to regions in the world where mosquito and fly resistance is pervasive.

Rapid Risk Assessment of Banana Pests and Disease in Colombia

Authors:Sydney Barker, Jacobo R. Buritica, Neha N. Kallamvalli, David H. McDermott, and Karen A. Garrett

Colombia ranks as the fourth largest exporter of bananas and plantains globally, contributing to over 10% of worldwide trade. These fruits serve as dietary staples in Colombia, playing a crucial role in national food security. However, their production is challenged by pests and pathogens, particularly in the absence of commercially available resistant varieties. Prompt risk assessments are thus vital for crop sustainability and for shaping surveillance plans. In our study, we adopted a rapid risk assessment method (garrettlab.com/r2m), analyzing the landscape of banana and plantain cropland densities using epidemic network metrics such as node degree and betweenness centrality to gauge habitat interconnectedness in Colombia. We also assessed international trade risks, considering factors like host availability, trade volume, and the presence of the fungal pathogen, Fusarium oxysporum f. sp. cubense Tropical Race 4, one of the most severe global threats to banana and plantain. Three Colombian regions, namely Antioquia (a leading banana exporter cluster), Quindío (a plantain-dominant area for the national market), and zones adjacent to Venezuela (Norte de Santander and Arauca), emerged as high-risk based on cropland connectivity. We highlighted trade-related risks tied to possible TR4 dispersal to and from specific nations: the risk from Colombia to Belgium, the US, and the UK, and the risk of reintroduction from Peru, China, and the Philippines to Colombia. This rapid assessment highlighted priority locations for surveillance, management, and expert knowledge elicitation, and serves as a baseline for planning and upcoming international collaboration.

Building a Scientific Basis for Understudied Malaria vector, Anopheles Squamosus, In Africa

Authors: Dalia Dryden, Brooke Broder, Valerie Nguyen, Yoosook Lee

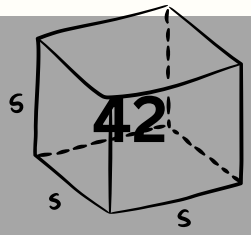
Despite the tremendous effort to minimize the impacts of malaria in southern Africa, including Zambia, it has yet to be eliminated from this region. Many understudied mosquito vector species inhabit this area and may perpetuate malaria transmission in pre-elimination zones. In most pre-elimination zones, malaria control is focused on attacking widely known primary vectors, which prevents them from reaching full elimination as these elimination methods often do not account for understudied vectors. Anopheles squamosus is one of the most abundantly caught mosquito species in southern Zambia. This species is also frequently infected with Plasmodium falciparum, a causal agent of human malaria. This leads to the hypothesis that An. squamosus is a critical vector of malaria transmission in Zambia and prevents the country from reaching full elimination status. However, this species is understudied due to previous notions that it is not medically significant to humans. Currently, literature on An. squamosus is scattered in multiple articles, some of which are no longer accessible online. This poses a challenge for students and researchers to synthesize the current knowledge and build a new hypothesis to improve our understanding of the biology of this important species. Here, we present a summary of the literature review on An. squamosus mosquito biology research findings relevant to Zambia and the neighboring southern African region.

Goldilocks Grain: Analyzing variation in spatial resolution to explore distribution dynamics in a Neotropical bird

Authors: Megan Quinn, Orlando Acevedo-Charry, Brynn M. Fricke, and Miguel Acevedo

Spatial models provide crucial insight that ecologists apply to better understand patterns and processes in nature including species distribution. These models are particularly relevant in the context of climate and land use change which directly alter habitat quality and species distributions. Quantifying ecological patterns at the appropriate scale is fundamental to better quantify species distributions and habitat-species relationships. Still, scales are rarely explicitly incorporated in species distribution models. If tradeoffs exist between coarse and fine grain data binning, then grain size optimization must be performed to accurately represent population dynamics. Fine spatial resolution is constrained by computational resources and data limitations, while coarser grains lose necessary resolution to accurately capture ecological processes such as local extinction and colonization. Our objective was to elucidate the optimal spatial grain to better model the distributional dynamics of the passerine bird, Thraupis episcopus. This species was selected because of its widespread distribution, easy identification, and availability of long-term citizen science data from eBird–a community science project that provides an accessible and cost-effective method of data collection. After filtering by sampling effort (~200,000 records), we gradually increased the grain of spatial resolution in a spatiotemporal subsampling of hexagonal cells of 1 to 300km diameters. Estimates of occupancy, local colonization, and extirpation for each grain size were modeled and compared with the Akaike Information Criterion.

Agricultural and Life Sciences

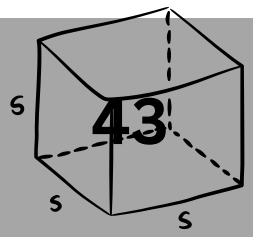


Parasitic nematode Romanomermis culicivorax transcriptome reveals potential biocontrol agents for mosquitoes

Authors: Mika Matteo, Peter DiGennaro

Romanomermis culicivorax is a nematode parasite of mosquito larvae. As part of its life cycle, the infective juvenile nematode penetrates host mosquito larvae and induces a cardiac arrest-like phenotype in the host. The nematode and mosquito genes involved in this interaction represent a novel source of potential biologically informed control methods for mosquitoes. The goal of this project is to identify such genes by examining the transcriptomes at different time points during parasitic invasion of R. culicivorax in two mosquito hosts, Aedes aegypti and Culex quinquefasciatus. Differential gene expression will be conducted through RNA isolation, sequencing, and bioinformatics using University of Florida supercomputer, HiPerGator, and the programming language, R, for further analyses. Pairwise comparisons of transcriptomes of different mosquitoes at various time points during the nematode life cycles will reveal conserved mechanisms required for nematode parasitism and mosquito host responses to infection, potentially including cardiac arrest. These genes may inform the development of novel, targeted, and biologically informed products, and methods to control mosquito populations. .

Agricultural and Life Sciences



Effects of the reduction in dive tourism due to the COVID-19 pandemic on cleaning behavior in Galapagos reef fishes

Authors: Kamila Koralasbayev, Dr. Robert Lamb

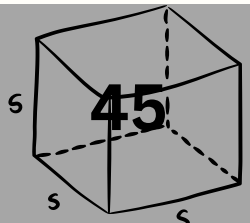
Cleaning interactions are an important mutualistic interaction in marine ecosystems, whereby "cleaner" species remove and eat ectoparasites and dead skin from "client" species. Cleaning behavior is essential for fish health but may be impacted by the disruptive presence of scuba divers in touristic locations such as the Galapagos Islands, which receives an average of ~25,000 visitors per month. Reef fish in the Galapagos are a diverse and highly abundant group of organisms that support local fisheries and play important ecological roles, necessitating research into the factors that support healthy populations. We took advantage of the complete cessation of dive tourism during the COVID-19 pandemic (March - October, 2020) to investigate the effects of scuba divers on the type and frequency of cleaning interactions in Galapagos reef fishes. We documented over 2,000 cleaning interactions carried out by 4 different cleaner and 32 client species. At established cleaning stations, we observed 3-4 interactions per minute. While client species were primarily resident reef fish, the pandemic period was characterized by a marked increase in visitation to cleaning stations by migratory pelagic species such as large jacks and sea-chubs. The absence of open-water species from cleaning stations when divers are present suggests that this guild of clients is particularly skittish. The unique opportunity provided by the pandemic to examine Galapagos fish cleaning interactions in the absence of divers allowed us to document the species-specific impacts of diver presence on cleaning mutualisms. While these effects were mild, enough divers visiting a cleaning station throughout the day may skew the client community towards resident reef fishes and away from pelagic visitors to the reef, thereby decreasing the benefits of the mutualism that would naturally occur and the overall health of pelagic species.

Detection of Postharvest Quality of Fresh-cut Lettuce Using Hyperspectral Imaging

Authors: Qiaowen Chen, Xiaolei Guo, Chiwah Tesung, German Sandoya, Alina Zare, Tie Liu

The shelf life of fresh-cut vegetables and fruits, such as lettuce, is influenced by various factors including environmental stresses and developmental regulation. These factors can affect the lettuce's quality, safety, and how long it remains suitable for consumption. The preservation of freshness and shelf life are critical components of lettuce cultivation. This project aims to examine factors affecting the shelf life of lettuce cultivar through physiological and biochemical analyses and image-based machine learning approaches. Multiple approaches are being conducted, including water loss/weight measurement, color measurement, chlorophyll and antioxidant level measurement as well as hyperspectral imaging (HSI), to comprehensively monitor the senescence of ten lettuce cultivars. By seeking connection between biological data of the lettuce and HSI analysis, this study seeks to identify characteristic features of fresh-cut lettuce during postharvest storage. Thus, the development of more effective methods for lettuce breeding and postharvest quality management.

Agricultural and Life Sciences



Polymerization shrinkage stress of new universal composite prototypes

Authors: S. Robbins, T. Sedlacek, E. Yu, A. Triplett, D. Oliveira, M.G. Rocha

Six resin composites were tested: 2 new universal composites prototypes (BU-1 and BU-2, 2 bulk-fill composites (Filtek Bulk fill One (FBO) and Reveal HD), 1 commercially available universal composite (Filtek Universal (FU)) and 1 conventional composite (Filtek Supreme (FS)). The PSS was analyzed using a universal testing machine (Instron 5550). Two glass rods (13 mm in length × 4 mm in diameter) had their contact ends roughened with 180-grit SiC grinding paper and treated with a silane primer (Monobond Plus). The 13-mm rods were held onto a stainless-steel fixture consisting of a slot that allowed the curing light to reach the 1-mm-thick resin composite (~0.150g) between the glass rods. The test began, and the curing light (Valo Cordless), fixed directly below the bottom glass rod, was powered on with 1000 mW/cm2 for 20s while the shrinkage of the composite was registered by the load cell. The tensile stress generated by the sample shrinkage is registered as a measure of load (N) during the polymerization shrinkage evolution for five minutes. The test was conducted five times for each group. Maximum stress (MPa) was obtained by dividing the maximal force by the cross-sectional area of the glass rod. Data were analyzed using one-way ANOVA with a level of significance of 5%.

Promoting Resilience in Aging Adults: An Intervention for Chronic Low Back Pain Management

Authors: Ben Ofri, Terrie Vasilopoulos, Emily Bartley

Background: Chronic low back pain (cLBP) is a leading cause of disability among older adults and is significantly associated with decrements in physical and psychological functioning. As the aging population in the United States continues to expand, the burden of cLBP is on the rise, necessitating urgent attention to geriatric pain management. In recent years, there has been a growing interest in the utility of resilience-based psychological interventions for chronic pain; however, this has been an understudied area in aging adults.

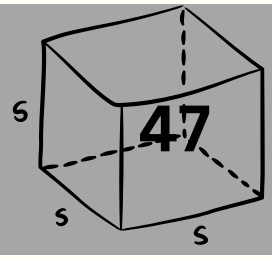
Aims: The aim of this study was to examine the effects of a novel resilience-focused intervention on pain and psychological outcomes in a sample of older adults with cLBP.

Methods: Fifty adults, ages >50 years, with cLBP were recruited for a single-arm trial consisting of 7 weekly telehealth group sessions. The intervention integrated positive psychology concepts (e.g., positive affect, pain acceptance, hopeful thinking, pain self-efficacy) and well-established cognitive-behavioral techniques (e.g., relaxation) for pain management. Key outcome measures include pain severity, pain interference, pain impact, depressive symptoms, and health-related quality of life, assessed at baseline and post-treatment.

Results: Results demonstrated that patients thought the intervention had high credibility (M=7.7/10, SD=1.6) and that they had high engagement (M=6.3/8, SD=1.0) in the intervention. Pain intensity (mean change= -1.2, 95%CI: -1.8,-0.7, p<.001), pain interference (mean change= -3.7, 95%CI: -5.3,-2.2, p<.001), pain impact (mean change= -2.7, 95%CI: -4.1,-1.2, p<.001) and quality of life (mean change= 0.28, 95%CI: 0.01,0.55, p=.04) significantly improved from pre- to post-intervention, while observed reductions in depressive symptoms did not achieve statistical significance (mean change= -1.7, 95%CI: -2.5,0.2, p=.08).

Conclusion: The findings from this study provide support for the use of resilience-focused interventions for aging adults with cLBP, which may be a step toward improved pain management in this population.

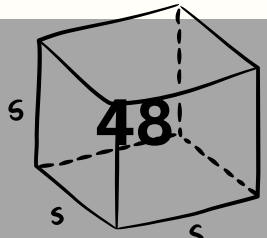
Dentistry



Spectrophotometric Analysis of Spherical and Prismatic Silver Nanoparticles stabilized with different L-Arginine Polymers used for dental caries prevention.

Authors: Mallorie Watson, Dayane Oliveira, Marcelle Nascimento, Jose Carlos Netto-Ferreira, Mateus Rocha

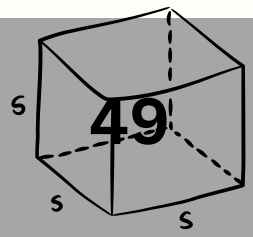
Objective: To evaluate the UV-Vis spectra of spherical and triangular silver nanoparticles (AgNP) stabilized with L-arginine and Poly-L-Arginine.
Materials and methods: Solutions were prepared using 100 mM silver nitrate, 100 mM trisodium citrate, and 0.1 M sodium borohydride. In one flask, 100 µL of silver nitrate was mixed with 1.5 mL trisodium citrate and diluted with 100 mL water. After adding 1 mL sodium borohydride, the mixture turned yellow within 2 minutes and was stored at 4°C. In another preparation, silver nitrate and trisodium citrate combined with 280 µL of 30% hydrogen peroxide, diluted with 100 mL water, and turned from clear to yellow to blue within 30 minutes after adding 1 mL sodium borohydride. After 24 hours, a 0.1 wt% L-Arginine solution and three 0.1 wt% Poly-L-Arginine variations (5-15 Kmol%, 15-70 Kmol%, >70Kmol%) solutions were mixed with the AgNPs in addition of 0.033 wt% PVP to prevent aggregation. Centrifugation at 6708 g for 20 minutes was used thrice for purification by replacing the supernatant with fresh water.
Results: The Spherical and Triangular samples with PVP (control) displayed peak absorptions at 394 nm and 800 nm. When compared to their Poly-L-Arginine counterparts, Spherical AgNP variants showed redshifts ranging from +5 nm to +14 nm, while Triangular AgNP variants exhibited significant blueshifts between -319 nm to -420 nm. These shifts in peak absorption, influenced by the molecular weight of L-Arginine polymers, highlight their impact on nanoparticle optical properties. These molecular red and blue shifts can be harnessed to tailor surface plasmon resonance, enabling precise control of the surface plasmon resonance for target reactions by dental materials against biofilms. Conclusions: Spectra analysis of AgNP formulations with different L-Arginine polymers has unveiled noteworthy shifts in UV-Visible peak absorptions that can be used to target reaction in dental biofilms.



Exploring the Relationship Between Student Engagement on Virtual Learning Environments and High-Stakes Exam Performance

Authors: Alejandra Casillas, Jaiden Magnan, Walter Leite

Virtual learning environments (VLEs) play an increasingly critical role in modern education. This study highlights the importance of student engagement in VLEs. Identifying specific engagement behaviors that correlate with higher assessment scores provides valuable opportunities to enhance student performance. The primary aim of this research was to investigate the relationship between activities that indicate student self-regulated learning (SRL) within a virtual learning environment (VLE) and their performance on a high-stakes exam. The study is specifically interested in how students used online discussion, practice questions, and video activity in a mathematics VLE. Utilizing k-means and hierarchical clustering techniques, students were classified into distinct clusters based on their interactions with the VLE. These clusters were then compared with respect to mean exam scores to assess their impact on assessment performance. The results show that students who actively engaged in making discussion posts, utilizing video, completing practice problems, and reviewing their incorrect responses problems, achieved better scores on a high-stakes algebra assessment. This study emphasizes the potential of VLE to facilitate engagement with mathematics and improve student outcomes.



Predicting Algebra EOC Outcomes Using Student Activity on Online Learning Platforms

Authors: Jason Liang, Shibani Rana, Amber Hatch, Walter Leite

---

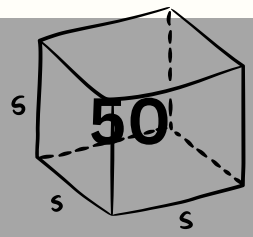
Online learning platforms provide a variety of tools to help students succeed. Among these are instructional videos, practice questions, and collaborative learning tools. With so many ways to engage with the platform, it is critical for teachers to know which of these are most conducive to learning. Our objective is to identify the actions which are most highly correlated with success on the Florida End-of-Course (EOC) Assessments.

The learning platform we examined was Math Nation, a widely used mathematics platform. Our dataset included the action logs of over 1000 students in the Palm Beach County school district over the course of a school year.

We used random forest and neural network approaches to build models to study the dataset. The neural network was built using the Keras API for TensorFlow, and is feed-forward. We used the RandomForestClassifier from scikit-learn to fit the data and evaluate the model, including area under the curve accuracy and feature importance.

Our neural network model was able to obtain an accuracy score of .89 and an F1 score of .87 when compared against the test data.

Education



Do Intelligent Tutoring Systems Benefit K-12 Students in the U.S.? A Meta-Analysise

Authors: Huibin Zhang, Shibani Rana, Yide Hao, Amber Hatch, Lingchen Kong, Huan Kuang, Walter Leite

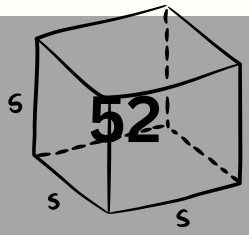
As the access to computers by U.S. K-12 students has increased in recent years, so has the potential for students to benefit from intelligent tutoring systems (ITS). Therefore, it is important to understand in which conditions U.S. students have benefited from ITS. This meta-analysis evaluated the heterogeneity of ITS effects across studies focusing on elementary, middle, and high schools in the U.S. Overall, there was a significant positive effect size of ITS on U.S. K-12 students' learning outcomes (g=0.322, SE=0.111, p=0.010). ITS used with middle school students (g= 0.357) produced a significantly lower effect compared with other grades (g=0.409). The results show support for expanding the use of ITS in U.S. K-12 classrooms..

They've Got the Power: Leveraging Servant Leader Intern and Scholar Cultural Match to Shape the Freedom School Experience

Authors: Dahlia Fabregat, Taryrn Brown, Ph.D., Erica McCray, Ph.D.

Inequality and inequity are persistent problems impacting students of color in educational spaces. For example, colorblind policies, testing frameworks created in response to No Child Left Behind, and disproportionate discipline affect the educational experiences of minoritized students on individual and institutional levels. Several interventions have been identified to mediate this, including pre-service partnerships with community groups, culturally responsive teaching practices, restorative applications, and the use of anti-racist theory in educational spaces. However, there are still limitations to intervention effectiveness, especially tied to the representation of people of color in schools.

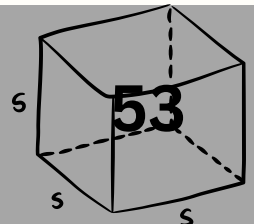
Some alternative education spaces addressing these limitations include the Children's Defense Fund's Freedom Schools, which were inspired by the 1964 Mississippi Freedom Summer Project. Currently, there are over 170 Freedom School sites across the United States, all of which aim to support underserved minority students in their community. Freedom Schools are unique academic environments; their Integrated Reading Curriculum aims to build students' reading abilities and prevent summer learning loss while offering culturally relevant representations. Additionally, they are traditionally staffed by college students who work as Servant Leader Interns (SLIs) or teachers. The purpose of this phenomenological research study is to examine the lived experiences of one Servant Leader Intern at a Freedom School in the Southeast United States in order to understand how their background uniquely supports their work within Freedom Schools and with scholars of the program. The current study is guided by two research questions: (1) What experiences do ethnically diverse SLIs describe in their work with ethnically diverse Scholars? (2) How do SLIs' lived experiences impact their work with Scholars and within the Freedom School overall? By better understanding the lived experiences of SLIs, community stakeholders can better unlock their potential to support underrepresented students.



Closing Chemistry Content Knowledge Gaps For BLV Students

Authors: Isabella Cherin, Kent Crippen

Chemistry is largely a visual content area with learning demands that involve three-dimensional molecular structures, atomic bonding, atomic structure, and gas laws which would pose a problem for blind and low-vision students. For example, congenitally blind individuals, those who are born blind or have low vision or lose vision before the age of 2 due to inherited, non-inherited generics, or birth/childhood complications, have decreased accuracy in spatial awareness and mental imagery in comparison to sighted individuals. This review of the literature explored how the need for mental imagery and spatial awareness implied by specific chemistry concepts might impact congenitally blind students and limit their ability to successfully learn and apply chemistry content knowledge. The Advanced Placement Chemistry standards supplied by the College Board were used to define Chemistry content. Each standard was assessed in terms of the need for spatial awareness, mental imagery, and sighted tasks. Findings show that congenitally blind students are likely to perform less accurately when given descriptive words compared to sighted students which we predict would result in decreased accuracy in comprehension in chemistry tasks such as looking at the atomic model. Incorrect mental models will result in an increased number of misconceptions and increased content knowledge gaps for blind and low-vision students. In order to close these gaps, students need tactile experiences to perceive the environment and create more accurate mental imagery. Complete findings are presented for each standard with recommendations for accommodations that should support these students. Experimental testing of these recommendations represents a next step for this project.
.



The Efficacy of a Sensory Processing Intervention on Children's Spirituality, Happiness and Psychological Well-Being: A Pilot Study

Authors: Paola J. Sullivan, Joseph M. Hughes, Dr. Ana Puig, Dr. Jorge Ruiz-Menjivar

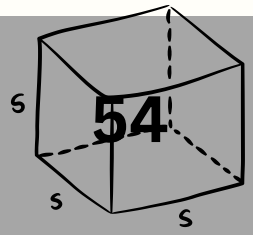
This research project explores the intricate connections between spirituality, happiness, and psychological well-being in children aged 8 to 10. Despite extensive studies in adults and adolescents, there is a notable research gap concerning children's spirituality. The study aims to investigate the effectiveness of a sensory processing intervention, using a children's book, on self-reported spirituality, happiness, and overall psychological well-being. It is based on the National Interfaith Coalition of Aging (NICA) Project's framework, which defines spirituality in four essential domains: 1) personal; 2) communal; 3) environmental; and 4) transcendental.

The research has three objectives: 1) Provide children with a mindfulness and sensory development children's book to impact sensory awareness, spirituality, happiness, and well-being; 2) Analyze children's attitudes and practices related to spirituality; 3) Support children in developing sensory awareness, spirituality, happiness, and well-being.

The study's research questions focus on the relationships among children's spirituality, happiness, and psychological well-being and whether a spiritual intervention involving a mindfulness and sensory processing children's book can enhance these aspects.

A quasi-experimental design is used, with data collected through questionnaires from 3rd, 4th, and 5th-grade students at PK Yonge Developmental School in Gainesville, Florida. Participants are randomly assigned to treatment and control groups, and data is collected before and after the intervention.

Data analysis includes descriptive analysis, normality testing, hierarchical regression, ANOVA, and missing data analysis using SPSS. The analysis will provide insights into how spirituality, happiness, and psychological well-being predict specific outcomes. The research aligns with best practices in quantitative research and aims to enhance our understanding of the relationships between spirituality, happiness, and psychological well-being in children, ultimately informing qualitative discussions.



Improper Ferroelectricity at the Monolayer Limit with Undiminished Curie Temperature in h-LuFeO3

Authors: Adriana LaVopa, Yilin Evan Li, Darrell Schlom

Ferroelectrics are materials that exhibit a spontaneous polarization, which can be reversed with the application of an external electric field. These materials show great potential for use in creating smaller, faster, and more efficient electronic devices. Improper ferroelectrics in particular exhibit complex crystal structures, which may allow them to circumvent the limitations of other ferroelectrics. Experiments consistently find a thickness limit below which proper ferroelectricity is not observed, while theoretical calculations imply the absence of such a limit for improper ferroelectricity. With this work, we demonstrate that hexagonal LuFeO3 (h-LFO) exhibits improper ferroelectricity at half-unit-cell thickness and undiminished Curie temperature. We report that the novel bottom electrode, SrCo2Ru4O11 (SCRO), promotes the growth of the ferroelectric phase of h-LFO at low thickness, while other materials, such as yttria stabilized zirconia (YSZ), iridium, and platinum, do not. Our results demonstrate an absence of critical thickness for ferroelectricity in h-LFO and provide a framework for the fabrication of ultrathin improper ferroelectrics through epitaxial engineering.

Statistical Analyses of Properties of Multicomponent Alloys

Authors: Aahan Dwivedi, James Hamlin

High-entropy alloys are a novel class of materials with five or more elements alloyed together at relatively equiatomic ratios, unlike traditional alloys with one primary element and secondary additives. These alloys have shown potential for better mechanical and functional properties than traditional alloys, but due to the sheer size of the parameter space for elemental ratios in any given alloy, it is difficult to optimize the alloy composition for desired properties.

In this work, we refine a novel statistical and machine learning model to predict the lattice constant for a specific high-entropy alloy, the Cantor Alloy (CrMnFeCoNi), as a function of its elemental ratios. Initially, the method is used to analyze single substitutions of the alloy. Expanding from that, it is then applied to a range of compositions for the alloy found in literature, no longer restricted to the single-substitution criteria.

We find that the regression serves as a fair predictor of lattice constant for the single-substitution case, successfully isolating a coefficient for each element in the alloy and having reasonably accurate predictions. However, in the general case, the accuracy of this method is significantly reduced. Although the coefficients found by the model are still relatively similar to those in the single substitution case, it is not able to predict the lattice constant nearly as well.

Automated Electroplating System for the Fabrication of Multiple Nanolayered Metaconductors

Authors: Ariel David Cerpa, Harry Friedman, Saeyeong Jeon, Alex Wilcher, Yong-Kyu Yoon,

The objective of this research project is to develop an automated electroplating system (AES), aiming to replace the current manual procedure, for the fabrication of multiple nanolayered metaconductors. This transition is expected to offer significant advantages to individuals involved in the electroplating process primarily through a substantial reduction in the time required for the electroplating process.

The system is comprised of a three-axis linear motion system, two hotplates/stirrer, and a sourcemeter all of which are connected to a microcontroller. The microcontroller is paired to a computer with the AES graphic user interface (GUI) through Bluetooth wireless communications. The user can input their plating sequence in the system through the GUI, and the system will execute the sequence when the user sends the “Start Sequence” command.

The project will compare plated samples done with the AES and one done manually. While it is not expected to observe any significant differences in quality and functions between those samples, it is anticipated that the samples done using the AES will be more uniform since there is less variation in each sequence. This uniformity will offer better qualities of electroplated metaconductors materials and devices.

Humanized Injectable Hydrogel for Injured Spinal Cord Regeneration

Authors: Kennedy Moes, Gopal Agarwal, Christine E. Schmidt

TSpinal cord injury (SCI) affects over 299,000 patients globally. However, to date there is no treatment available that can promote locomotor recovery after SCI. In this project, we aim to develop a clinically translatable injectable hydrogel that can provide pro-regenerative cues for promoting axonal regeneration. Decellularized human sciatic nerve (dHSN) based allograft do exists and have shown potential in peripheral nerve regeneration. However, fabrication of injectable hydrogel using dHSN is still a challenge. In this proposal, human sciatic nerves were obtained from NDRI tissue bank. The nerves were then decellularized modifying our previous protocol for rat peripheral nerves, in brief adding a delipidation step and increasing the time of each wash. To test the efficiency of the decellularized process, DAPI stain was performed on resulting decellularized nerve segment and compared with fresh nerve. Confocal imaging revealed absence of DAPI staining in decellularized nerves, demonstrating devoid of nuclei presence in decellularized nerves. In future, we plan to perform Oil Red O staining (for estimation of lipid remnants), extracellular marker staining (Collagen I, Collagen IV and laminin), and analyze the potential of decellularized human peripheral nerve matrix to digest and form injectable formulation. We anticipate that developing injectable formulation using dHSN is a clinical viable biomaterial-based approach for SCI regeneration in patients.

Evaluating the synthesis of granular silk fibroin scaffolds for applications in tissue engineering

Authors: Cathrine A Beshay, Marisa O Pacheco, and Whitney L Stoppel

Naturally derived silk fibroin materials from the cocoons of Bombyx mori have been formulated into particles, scaffolds, and hydrogels for a variety of applications in regenerative medicine and tissue engineering. Silk fibroin nanoparticles can be used for encapsulation and controlled release of bioactive compounds. We have taken this a step further, generating granular scaffolds that maintain this controlled release behavior while also stabilizing the nanoparticles in a sponge-like matrix that allows for targeted cell-material interactions or alternative particle delivery strategies. The mechanical tunability afforded by the silk fibroin allows for adjustments in particle size, particle fraction, and scaffold porosity in this two-part system. We investigated the extent to which key particle synthesis steps, such as extraction time and probe sonication-based phase separation, impact particle size and the properties of formed granular scaffolds. The molecular weight and the consequent particle size range resulting from the varying extraction times of 30, 60, and 90 minutes were analyzed with dynamic light scattering (DLS) and scanning electron microscopy (SEM). Granular scaffolds were then prepared by packing and lyophilizing particle suspensions. Resulting particle fraction and porosity were evaluated through histology and scanning electron microscopy. Future work will evaluate the controlled release properties and cell-material interactions.

Microstructural Characterization of High Yield Strength Steels Undergoing Temper Embrittlement

Authors: Shannon Gerard, Aroba Saleem

High-strength steels are essential for pressure vessels, such as nuclear reactors and submarines, to endure extreme environments. Steel undergoes a phenomenon when exposed to a certain temperature range for a long time, in which impurity elements accumulate at grain boundaries leading to increased brittleness at these boundaries. This results in decreasing the toughness of the material, therefore causing temper embrittlement. As the steel ages, the potential for cracks and fractures grows, amplifying the severity of minor accidents. To better understand the microstructural changes due to temper embrittlement of HY80 steel, a study was conducted with five steel samples heat-treated to varying degrees of embrittlement at 525 °C. The microstructural changes were first characterized with the Scanning Electron Microscope (SEM) and Electron Backscatter Diffraction (EBSD), then the consequential change in mechanical properties was evaluated with Vickers Microhardness and Charpy Impact tests.

Applications of magnetic nanoparticles and magnetic particle imaging for tracking alterations in blood flow

Authors: Isabelle Gerzenshtein, Marisa O. Pacheco, Carlos Rinaldi-Ramos, and Whitney L. Stoppel

Efficient and reliable assessment of altered or impeded flow of blood throughout the body, known as assessment of blood pooling in areas with a lack of blood flow, is essential in the diagnosis of patients across a variety of conditions. Current imaging modalities used to visualize accumulation of blood at places of injury or in disease (e.g., haemorrhagic cysts) include ultrasound, positron emission tomography (PET) scans, and magnetic resonance imaging (MRI). Limitations such as limited imaging depth and long scan times continue to motivate development of novel imaging modalities.1, 2 Magnetic particle imaging (MPI) is a promising tracer-based imaging modality that detects linearly quantitative signal of superparamagnetic iron oxide nanoparticles (SPIONs) due to the opposing magnetic fields generated by the instrument.2 MPI is well-suited to overcome constraints of other imaging techniques by allowing for high temporal resolution, nanoscale spatial resolution, and minimal tissue background signal. In this presentation, we summarize the current state of MPI as it relates to blood pool imaging for cardiovascular applications, highlighting recent developments in the field of MPI tracer optimization. We provide perspective on areas for future research where tracking internal bleeding or lack of blood flow will improve patient diagnosis.

References:

1. Han X, Li Y, Liu W, Chen X, Song Z, Wang X, Deng Y, Tang X, Jiang Z. The Applications of Magnetic Particle Imaging: From Cell to Body. Diagnostics (Basel). 2020;10(10). Epub 20201009. doi: 10.3390/diagnostics10100800. PubMed PMID: 33050139; PMCID: PMC7600969.

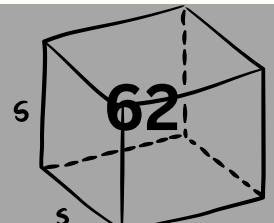
2. Panagiotopoulos N, Duschka RL, Ahlborg M, Bringout G, Debbeler C, Graeser M, Kaethner C, Lüdtke-Buzug K, Medimagh H, Stelzner J, Buzug TM, Barkhausen J, Vogt FM, Haegele J. Magnetic particle imaging: current developments and future directions. International Journal of Nanomedicine. 2015;10(null):3097-114.

Low Temperature Esterification Synthesis of Iron Oxide Nanoparticles for Prospective Use in Magnetic Particle Imaging (MPI)

Authors: Emma Keiser, Webley Woods, Ambar C. Velazquez-Albino, Eric Imhoff, Carlos M. Rinaldi-Ramos

Magnetic Particle Imaging (MPI) is an imaging technology being developed for medical applications that relies on the dynamic magnetization of superparamagnetic iron oxide nanoparticle (SPION) tracers. . These tracers are biocompatible and their surface can be tuned for various applications, including tracking cell therapies, magnetic fluid hyperthermia, and blood pool imaging. The specificity of their potential roles within the body requires reproducible synthesis and surface modification methods. To improve MPI performance, tracers with fine control of shape, size, and uniform magnetic properties are needed. Here, we explore a method for continuous and controlled synthesis, where esterification reactions between iron oleate and oleyl alcohol promote metal hydroxide formation and initiate nanocrystal growth. The well-defined reaction mechanism allows for tracking of reaction progress through FTIR , in contrast to thermal decomposition, the most used method for synthesis of high-quality MPI tracers. Additionally, the lower temperatures used in the esterification synthesis should avoid the undesired decomposition of solvents and surfactants that occurs in thermal decomposition synthesis , which could facilitate surface modifications. Overall, the esterification reaction can provide a higher level of control over the synthesis and resulting SPIONs, which has potential for reproducibly obtaining tracers with improved MPI performance.

Engineering

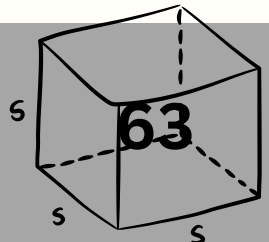


Highly Angle Dependent Structural Color Via Application of Aerogels in High-Low-Absorber Resonator

Authors: Sean Clark, Jennie Paik, Wei-Jie Feng, L. Jay Guo

Structural color is an environmentally friendly and non-toxic choice for coloring a surface, and Fabry-Perot trilayer structural colors are an incredibly versatile and offer a unique and eye-catching angle dependent chroma that is impossible with other methods. A Fabry-Perot trilayer is made of a partially reflective substrate, on top of which is a low refractive index optical cavity, and a transparent partial reflector above. In most cases this transparent reflector is a very thin film of a high refractive index material, as the Fresnel effect allows both the partial transmittance through the medium and towards the viewer, as well as the internal reflection of light. A specific wavelength of light is resonant to the internal cavity, determined by the cavity depth and will be trapped against the two reflectors, and as a result, will be omitted from the spectrum. This spectrum change would be visible to the viewer via the subtractive color effect. The virtual cavity depth is also affected by the angle of viewing, as well as the effects of refraction within the dielectric layer, as diffraction would bend the light downward into the substrate, shortening the virtual cavity depth. Because of this, the effective limit of the virtual cavity depth variance from normal to parallel view and in turn, the range of colors the FP trilayer can display lies in how low the middle layer's refractive index can be. Utilizing recent developments in spin-coated thin film aerogels, we have explored synthesis of ultra-low refractive index (RI ≈ 1.06 @ 589nm) thin films, from which we tested novel methods of deposition of the upper layer to construct a highly angle-dependent chromatic surface. The optical properties were measured using ellipsometry, and angle reflectance spectroscopy, while the physical characteristics were measured using methods like SEM and TEM.

Engineering 63



Effect of Duplex Region Phase Volume Fraction on the Properties of Bioresorbable Mg-Li-Zn Alloy

Authors: Skye Sisco, Sochima Ezenwajiaku, Michele Manuel

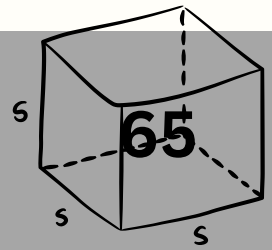
Magnesium (Mg) has been identified as a promising element for bioresorbable implants, which have the potential to eliminate the need for permanent implants or secondary removal surgery. Pure metallic Mg naturally degrades in the environment of the human body but possesses a rapid degradation rate and poor ductility, making alloying necessary. Additions of 5-10 weight percent (wt.%) lithium (Li) to Mg improves its ductility. Zinc (Zn) additions can improve corrosion resistance and mechanical strength. For this study, Mg-xLi-2 wt.% Zn (x= 6.2, 7.5, and 9 wt.%) alloys were cast and heat treated. Their microstructure, mechanical properties, and degradation rates were studied to investigate the effects of composition and phase fraction on properties. Data shows a decrease in corrosion rate and yield strength, along with an increase in elongation, with an increase in Li content. Results suggest that small changes in phase volume fraction have a significant impact on ductility and degradation with a small effect on strength. These results indicate that working within the duplex region is promising, and further investigation is needed to evaluate mechanisms of balancing biological, material, and mechanical properties.

The Interplay of Mechanosensitivity and YAP Expression in Human Non-Small Cell Lung Cancer

Authors: Miao Huang, Heyang Wang, Chase Stallings, Cole Mackey, Quang Vo, Mu Yu, Xin Tang

PC9 Non-Small Cell Lung Cancer (NSCLC) is not usually mechanosensitive. However, recent studies suggest nuclear concentration of mechanosensitive protein YAP increases in drug-treated PC9 cells, indicating potential mechanosensitivity. Our study sought to investigate the mechanosensitivity of drug-resistant PC9 NSCLC cells by observing how YAP expression and location are influenced by substrate stiffness. To achieve this goal, YAP was tagged with mNeonGreen2 fluorescent protein to be viewed with a fluorescence microscope, then drug-resistant cells were selected from parental culture by exposing the PC9 cells to increasing AZD9291. Selected and non-selected cells were seeded onto 5kPa polyacrylamide hydrogels (representing soft substrate) and glass (representing stiff substrate) and allowed to adhere for 48-72hrs. After adhesion, fluorescence microscopy and ImageJ software were used to quantify and compare nuclear and cytoplasmic YAP concentrations to obtain N/C ratios in each cell. Results found no significant difference in YAP N/C ratio on 5kPa gel versus glass in non-selected cells, indicating that regular PC9 cells are not normally mechanosensitive. Importantly, however, YAP N/C ratio increased significantly with substrate stiffness in selected cells, indicating YAP migration from cytoplasm to nucleus in response to stiffer culture substrate. We conclude that PC9 NSCLC cells that successfully resist drug treatment become mechanosensitive, and that PC9 being mechanosensitive allows application of mechanical stimuli to affect YAP expression. Future directions include exploration of methods of YAP denuclearization via mechanical stimuli as a pathway to reverse drug resistance.

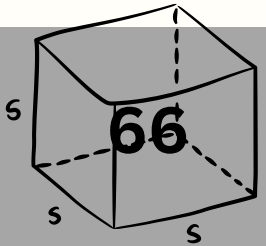
Engineering 65



Spacer-only diagnostics with CRISPR-Cas12i

Authors: Carlos Orosco, Santosh R. Rananaware, Vedant N. Karalkar, August P. Bodin, Lilia G. Yang, Minji Chang, Zoe R. Fang, Ian H. Lange, Piyush K. Jain

Type V CRISPR-Cas systems, such as Cas12a, Cas12b, and Cas12c, have been established tools in CRISPR-based nucleic acid diagnostic platforms. During our investigations into the diagnostic capabilities of CRISPR-Cas12i, an understudied member of the type V CRISPR-Cas system, we serendipitously discovered that introducing only the spacer of the guide RNA, without its scaffold, induced selective trans-cleavage upon recognition of ssDNA targets in cis, but not dsDNA. Leveraging this discovery we engineered a diagnostic platform pioneering the use of short endogenous RNAs, particularly miRNAs, as surrogate guides for nucleic acid detection. With our new approach, we precisely detected synthetic mimics of clinically relevant miRNAs such as miR-21, miR-155, and miR-122 by simply supplying Cas12i and a short single-stranded cDNA to the miRNA-rich sample to initiate a trans-cleavage reaction. Our methodology provides an economical avenue for nucleic acid diagnostics by utilizing endogenous RNA as a guide for Cas12i, circumventing the need for complex guide RNA synthesis. Our work contributes to the expanding toolkit of Type V CRISPR-Cas systems for nucleic acid research and highlights the distinctive attributes of CRISPR-Cas12i.



Gait Analysis of Male Sprague Dawley Rats Treated with Intra-Articular Delivery of Indoleamine 2,3-Dioxygenase Galectin-3 Fusion Protein for Osteoarthritis Treatment

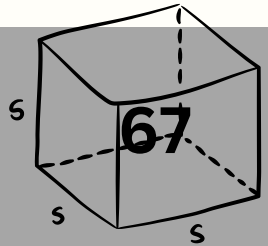
Authors: Jonathan O. Cooper; Carlos J. Cruz; Kyle D. Allen PhD

Chronic osteoarthritis (OA) inflammation causes disability and pain, often leading to compensatory gait changes. Current OA treatments are unable to deliver long-term alleviation, presenting the need to find a treatment. Our research investigated a potential preventative disease-modifying treatment, indoleamine 2,3-dioxygenase galectin 3 (IDO-Gal3) fusion protein, to target joint inflammation. We hypothesized that reducing joint inflammation using IDO-Gal3 may prevent OA-related gait compensations.

Male Sprague Dawley rats (N = 16) had OA surgically induced via a medial meniscus tear and medial collateral ligament transection. One week post-surgery (week 0), animals were split into two groups: 1) IDO-Gal3 (n = 8) and 2) saline (n = 7) via intra-articular injections. Walking gait was collected before surgery (baseline), pre-treatment (week 0), and then weekly after treatment for four weeks. Gait trials were collected using a highspeed camera (500 fps) and a three-component force panel instrumented gait arena. Videos were analyzed using our open-source software Automated Gait Analysis Through Hues and Areas (AGATHA) to calculate gait parameters (e.g., stride length, percentage stance time).

At week 4, IDO-Gal3-treated rats tended to walk with shorter stride lengths than vehicle-treated rats; also, IDO-Gal3-treated rats tended to spend more time walking on their OA and non-OA limbs. For all weeks, both groups displayed symmetric and balanced walking gait.

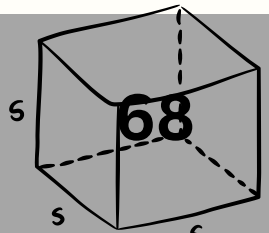
Our research investigated the effect of a disease-modifying preventative treatment, IDO-Gal3, on OA-related gait compensations. Our preliminary findings suggest that IDO-Gal3-treated rats walked with greater OA gait compensations. Specifically, IDO-Gal3-treated rats walked with shorter stride lengths and increased stance times on both limbs. These results may suggest that IDO-Gal3-treated rats displayed more of a shuffle-stepping gait compensation than vehicle-treated rats, although these results are inconclusive. Future work is ongoing for additional data analysis and determining statistical findings.



CODEX and H&E Imaging: Cell Type Mapping, Analysis, and Visualization Pipeline

Authors:Julio A. Maragall, Nicholas Lucarelli, Samuel Border, Myles Joshua T. Tan, Seth Winfree, Zoltan Laszik, Michael Eadon, Tarek M. El-Achkar, Sanjay Jain, and Dr. Pinaki Sarder

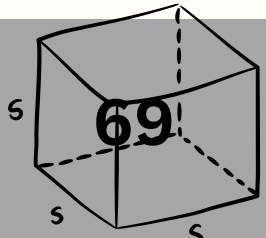
Spatially resolved molecular imaging has provided an unprecedented view into the intricate cellular neighborhoods in histological sections. Techniques like Co-Detection by Indexing (CODEX) present a holistic view of tissue histology at the slide-level. However, the vast data from CODEX, encompassing up to 60 molecular markers, challenges the analysis process. We hypothesized that an advanced analytics pipeline can efficiently process and extract insights from CODEX-generated whole-slide imaging data, revealing cellular heterogeneity in kidney histology. Our pipeline commences with the semantic segmentation of H&E-stained tissue WSIs, transitioning to image registration with corresponding CODEX images. From the registered images, we extracted the spatial location of segmented nuclei, using it for feature extraction from 44-channel CODEX images (sourced from a dataset at Indiana University). Image features underwent reduction using UMAP (Uniform Manifold Approximation and Projection) before unsupervised clustering analysis. Subsequently, results were mapped back to histological tissue images. Our analysis identified 14 distinct cellular clusters. An intriguing observation was the high alignment between labeled objects and specific markers: notably, 88% of podocytes resided in a primary cluster in UMAP space, adjacent to clusters dominated by renal vasculature cells. Of the 626 features analyzed, 44 were pivotal to the "podocyte" cluster, accounting for about half of its variance ($p<0.05$). Our pipeline showcases promising potential in yielding profound cellular insights. Conclusively, our pipeline exhibited exciting potential to provide deep cellular insights that enhance kidney research and patient care.



Localized delivery of immunomodulatory Indoleamine 2,3 dioxygenase loaded within injectable hydrogels for ameliorating neuroinflammation in injured spinal cord

Authors:Steven Robles Blasini, Gopal Agarwal, Allison Campbell, Arun Wanchoo, Jacob Fuhr, Benjamin Keselowsky, Prodip K. Bose, Christine E. Schmidt

Spinal Cord Injuries (SCI) affect around 300,000 patients globally and there is no treatment available to promote full locomotor recovery. After SCI, neuroinflammation and glial scar formation inhibit axonal regeneration, hindering locomotor recovery. Indoleamine-2,3-dioxygenase (IDO) is an enzyme that is upregulated due to proinflammatory cytokines released after injury as a feedback mechanism to maintain homeostasis in the tissue microenvironment. The IDO enzyme was functionalized with galectin 3 fusion (Gal3) to enhance tissue localization, mediated by Gal3 binding with proteoglycans. IDO-Gal3 has previously been able to suppress local inflammation in osteoarthritis but the therapeutic benefit of IDO/IDO-Gal3 enzyme still needs to be evaluated. Our lab has developed injectable hydrogels from decellularized nerve tissue (iPN), that can provide pro-regenerative cues like collagen I, laminin, and provide a slow, sustained release of IDO-Gal3. We aim to analyze the effect of localized delivery of IDO-Gal3 using iPN in ameliorating neuroinflammation in injured rat spinal cords. In-vitro studies have shown that iPNs were able to release IDO-Gal3 for up to 2 days on PBS. Sprague Dawley female rats were used to model moderately contused SCI in the T9-T11 thoracic region. Around 6µg of IDO-Gal3 were loaded within iPN and administered using a Hamilton syringe after 1 week of injury at the injury site. 5 weeks after injury, the spinal cords were fixed and stained with neuroinflammation markers of astrocytes (GFAP) and microglial cells (CD206, CD86). iPN+IDO+Gal3 were shown to have significantly lower GFAP expression compared to injured-only animals. No significant difference was seen in CD206/CD86 expression in animals treated with iPN+IDO-Gal3 as compared to only injured animals. In the future, we plan to analyze the effect of iPN+ IDO-Gal3 on axonal regeneration and locomotor recovery. The success of this project will lead to a therapeutic regime that can promote locomotor recovery in SCI patients.

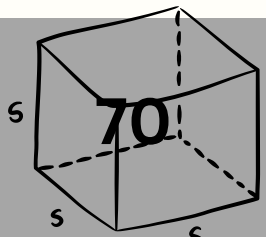


Co-assembled Peptide-Protein Granules for Intracellular Delivery

Authors:Madisen R. Domayer, Renjie Liu, Gregory A. Hudalla

Intracellular delivery of protein therapeutics has many challenges and limited availability until now. The current methods utilize electroporation, delivery vehicles that facilitate protein escape from intracellular vesicles during endocytosis (i.e., endosomal escape), or highly charged peptides that mediate direct protein crossing of the cell membrane [1]. Key challenges with these approaches include low delivery efficiency, cytotoxicity, or both. In addition to high delivery efficiency and cytocompatibility, an ideal intracellular delivery vehicle would require low amounts of protein, maintain protein activity during internalization, and work universally with various cell types (e.g., adherent and suspended). Here we will present our research developing co-assembled peptide-protein granules for intracellular delivery. These granules are based on a series of charge-complementary co-assembling peptide pairs, known as “CATCH (+/-)”. When combined in solution, CATCH peptide pairs co-assemble into supramolecular biomaterials, including nanofibers and fibrillar hydrogels [2-4]. Here we will show that the CATCH(+) peptide and protein with a CATCH(-) fusion tag can co-assemble into nanoscale granules in the presence of macromolecular crowders.

A mixture of CATCH(6+) peptide, CATCH(-)-GFP, and PEG produces nano-scale supramolecular granules. Granule shape, size, and assembly kinetics are affected by the molecular weight and concentration of PEG used, demonstrating that the system can be controlled. As the molecular weight of PEG increases, the granules form faster and are larger in size. Higher concentrations of PEG produce the same effect. Granules formed in mixtures of CATCH(6+) peptide, CATCH(6e-)-GFP, and PEG did not induce death of NIH3T3 fibroblasts (i.e., were cytocompatible). After 24 hours of treatment with granules, more than 90% of NIH3T3 cells were GFP positive. CATCH peptide-protein granules yielded greater GFP delivery efficiency and induced less cell death than other methods, such as cell penetrating peptides and electrophoresis.



Parameters influencing the solubilization of Plodia interpunctella silk fibroin for biomaterial applications

Authors:Adelyn L. Richgels, Andrea A. Orozcotorres, Lauren E. Eccles, Whitney L. Stoppel

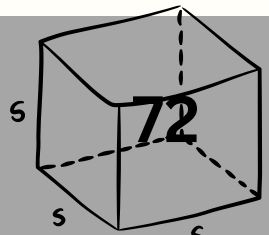
Biomaterial design has been a focus in medicine for tissue engineering and drug delivery applications, with shifts to investigate the potential of natural biopolymers for material fabrication. Silk-based biomaterials have been studied due to their mechanical properties, biocompatibility, and biodegradability that prove advantageous in a variety of applications. This field is largely dominated by the study of the Bombyx mori (Bm) silkworm due to its prominence within the textile industry. Despite its wide range of functionality, low environmental control on Bm rearing limits the consistency of its silk fibers. To address this, we study the potential of Plodia interpunctella (Pi) as an alternative silk fiber source. Pi can be reared in a controlled laboratory setting, with these efforts establishing basic methods to generate silk fibroin solution from Pi silk fibers. This work aims to address on-going challenges with complete resolubilization of silk fibroin. We examine the principles of protein solubilization, primarily through the Hofmeister series, to improve our reproducibility and consistency. Parameters such as solvent, concentration, temperature, and dialysis methods are investigated to establish consistent solubilization protocols. Resulting silk fibroin solutions are used to create silk-based particles, films, and sponges, highlighting the potential of Pi silk in the biomaterial field.

Environmental Applications of Biochar

Authors: Camil Coss Flores, Yue Zhang, Bin Gao

This study investigates the potential of biochar and hydrochar, produced from banana peels, as solutions for mitigating food waste and reducing greenhouse gas emissions. Annually, one-third of all food produced is wasted, leading to a loss of $240 billion in the United States alone. This waste also contributes to the food system's responsibility for a quarter of greenhouse gas emissions. Biochar and hydrochar offer a cost-efficient way to capture carbon from our atmosphere, utilizing organic waste as feedstock. Biochar is derived from the pyrolysis of biomass under an oxygen-limited atmosphere. It is gaining more attention in environmental remediation, due to its advantages of large specific surface area, high adsorption performance, and low cost. Hydrochar is a special type of biochar that is produced by the hydrothermal carbonization process. This process is carried out at relatively mild temperatures and low pressure. Both processes convert organic waste into valuable carbon-based products while minimizing greenhouse gas emissions. In this work, banana peels were collected from the University of Florida’s dining halls to produce biochar and hydrochar. The peels were cleaned, dried, and milled before undergoing pyrolysis or hydrothermal carbonization. The adsorption capacity of the resulting biochar and hydrochar for Methylene blue (Organic dye) in water was investigated via batch adsorption experiment, and the adsorption dynamics were depicted using kinetic models. The results showed that the kinetics of Methylene blue adsorption onto the biochar and hydrochar samples consisted of two stages: rapid adsorption and slowing adsorption. The pseudo-second order and the Ritchie models best fit the experimental data. This research provides valuable insights into the potential of biochar and hydrochar as solutions for mitigating food waste and reducing greenhouse gas emissions. Further research is needed to optimize these processes and explore their potential applications in various industries.

Engineering

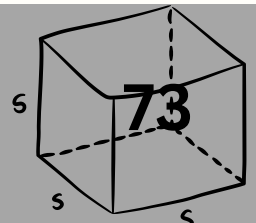


Injectable Decellularized Porcine Peripheral Nerve Based Hydrogel for Schwann Cells Delivery in Injured Spinal Cord

Authors: Samantha Shumard, Gopal Agarwal, Steven Robles Blasini, Olivia Osborne, Michaela W. McCrary, Jorge Mojica Santiago, Breanna Ausec, Christine E. Schmidt

Schwann cells (SCs) are currently studied in clinical trials for spinal cord injury treatment, however, the major lacunae of direct SCs transplantation are their lower retention (only ~5-34%) and viability at the site of injury. In this study, we aim to fabricate injectable hydrogel using decellularized porcine peripheral nerves and evaluate its potential for SCs delivery in injured spinal cord. To achieve this, porcine peripheral nerves were decellularized and delipided nerves and digested using pepsin acid solution for 48 hours at room temperature, neutralized to a pH 7.6, and concentration was adjusted to 10 mg/mL using 1X PBS. To biomimic the mechanical strength, genipin was used as a crosslinker and the gelation kinetics and injectability of the hydrogels were measured using frequency sweep and shear thinning property respectively. The mechanical strength of genipin crosslinked hydrogel biomimic the native spinal cord tissue and was higher than uncrosslinked hydrogel, as well as the gelation kinetics of genipin crosslinked hydrogels was faster than uncrosslinked hydrogel. Additionally, genipin and uncrosslinked hydrogels showed shear thinning properties, demonstrating injectability. SCs viability in uncrosslinked and genipin crosslinked hydrogels will be evaluated using Alamar Blue reagent and Live Dead staining. In vitro biodegradation of genipin and uncrosslinked hydrogels incubated in 1x PBS will be evaluated by measuring the difference in mass of hydrogel at different time points. Also, we aim to study the efficiency of developed injectable formulation to efficiently deliver SCs in contused rat spinal cord. We anticipate that the developed injectable hydrogel has clinical translational potential to deliver various therapeutics including SCs.

Engineering

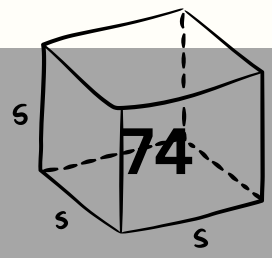


Investigating the role of hepatic stellate cells in liver remodeling after Leishmania donovani infection

Authors: Joshua Ruley, Tia Monjure, Javier Rosero, Peter E. Kima Ph.D., Ana Maria Porras Ph.D.

Visceral Leishmaniasis, a tropical disease caused by the Leishmania donovani (Ld) parasite, affects over 600,000 people annually, causing liver and spleen enlargement in infected hosts. Despite its 95% mortality rate, the disease remains understudied, and the mechanisms of disease progression are currently unknown. Characterization of the liver's structure before and after infection revealed an increase in extracellular matrix (ECM) remodeling as the disease progresses. These results identified hepatic stellate cells (HSCs), the ECM producing cells of the liver, as possible role players in Ld infection. We hypothesize that HSCs become more activated, thus producing more ECM, as Ld infection progresses. To test this hypothesis, we selected the LX-2 hepatic stellate cell line due to its widespread use and cost efficiency relative to other HSC lines. HSC samples were infected with Ld parasites for 24, 48, and 72 hours. In order to evaluate the success of the infection, we developed a custom MATLAB script to determine the infection rate of our samples. The script is able to automatically identify parasite and HSC nuclei, and compare their locations to determine infection rates. Next, HSC activity was assessed at each time point by quantifying the levels of alpha-Smooth Muscle Actin (α-SMA), a protein associated with cell activity. We saw an initial increase in α-SMA between the uninfected control and the 24 hour sample. However, we saw a decrease in α-SMA between the 24 and 72 hour timepoints, suggesting activity may decrease over the course of the infection . To support the data from this experiment, we will quantify other markers for cell activity, using ELISA and proliferation assays. In all, the results of this study provided us with a better understanding of how Ld affects the liver in infected hosts, and will inform future experiments that investigate the mechanisms of Leishmaniasis progression.

Engineering

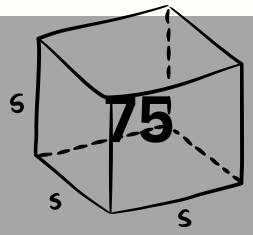


A Behavioral Analysis of an Injectable Therapeutic for Spinal Cord Injury In Vivo

Authors:Izabela Zmirska, Allison Campbell, Gopal Agrawal, Jacob Fuhr, Prodip Bose, Benjamin G. Keselwosky, Chirstine E. Schmidt

There are approximately 300,000 Americans living with spinal cord injury (SCI), a life-altering and debilitating central nervous system injury. Currently, the standard of care for patients is acute steroid administration and analgesics for temporary pain relief. Unfortunately, there is no cure for SCI. Indoleamine 2,3- dioxygenase (IDO) is a promising regulator of the immune response in SCI due to its ability to reduce pro-inflammatory potentiation and induce pro-regenerative immune cell phenotypes. When functionalized with Galectin-3 (Gal3), local tissue retention is increased through glycosaminoglycan binding. Another potential therapeutic utilizes injectable decellularized rodent sciatic nerve hydrogels (iPN) that can be mechanically tuned to match native spinal properties, providing the right physical environment for nerve regeneration. By examining how IDO-Gal3, iPN, and IDO-Gal3+iPN hydrogels function in rodent models with SCI, we can determine their effectiveness as a SCI therapeutic. From a behavioral perspective, this is done by analyzing the performance of rodents over the course of 5 weeks post injury. Specifically, the horizontal ladder (HL) test and Basso, Beattie and Bresnahan (BBB) locomotor scale were used to quantify behavior. In a small sample of preliminary data (n=3), overall behavior trends were positive with treatment. Unfortunately, no statistical significance was observed between treatment groups. The use of a larger cohort may reduce animal response variability, and hopefully provide statistically significant results. .

Engineering



Using Machine Learning to Aid Development of Near-Infrared Fluorescent Nanosensors for Oxytocin

Authors: Xavier Velez, Jaquesta Adams, Payam Kelich, Lela Vukovic, Markita Landry

Oxytocin, a neuropeptide widely linked to pro-social tendencies, has substantial effects on our ability to regulate our emotions and behaviors. However, established methods of measuring neuropeptides lack high spatiotemporal resolution, which is necessary for detecting oxytocin signaling events and understanding inter-neuronal communication. Corona phase molecular recognition is a phenomenon in which an aptamer (ssDNA or ssRNA) attaches to a single-walled carbon nanotube (SWCNT) and forms a binding pocket for a given analyte (i.e., oxytocin), enabling imaging via near-infrared fluorescence modulation. However, the near-infrared fluorescent response from the carbon nanotubes is dependent on the aptamer, which is chosen from a pool of approximately 1010 ssDNA sequences. The Landry Lab previously used an in vitro selection technique to identify a set of aptamer-SWCNT constructs with high oxytocin binding affinity from the large ssDNA pool. We hypothesized that using machine learning to predict candidate aptamers would reveal novel sensors with a high response to oxytocin, defined by at least a 160% increase in fluorescence at the 1195 nm wavelength. Using machine learning pipelines from the Vukovic lab, 19 ssDNA sequences were predicted to have a high binding affinity to oxytocin. 14 were found to have met the criteria for a high responder, resulting in a 73.7% hit rate. While further characterization of the responsive sensors is needed, these initial results suggest that a machine learning approach to aptamer selection may be more efficient and effective than a manual approach. Further use of machine learning methods may continue to reveal responsive nanosensors for other neurotransmitters, enabling a more comprehensive understanding of the role neurotransmitters play in behaviors and disorders.

Flow Through Reactor Design for Oxygen Diffusion Assessment of Silk Fibroin Hemoglobin-Based Oxygen Carriers (sfHBOC)

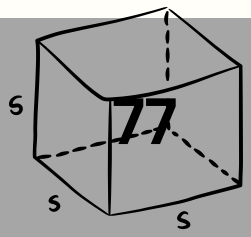
Authors: Travis D Truong, Marisa O Pacheco, Whitney L Stoppel

Hemoglobin based oxygen carriers (HBOCs) have shown promise in addressing critical issues in healthcare as oxygen therapeutics.1 These molecules are designed to mimic the oxygen carrying capabilities of hemoglobin in red blood cells, providing potential for treating diseases and injuries related to hypoxia, acute blood loss and other hematologic conditions. Our group demonstrated that silk fibroin nano- and microparticles isolated from Bombyx mori silkworm cocoons are able to act as a carrier for hemoglobin.2 Precise and accurate release of oxygen by these oxygen carriers is an important property in its application in medicine. Our work aims to assess the time dependent oxygen diffusion and binding kinetics of our sfHBOCs based on particle size and level of hemoglobin incorporation. Using computer aided design (CAD) and 3D printing, a flow through reactor has been designed, intended for use in assessing the diffusive properties of our sfHBOC system. Charged particles will be packed into this flow through reactor with PreSensO2 oxygen sensors placed at the inlet and outlet in order to measure oxygen release of the system. With this data we will be able to assess the relationship between particle structure and O2 transport.

1. Remy B, Deby-Dupont G, Lamy M. Red blood cell substitutes: fluorocarbon emulsions and haemoglobin solutions. Br Med Bull. 1999;55(1):277-98. Epub 2000/03/01. doi: 10.1258/0007142991902259. PubMed PMID: 10695091.
2. Pacheco MO, Lutz HM, Armada J, Davies N, Gerzenshtein IK, Cakley AS, Spiess BD, Stoppel WL. Silk Fibroin Particles as Carriers in the Development of All-Natural Hemoglobin-Based Oxygen Carriers (HBOCs). bioRxiv. 2023. Epub 20230302. doi: 10.1101/2023.03.01.530637. PubMed PMID: 36909572; PMCID: PMC10002772.

.

Engineering

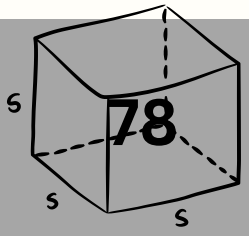


Exploring the Effects of A Mras Mutation via Proteomics and Phosphoproteomics Analysis

Authors: Dylan Tan, Teresa Lee, Xiao Fan

Mras, a gene in the Ras/MAPK pathway, is a potential contributor to the development of cardiomyopathy. Our research sets out to investigate the potential effects of a cardiomyopathy predisposition gene Mras to support future research and gene therapy efforts. We introduced a G23V missense mutation in the Mras gene of 8 house mice (Mus musculus) through base editing techniques. The mice were split into 4 males and 4 with 8 controls split up into 4 males and 4 females. The protein counts and phosphorylation levels were collected via mass spectrometry and subsequently passed through MaxQuant's workflow for proteomics and phosphoproteomics respectively. The protein abundance was normalized using label-free quantification (LFQ) techniques before we performed differential expression analysis, Gene Ontology (GO) analysis, and Kyoto Encyclopedia of Genes and Genomes (KEGG) analysis in R using Bioconductor packages. For phosphoproteomics we used MaxQuant's Perseus platform to perform pre-processing, such as normalization, imputation, and Analysis of Variance (ANOVA) tests for possible sex bias, differential phosphorylation via two-sample t-tests, and visualization via heatmaps and profile plots. We identified 50 differentially expressed proteins, 159 enriched protein sets from GO analysis, and 13 enriched pathways from KEGG analysis. Three proteins were found to be differentially phosphorylated, however 5 other proteins were demonstrated to be correlated to Mras phosphorylation levels. Notably, via proteomics analysis, it was found that when Mras was upregulated, Hras, another protein within the Ras/MAPK pathway, was downregulated, suggesting a potential complementary relationship in their functional roles. It is important to emphasize that while our research yields valuable insights, further studies are imperative to validate and build upon these preliminary results.

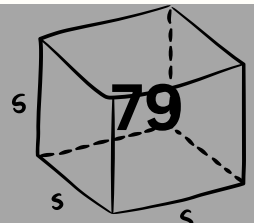
Engineering 78



Engineering 3D Hydrogels of Varying Stiffness to Investigate Cancer Cell Behavior

Authors: Gabriella Flinn, Suzanne Lightsey, Madison Temples Ph.D., Sharma Blanka Ph.D.

Lung cancer is the leading cause of cancer-associated death and is the second most common cancer type. Tumors vary in stiffness throughout their life cycle and differ between primary and metastatic tumors. Traditionally cells are cultured in a 2D environment, but this fails to accurately represent tumor properties, such as the tumor microenvironment, stiffness, etc. The goal of this study was to engineer the stiffness of a 3D polyethylene glycol (PEG) based hydrogel and evaluate the impacts of stiffness on cancer cell growth. Through modifying PEG-diacrylate (PEG-DA), the structural backbone of our hydrogel, I was able to create five different hydrogel compositions, with distinct mechanical properties. The mechanical properties were determined through rheology and swell ratio, the results of rheology demonstrated that an increase in molecular weight of PEG-DA decreased stiffness and that an increased concentration of PEG-DA increased stiffness. The trends of rheology and swell ratio are inversely correlated. A cell metabolism assay was also conducted using A549 cells. At earlier time points the hydrogels with the softest stiffness had a higher cell growth rate in comparison to other conditions. Hypothesis regarding why the soft hydrogel may have had a large growth rate at the beginning is similarity to the stiffness of biological lung tissue, or similarity to stiffness of metastatic tumors, future studies would be needed to test these hypotheses. Future work will investigate the influence of stiffness on the lung cancer cell phenotype and immunosuppressive profile, with a long-term goal of better understanding how the altering mechanical properties of solid tumors impede our immune cell function. insights, further studies are imperative to validate and build upon these preliminary results.

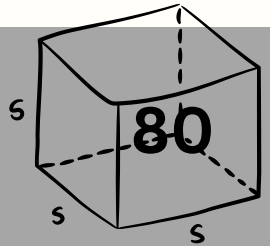


Using Software-Defined Radios to Simulate Signal Attenuation in Autonomous Vehicle (AV) Communication

Authors: Matthew Self, David Greene, John Shea

As the autonomous vehicle industry grows, communication between AVs becomes increasingly important, and emulating RF signals between vehicles is desired. In order to create a proof-of-concept for a system in which radio frequency signals between autonomous vehicles are simulated over potential routes, this project involves the integration of USRP SDRs, an Attenuation Channel Matrix, and a web-based graphical user interface. The user interface utilizes a Flask server backend, paired with an HTML/JS/CSS front-end, and HTTP server-client communication with the radios and channel matrix. After developing a prototype with a single transmitter and receiver, tests were performed to determine if the components were properly integrated. Iteration of the design led to a single-transmitter, multi-receiver setup that applied variable attenuation levels to each signal path, emulating up to 3 AVs traversing a map. Further research and development continues to optimize the GUI and scale the number of transceivers.

Engineering



Effective Connectivity Analysis of the Electrocortical Dynamics during Table Tennis

Authors: Bishoy Pramanik, Jacob Salminen, Amanda Studnicki, Daniel P. Ferris

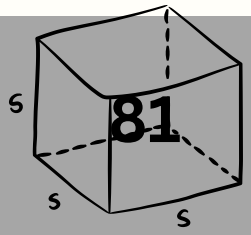
Table tennis is a dynamic and complex task that can provide insight into motor planning, visuomotor integration, and executive functioning. Electroencephalography (EEG) reliably measures brain electrical activity during human movement making it an ideal tool to understand brain function during table tennis (Studnicki A, 2022; Gonsisko CB 2023).

We analyzed an existing data set from the Human Neuromechanics Lab (Studnicki A,2022). Twenty-five participants (ages 23.5 ± 6.7 years, mean ± SD) played table tennis while wearing high-density EEG sensors to measure brain activity. The EEG headset has a dual-layer setup, with 120 scalp, 120 noise, and 8 EMG electrodes. Participants played against either a human or a ball machine. The EEG channel data were pre-processed using empirically validated algorithms (Studnicki A, 2023), then decomposed into component activations using independent component analysis (ICA), and source-localized to regions within the brain.

We used the Source Information Flow Toolbox in EEGLAB (v2022.1) to generate the connectivity model. We calculated effective connectivity using a sliding window MVAR method with a Direct Directed Transfer Function. We fit separate multivariable regressive models under the Harlan-Quinn information criterion to determine the appropriate model orders. After fitting and validating the models, we performed an analysis of variance to determine significant (alpha > 0.01) between-brain region connections between participants playing against a human and ball machine opponent.

Our preliminary findings reveal increased connectivity during ball machine trials between the cuneus and right posterior parietal regions, indicating a heightened reliance on visuo-spatial processes in the absence of human body cues. Additionally, we noted enhanced connectivity in the left supplementary motor cortex during ball machine trials, suggesting a potential increase in motor planning compared to human opponents. It is important to acknowledge that these results are preliminary and subject to further analysis as our study progresses.

Engineering



PAM-free diagnostics with diverse type V CRISPR-Cas systems

Authors: Santosh R. Rananaware, Katelyn S. Meister, Grace M. Shoemaker, Emma K. Vesco, Luke Samuel W. Sandoval, Jordan G. Lewis, Brianna Lauren Maria Pizzano, August P. Bodin, Vedant N. Karalkar, Ian H. Lange, Minji Chang, Lilia G. Yang, Piyush K. Jain

Type V CRISPR-Cas effectors, such as Cas12a and Cas12b, have revolutionized molecular diagnostics by facilitating the detection of nucleic acid biomarkers. However, their dependence on the presence of protospacer adjacent motif (PAM) sites on the target double-stranded DNA (dsDNA) greatly limits their flexibility as diagnostic tools. Here, we present a novel method named PICNIC for PAM-independent detection of nucleic acid with CRISPR, that addresses this limitation. Our approach involves the separation of dsDNA into individual single-stranded DNA (ssDNA) strands through a high-temperature and high-pH treatment. We then detect the released ssDNA strands with Cas12 enzymes in a PAM-free manner. We show the utility of PICNIC by successfully applying it for PAM-free detection with three different subtypes of the Cas12-family - Cas12a, Cas12b and Cas12i. Furthermore, by combining PICNIC with a short 15-nucleotide crRNA, we enabled PAM-independent detection of clinically important single-nucleotide polymorphisms (SNPs) with CRISPR. We applied this approach to detect the presence of a drug-resistant variant of HIV, specifically the K103N mutant, that lacks a PAM site in the vicinity of the mutation. The designed truncated crRNA targeted the SNP site, resulting in high sensitivity and specificity for identifying the drug-resistant variant. Additionally, we successfully translated our approach to clinical samples by detecting human plasma samples for HIV RNA with a high specificity and accuracy, in a PAM-free manner. In summary, PICNIC is a simple yet groundbreaking method that enhances the flexibility and precision of CRISPR-Cas12 based diagnostics by eliminating the restriction of the PAM sequence.

Discovery of Novel Terpenoids from Predicted Terpene Synthases Genes

Authors: Melvin, Alsup, Tyler A., Jeffrey D. Rudolf

Natural products are chemical compounds produced by organisms and they possess pharmaceutical and commercial relevance; contributing to about 50% of commercial drug products (2). Terpenoids are the largest and most structurally diverse family of natural products (2). Surprisingly, the fascinating mechanisms of how terpene synthases (TSs) make terpenes are not fully understood. Approximately 50,000 terpenoid metabolites, encompassing nearly 400 different structural families, such as monoterpenes, sesquiterpenes, and diterpenes, have been found in both terrestrial and marine plants, liverworts, and fungi. However, only a small portion of these widespread metabolites have been identified in prokaryotes. Our research aims to identify novel terpene scaffolds by screening predicted bacterial TS genes in an engineered terpene precursor overproduction system.

Understanding Disproportionate Minority Contact within the Juvenile Justice System

Authors: Jasmyne Nelson, Abigail Fagan

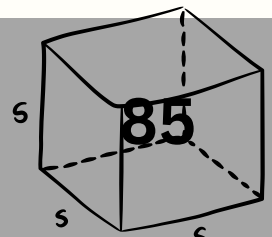
Minority youth's contact with the juvenile justice system is a significant problem in the United States. From arrests to dispositions, there is a disparity between youth of color and White youth at every stage of the juvenile justice system. For example, in 2019, 35% of delinquency cases involved Black youth although they represented only 15% of the U.S.. Population. This phenomenon, known as Disproportionate Minority Contact (DMC) is a serious and federally recognized issue. While studies have investigated DMC in recent year, more research is needed. This projects aims to better understand DMC in the context of the state of Florida.

The 1980's AIDS Epidemic: The Role of African American Evangelical Churches in Organizing a Public Health Response

Authors: Sierra Mulholland; Dr. Anna Peterson

In 1981, America experienced the first cases of a virus that would come to define the decade: Human Immunodeficiency Virus (HIV). HIV is often untreatable and develops into a fatal condition called Acquired Immunodeficiency Syndrom (AIDS). The virus spread rapidly between populations of gay men and disproportionately impacted African American communities. At the start of the pandemic, evangelical churches were responsible for the spread of stigma through religious teachings like divine retribution and intolerance toward homosexuality. However, as time passed, churches began to realize their roles in responding to the epidemic and providing aid to their congregants. Of the most important religious institutions during the epidemic were African American evangelical churches. I investigate the positive and negative implications of Black churches in the 1980s HIV response. Additionally, I explore how traditional evangelical religious teachings overlap with secular responses to the disease. Comparing those responses to current organizing, I conclude that Black churches should be utilized more frequently during public health crises to dispel accurate information, provide resources, and foster community.

Liberal Arts & Sciences



Aspect Based Sentiment Analysis on ancient Greek and Latin

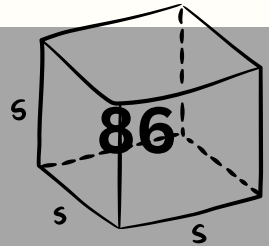
Authors:W. Bowman, D. Chong, G. Gnanam, M. Gontu, Z. Hracho, A. Jain, N. Owji, R. Prasad, N. Saririan, A. Stein, N. Stevens, J. Yu, E. Bozia

Recent Artificial Intelligence developments initiated discussions on whether and how we could apply technologies to classical studies. Though great strides have been made in the area of natural language processing in ancient texts, specifically with the aspect-extraction of Greek-Bert, most researchers have found it difficult to apply their software to text that lies outside of their sample data. Further, there has been little progress on a sentiment analysis model for Ancient Greek and Latin texts. Our research aims to bridge this gap.

Specifically, we use data from open source libraries such as the Open Greek and Latin Project and the Perseus Project, allowing us to compile the majority of surviving Ancient Greco-Roman texts. For software development, we employ Greek-Bert for aspect tagging, Classical Language Toolkit for lemmatizing, and Python Aspect-Based Sentiment Analysis Package for sentiment labelling. Additionally, we construct testing data using random sentence generation by providing lists of words and connecting them to form rudimentary sentences with associated sentiments.

At this point, we have developed an NLP model that is beginning to understand Ancient Greek and Latin beyond their linguistic structure, and, even though our results are preliminary, the model is broadly able to differentiate negative and positive sentiment associated with a sentence aspect. This work allows us to quantify the way in which ancient peoples discussed different races, genders, and ethnicities.

Liberal Arts & Sciences

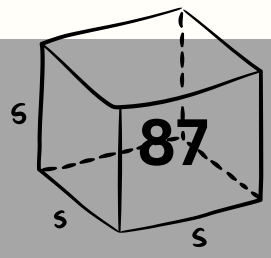


Using the Bayesian Statistical Framework for Testing Paleomagnetic Reconstructions

Authors: JJ Ruse, Joseph Meert

The theory of plate tectonics states that continents are in constant motion such that the geography of the Earth has changed over time. Paleogeography can be examined in deep-time (>600 million years ago) using a combination of paleomagnetism and geochronology. To decipher past geography, we need to know where the continents were located and when they occupied that location. There are errors associated with each measurement and are described using Fisherian statistics. The most common is called alpha-95, which describes an angular cone of 95% confidence about the mean direction. To reconstruct past geometries of continents, paleomagnetists examine similar age rocks from one or more continents. If those rocks yield a similar latitude, then the continents could be rotated together and examined to test whether the geological links were reasonable. More robust statistical methods are being developed for comparison which consider errors in age and position. Bayesian statistics allows us to test for overlap as a continuous probability from 0% (not similar) to 100% (identical). This project focuses on using Bayesian probabilities to test 'goodness of fit' and a variety of proposed paleogeographies from 1000-1800 million years ago using these new methods along with other new tools being developed.

Liberal Arts & Sciences



Relating Self-Report and Performance in Bilingual Language Dominance Assessment

Authors: Guadalupe Diaz, Edith Kaan

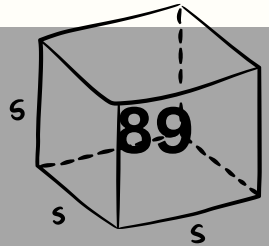
Language dominance, a pivotal aspect of bilingualism, profoundly influences linguistic behaviors such as code-switching. Prior research has demonstrated that bilingual individuals generally possess a considerable ability to accurately identify which of their two languages holds dominance. However, the degree of distinction between the languages can differ depending on the context and the specific assessment methods (Gollan, 2012). This study aims to systematically examine the extent of correlation between individuals' self-reported language dominance and their performance in language-related cognitive tasks, shedding light on the reliability of self-assessment. The study will involve Spanish-English bilingual individuals in the United States who have acquired Spanish since birth and English before age 12. These participants will first complete the Multilingual Naming Test Sprint (Garcia & Gollan, 2021), naming 80 items modeled from the original study. They will also complete a Language Background Questionnaire adopted from two widely used assessments: the Bilingual Language Profile (Birdsong, 2012), which assesses language usage, history, skill level, and attitudes, and the Bilingual Code-Switching Profile (Olson, 2022), which considers code-switching use frequency and history. Statistical analysis will determine the correlation between self-reporting and Multilingual Naming Test Sprint performance. While the questionnaire emphasizes linguistic history and the Mint-Sprint centers on cognitive domains, investigating their correlation holds promise for a deeper comprehension of bilingualism's cognitive implications. This study contributes to a more holistic understanding of bilingual individuals' cognitive strengths and challenges, paving the way for tailored interventions and cognitive enhancement strategies.

Three-Dimensional Simulations of Planet-Induced Gap Openings in Protoplanetary Disks

Authors: Grady Robbins, Jaehan Bae

As they form, planets excite spiral waves which steepen into shocks and open annular gaps in their natal protoplanetary disks. Recent studies have shown that a single planet can open multiple gaps at the radial locations each spiral wave steepens into a shock. However, these previous studies are limited to a two-dimensional space where the vertical structure of gaps and vertical gas motions within and around gaps cannot be examined. In this paper, we investigate the formation of multiple gaps by a planet using three-dimensional hydrodynamic simulations. We show that a singular planet can open multiple gaps in three-dimensional spaces and that the radial location of the gaps shows an excellent agreement between two- and three-dimensional simulations.

Liberal Arts and Sciences



Influence of sex on cocaine relapse and prefrontal cortex activity in a voluntary abstinence model

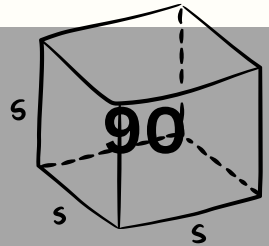
Authors: Gabriela Ospina, Cassidy Jones-Goucher, Lori Knackstedt

Contingency management, a strategy for treating substance use disorder, involves offering non-drug incentives in exchange for drug abstinence, but when these incentives are removed, drug-seeking behavior often resumes. This phenomenon is observed in animal models as well. In this study, rats were trained to self-administer drugs and then given the choice between drugs and non-drug rewards. While most rats abstained from drugs, a subset continued to choose cocaine during voluntary abstinence. Interestingly, these rats exhibited different brain activity patterns, with lower c-Fos expression in the prefrontal cortex after voluntary abstinence compared to abstinence without alternative rewards. The study aimed to explore if female rats exhibit similar responses and c-Fos expression patterns in the prefrontal cortex during voluntary abstinence. It also hypothesized that rats preferring cocaine over non-drug rewards would show higher c-Fos expression.

Male and female rats underwent a period of voluntary abstinence where they could choose between cocaine and sucrose rewards. Initially, both sexes preferred cocaine, but their preference shifted to sucrose around day 6. During the last five days of voluntary abstinence, a portion of both males and females continued to choose cocaine. No sex differences were observed in cocaine-seeking behavior during the relapse test.

The study's ongoing analyses include examining prefrontal cortex c-Fos expression through immunohistochemistry. Overall, the findings suggest that sex does not significantly impact cocaine-seeking behavior during or after voluntary abstinence procedures. This research contributes to understanding the prefrontal cortex's role in cocaine relapse after contingency management.

Liberal Arts and Sciences



Comparative Fitness of Invasive and Native Populations of the Coqui Frog Eleutherodactylus coqui

Authors: Sarah Varon, Zuania Colón-Piñeiro, Anja E. Julian, Arik Hartmann, Sarah McGrath-Blaser, Patricia A. Burrowes, and Ana V. Longo

Invasive amphibian species have a remarkable capacity to adapt to novel environments.

In this study, we collected data on Eleutherodactylus coqui frogs from two locations: Hawaii (invasive) and Puerto Rico (native). Our goal was to compare individual-level fitness correlates that could explain differences in population success. To do this, we evaluated the following metrics: snout-vent-length (i.e., frog body size, =SVL), weight, growth rates, body condition, bacterial diversity, bacterial load, and fungal infection. Data from the Hawaiian population were collected both in the field and in the lab after capture. Puerto Rico samples were only taken in the field through mark and recapture surveys. We used skin swabs to determine the infection load of Batrachochytrium dendrobatidis (Bd), a fungal pathogen associated to declines in their native range. In addition, we used skin swabs to determine bacterial load for the Hawaii population and bacterial diversity for the native population. In both populations, Bd-infected individuals had higher growth rates, suggesting that frogs are investing in growth instead of fighting the infection. We also found a positive correlation between bacterial load and SVL in the Hawaii population, but no correlation between bacterial diversity and SVL in the Puerto Rico population. Although frogs were larger in Puerto Rico, body condition was higher in Hawaii. These preliminary findings highlight differences between invader and native populations that can help us understand how environmental pressures shape organismal responses. .

Using Biophysical Techniques to Explore the Dynamics of GPCR - G Protein Ternary Complexes

Authors: Larissa Silva, Daniel Nutter, Gabriella Sprague, Matthew Eddy

G protein-coupled receptors (GPCRs) constitute the largest superfamily of membrane proteins in the human genome and mediate numerous physiological processes throughout the human body. Their significant physiological relevance makes them promising drug targets, and advancing their therapeutic potential requires a deeper understanding of their interactions with their partner proteins. Here, we perform single-molecule FRET experiments to study the dynamics of the A2A adenosine receptor (A2AAR) in complex with an engineered Gs protein. We also discuss solution NMR studies that complement our understanding of the complex assembly process. We find that the dynamic behavior of the complex is dependent on ligand efficacy, and determine that complex assembly requires conformational rearrangements throughout the receptor.

Carly Achinapura

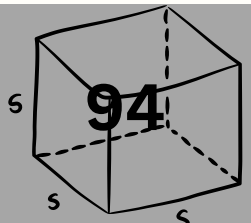
Authors: Charles Dickens and Redeeming the Fallen Woman: An Analysis of Fallenness in Charles Dickens's "The Chimes" (1844).

The ‘fallen woman’ was a Victorian stereotype given to widows, prostitutes, or single women whose moralities were questioned, with often fatal consequences. Many have looked at Charles Dickens’s portrayal of the fallen woman, but few scholars have studied the implications of ‘fallenness’ in Dickens’s The Chimes (1844), an understudied work of social criticism. The ‘fallen woman’ is presented in The Chimes through the characters of Meg, a wandering mother, and Lilian, a prostitute. Ultimately, I argue that Dickens shames the ‘fallen woman’ for her sexual promiscuity over her suicidal ideation, which perpetuated that promiscuity was more criminal than causing death. To analyze Dickens’s representation of ‘fallenness’ in The Chimes, I analyze scholarly works on ‘fallen women’ to provide historical context on Victorian England’s views of the stereotype. As the stereotype is related to Victorian lower-class social issues and gender politics, I delve into academic discourse on Dickens’s writing of women and the poor. I use Marilyn Kurata’s work to understand Dickens’s perspective on The Chimes and how Lilian’s and Meg’s ‘deaths’ relate to one another due to Victorian ‘womanhood.’ This research asks how Dickens portrays the ‘fallen woman’ and why Dickens portrays the ‘fallen woman’ in this manner.

Absolute quantification of endogenous lipids in mouse brain tissue by MALDI imaging mass spectrometry using standard addition

Authors: Katherine Gegoutchadze; Julia R. Bonney; Boone M. Prentice

Matrix-assisted laser desorption/ionization (MALDI) imaging mass spectrometry (IMS) is a label-free analytical technique that enables the spatial mapping of compounds such as lipids, proteins, and metabolites in tissues. More recently, this technique has been used in the pharmaceutical industry to determine the spatial distributions of potential therapeutics and their metabolites. Quantitative MALDI IMS allows for both the absolute quantification and spatial visualization of the target analyte in tissue but is complicated by challenges such as spot-to-spot and shot-to-shot variability caused by tissue heterogeneity, matrix ion suppression, and uneven co-crystallization of matrix and analyte. Prior research to confront these issues include improved matrix application, internal normalization, and external normalization (e.g., internal standardization). An alternative external normalization method is standard addition, in which known quantities of the analyte are added as the standard. In this work, we employ the standard addition approach to quantity two phosphatidylcholine (PC) lipids in mouse brain tissue. Two mouse brain serial sections were sectioned onto an indium tin oxide-coated slide and mixtures of PC lipid standards PC 18:1/16:0 and PC 18:1/18:0 were sprayed onto one of the tissues using a robotic sprayer. A 1,5-diaminonaphthalene (DAN) MALDI matrix was then sprayed onto both tissue sections. Mass spectra were collected from the white matter, cerebral cortex, and molecular layer of each brain section (n = 5 measurements). The PC lipid concentrations were calculated for each of the three regions and were determined to be 5.19, 17.6 and 16.7 mg/g, respectively, for PC 18:1/16:0 and 3.63, 3.25 and 2.85 mg/g, respectively, for PC 18:1/18:0. This workflow was also performed to quantify one PC per experiment and four PCs per experiment. Future work includes acquiring data for technical replicates and validating our results with those obtained using liquid chromatography-mass spectrometry (LC-MS).



Synthesis of Quinolinyl-N-acyl-hydrazones as potential candidates for the discovery of new Anti-Leishmanial and Anti-Chagas disease drugs

Authors: Samantha Boisvert, Jonathan Otero, Mindy Tran, Leamsi Soto-Ortiz, Yuanyuan Yang, and Simon Lopez D'Sola

Over 1 billion people are affected by neglected tropical diseases (NTDs), a group of parasitic, viral, and bacterial conditions prevalent in tropical and subs tropical areas. Two of these diseases, Leishmaniasis and Chagas Disease, are parasitic NTDs transmitted from insect bites. Leishmaniasis is spread by the bite of phlebotomine sand flies which causes an infection with Leishmania parasites. Over 350 million people across 88 countries are at risk for Leishmaniasis, with 1.2 million new cases annually. Chagas disease is spread by insect bites which can cause an infection with the Trypanosoma cruzi parasite. Chagas is prevalent only in the Americas, with 70 million people at risk. Over 8 million people are believed to have Chagas, most of whom are unaware they are infected. Both diseases suffer from severe limitations in their treatments. Current drugs used to treat these conditions are usually highly toxic and are experiencing increasing parasite resistance. Therefore, in response to the urgent need to develop more selective, effective, and newer drugs to treat Leishmaniasis and Chagas. This project endeavors to design and synthesize potential candidates for the discovery of new anti-leishmanial and anti-Chagas drugs. Using the N-acylhydrazone scaffold, several compounds were designed as potential multitarget drugs. The N-acylhydrazone scaffold was selected because of its antimicrobial and antiparasitic properties, and subsequently, its ability to act as a pharmacophore for the inhibition of cysteine proteases involved in the survival of parasites. Further, the design utilizes a quinoline ring with a methoxy group to further enhance the biological activity of the molecules. The synthesis of the final compounds, 2-methoxy-quinolinyl-N-acylhydrazones, involves a series of 4-5 steps. Upon completion, the compounds will be sent to the Universidad de la Republica in Uruguay for biological testing and molecular modeling.

Developing Geospatial Datasets for Evaluating the Role of Land Ownership versus the Environment in Namibia

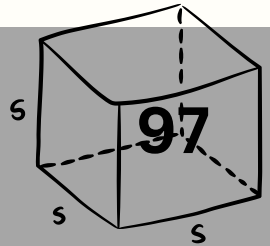
Authors: Patrick Gawienczuk, Anusha Chaudhary, Dr. Jane Southworth

Namibia, a country known for its diverse land ownership systems, presents a unique landscape ranging from open communal lands to privately held farming areas. Land ownership (whether communal or private) and its associated institutions are building blocks for communities; they frame how groups interact with their environment and develop economically. This study is a component of a broader research initiative aimed at unraveling the pivotal role of land tenure systems in influencing land cover changes, in comparison to other key variables like precipitation and temperature. To achieve this, we have meticulously constructed a comprehensive database that amalgamates existing datasets. This data repository forms the bedrock for quantifying and understanding land cover transformations and evaluating shifts in the Normalized Difference Vegetation Index (NDVI) across Namibia. By systematically incorporating the influence of precipitation into our analysis, we intend to unearth the complex interplay of factors that underlie shifts in land cover within this unique context. This research holds the promise of illuminating the dynamics between land tenure and human-environment interactions, shedding light on how people in Namibia engage with their surroundings and foster economic growth. In essence, it presents an opportunity to glean valuable insights into the intricate relationship between land ownership systems and the broader environmental and economic tapestry of Namibia, ultimately contributing to a deeper understanding of sustainable development in this region.

Quality of Online Users' Responses to Suicidal Communications on Quora

Authors: Alexandra Kearns

As social media platforms have become increasingly popular, users have become more connected to other cultures and ideas, and topics discussed on online forums have diversified. Although there are benefits to this increased connectivity, unregulated discussion of sensitive subjects such as suicide are among the more concerning prospects of the internet. This study used a content analysis approach to evaluate response posts to suicidal communications on the social media platform Quora. Posts were analyzed in a cultural context by comparing those made by users from individualistic or collectivistic countries; the clarity of messaging was also explored. A total of 1,000 posts were coded based on 12 strategies that they could use (or not use), a 4-point clarity scale, and the orientation of their country's culture (if included in their profile). The most frequent strategies used were supportive strategies, specifically persuasion, advising, and emotional support. Culturally, posts from individualistic cultures tended to be clearer and used supportive strategies more frequently than collectivistic cultures. The purpose of this research is to shape future online suicide interventions and inform future research on responses to suicide.



Star Formation in G0.253+0.016

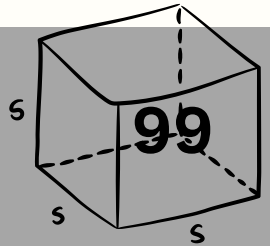
Authors: Brighten Jiang, Alyssa Bulatek, Adam Ginsburg

Star clusters are being observed with increasing detail in galaxies, but understanding how they form is still a puzzle. A specific type of cluster consisting of young and massive stars is called young massive clusters (YMCs). These regions are of interest because they could be a progenitor for other types of stellar clusters (ex. globular clusters), so understanding how YMCs form may shed light on other types of cluster formation. The region my project looked at is G0.253+0.016, a region of high mass and density, yet shows little to no star formation. Despite having the mass to form a YMC, the future of the region is still uncertain. Many of its internal processes are not known and it's in a particularly extreme region of the Milky Way. In-depth studies of the region could reveal the conditions through which a high-mass cluster is formed. I use data collected from the EMIR spectrograph to classify 13 sources within the region. After reducing the raw data, I analyze it to measure properties of the stars. Using specific absorption lines, I was able to tell what type of star each object is and whether the star is in the region or not.

Tikkun Olam: The Role of Judaism in Achieving Women's Suffrage in the United States

Authors: Megan Meese

In the United States (US), the late 19th and early 20th centuries were characterized by the revitalization of the women's suffrage movement and a rapid increase in the Jewish population upon rising antisemitism in Eastern Europe. While correlation is not necessarily causation, this simultaneity was not accidental. Jewish teachings about the equality and dignity of humankind positioned the Jewish community to favor women's suffrage. Values of tzedek (pursuing justice) and tikkun olam (repairing the world) motivated US Jews to pursue active roles in orchestrating this social change, which became central to the practical religion of American Judaism, especially in the reform movement. Many members of the Jewish community were able to integrate themselves in modern, Gentile, American society through such work. Furthermore, Jewish lived religion and experiences with antisemitism evoked an empathy that inspired many Jews to combat discrimination and inequality against other marginalized groups, women in this case. Contemporary American Jews continue to uphold these traditions of activism. Thus, religion can inspire social change by empowering individuals to work towards an improved, moral world; pursuing social change is a mitzvah (commandment/good deed) in Judaism.

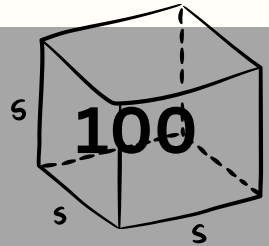


Exploring soil bacteria in the Everglades Agricultural Area for biocontrol of rice blast disease

Authors: Richmond Baptiste, Timoty Johnson, Matthew Vanweelden, and Jessie Fernandez

Ensuring the health and productivity of crops depends on understanding the intricate relationships between soil bacteria and plant pathogens. This study aims to investigate the inhibitory potential of soil bacteria against the destructive rice blast fungus Magnaporthe oryzae and uncover the mechanisms underlying this inhibition. Soil samples were collected from three separate agricultural rice fields located in the Everglades Agricultural Area in southern Florida. These fields contain nutrient-rich soil with 85% organic matter content. To ensure a representative sample, we randomly collected five soil cores, each covering approximately 0.5 square feet, from each field. Each soil sample was processed into a liquid suspension, serially diluted, and plated on selective media to isolate pure bacterial cultures. This process yielded a total of 150 bacterial isolates. To evaluate the potential of these bacterial isolates as biological control agents, we conducted antagonism assays to measure their inhibitory effects against M. oryzae. Initial tests focused on 136 out of the 157 bacterial isolates. The methodology involved the extraction of mycelia punches from the growing edges of M. oryzae. These punches were then cocultured with bacterial isolates, and fungal inhibition was measured after five days. Twelve out of the 136 bacterial isolates displayed antagonistic activity against M. oryzae in vitro. This comprehensive approach highlights the critical role of soil bacteria within the soil microbiome and their potential for biocontrol of plant pathogens. Our future directions include whole-genome sequencing and DNA mutagenesis to gain deeper insights into the inhibition mechanisms of soil bacteria on M. oryzae.

Liberal Arts and Sciences

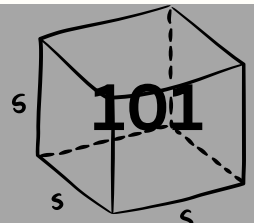


Characterizing the First Galaxies Using Machine Learning

Authors: Sherwin Ben, Sethuram Snigdaa, Brummel-Smith Corey, Wise John

Cosmic reionization is likely driven by UV starlight emanating from the first generations of galaxies. The UV escape fraction, defined as the fraction of photons escaping into the intergalactic medium, is a useful metric to quantify a galaxy's contribution to reionization. However, the UV escape fraction is notoriously difficult to predict since it depends on local conditions and is highly variable over time. Using data from the Renaissance Simulations, we attempt to make predictions about the impact of the first stars and galaxies on their environments. We present a time-independent classification model using a general artificial neural network architecture to predict the UV escape fraction given other galaxy properties---namely halo mass, stellar mass, redshift, star formation rate, lookback time, and gas fraction. We find our accuracy to be approximately 50-65% on our validation set, depending on the dataset size from each zoom-in region of the Renaissance Simulations.

Liberal Arts & Sciences 101



Additional Support Expected from White vs. Non-White Students for Course Transitions During the COVID-19 Pandemic

Authors: Catherine Cardenas, Emily Scoufis, Adrian Herrera, Melisa Sumer, Shreya Gadikota, and Feihong Wang

The COVID-19 pandemic disrupted the academic lives of students with large-scale changes from in-person to online course learning (DeCoito & Estaiteyeh, 2022). In response, educators accommodated the challenges of in-person to online course-taking for students (Martin et al., 2022). We sought to expand the literature regarding the variation of additional support expected by college students of different ethnicities to ease their online learning transition. We conducted a thematic and secondary analysis from survey data on 186 consenting students enrolled in general psychology in Spring 2020 at the University of Florida on their expectations for additional support in the online learning transition. Of the students, 52.5% were white and 47.5% were non-white. The thematic analysis yielded 9 major expectations and appreciations from students concerning their instructors: support, accommodations, open communication, extra resources provided, being understanding, course modifications, maintaining course consistency, safety, and no expectations. The Mann-Whitney U Test indicated that ethnicity did not significantly differ between total number of appreciations (U=2104, P=.098) and total number of expectations (U=2860, P=.086). Our findings indicate that regardless of ethnic background, students reported similar aspects of appreciation and expectations for course transitions during COVID-19. Implications of the findings for higher education will be discussed.

Does Stereotype Threat Drive Feelings of Imposter Syndrome in Students from Historically Marginalized Communities?

Authors: Chelsey Leveque and Dr. Kimberly Fairchild, PhD

Research has shown that imposter syndrome is especially prevalent in persons of color in higher education and various professional fields (Nadal et al., 2021). This study sought to explore the relationship between stereotype threat and the imposter phenomenon by evaluating how the former reinforces feelings of fraudulence in students from historically marginalized communities. Using a self-created survey, participants' levels of imposter syndrome were measured prior and following their assignment to an experimental condition (i.e. Stereotype Threat, Values Affirmation, Control). SAT/GRE Verbal Reasoning Exam questions were administered in between each measure as a manipulation check. It was hypothesized that BIPOC participants in the Stereotype Threat group would report more imposter syndrome at Time 2 than participants in the Control group, after completing the questions. The findings suggested that assessment difficulty heightens feelings of imposter syndrome in college students. The relationship between stereotype threat and imposter syndrome was not evident in the present sample.

Trans and Gender Diverse Narratives in Discussions and Activism about Abortion and Reproductive Rights

Authors: Jules Sostre, Carlos Chirino, Roberto Abreu

While abortion rights have been a longstanding discussion, on June 24th, 2022 the supreme court overturned Roe v. Wade, a decision that federally legalized abortion. Consequently, 13 states had “trigger laws” in place almost immediately outlawing abortion. With this recent turn of events, it has sparked a surge of discussions and activism surrounding abortion rights. However, the discussions and activism taking place are widely centering cisgender women and erasing trans and gender diverse people who are also in need of adequate access to abortion and reproductive care. While there have been studies looking at creating more inclusive abortion activist spaces in other countries, namely Argentina, little to no literature can be found about creating abortion rights discussions and spaces within the United States more inclusive for trans and gender diverse people. Ultimately, the goal of this study will be to explore the experiences of trans and gender diverse people who are impacted by abortion rights in discussions and activism spaces. The study will be guided by the following research questions: What are the experiences of trans and gender diverse people who are impacted by discussions about abortion rights and activism? How would trans and gender diverse people who are impacted by abortion rights like to be involved in activism and discussions surrounding abortion? To answer these questions, this project will use a qualitative methodology (content analysis) and recruit approximately 54 transgender and gender diverse people, specifically using the conventional content analysis technique developed by Kondracki and Wellman (2002). While data analysis is underway, preliminary themes have begun to emerge such as the need for inclusive language in discourse, grave fear for the future and feeling rushed to make medical decisions, and accepting exclusion, putting aside identity, and feelings of dysphoria in order to come together and fight to address overturn.

Basal Cell Carcinoma, Squamous Cell Carcinoma, and Melanoma in Skin of Color: Diagnosis, Treatment, and Misconceptions

Authors: Leah Richard, Emily Bald

Skin cancer is an ongoing global health concern, approximately 2 to 3 million cases of non-melanoma skin cancer and 132,000 cases of melanoma skin cancer are diagnosed worldwide annually. The three most common types of human skin cancer are basal cell carcinoma (BCC), squamous cell carcinoma (SCC), and melanoma. There is a lower prevalence of skin cancer among populations with skin of color than among populations with white skin. Although skin cancer is less prevalent in non-white populations, patients of color with skin cancer have higher mortality rates. Public misconceptions and physician illiteracy of skin cancer within skin of color result in late diagnosis and more advanced stages of skin cancer manifesting within these populations. Historically, the majority of skin cancer research has focused almost exclusively on white populations. There is a lack of knowledge regarding the epidemiology of skin cancer in colored skin within the field. This presentation will address misconceptions and gaps in medical research on skin cancer in skin of color in order to increase public awareness and physician attention. Public educational interventions should be extended to target populations of people with skin of color. In addition, it is crucial to highlight the role of physicians in promoting preventive measures, such as self-examination and photoprotection. Addressing the barriers in skin cancer diagnosis, research, and prevention will help minimize healthcare disparities.

"Unveiling Gender Representation Shifts in Media: A Comparative Analysis of Sitcom Characters Pre and Post Gender Equality Movements"

Authors: Amberly Grace

A gender presentation in media has been related to various factors including gender targeted channels (Daalmans et. al 2017), behind the scene staffing (Lauzen et al 1999), and social norms and culture (Gill 2007). This current study is a content analysis of thirty American popular sit-com television shows created between 1950 and 2023. Specifically, both, female and male characters' level of extraversion, conscientiousness, openness, agreeableness, and calmness will be rated using the Ten- Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003). It is hypothesized that the depictions of characters will be affected following two social movements, the second wave feminist movement of the 1960s-1970s, and the "me too" movement of 2018, following increases in gender rights and more awareness. For example, there may be an increase in the depiction of male characters with stereotypically feminine traits, such as being more agreeable and conscientious; whereas there may be a shift in depicting female characters in stereotypically more masculine ways, such as being more extraverted, less agreeable and calm. The assumption is that media acts as an absorption of social factors present in society (Buonanno, 2014), therefore the analysis of it should reflect the societal changes in gender stereotypes and more acceptance of differences and similarities within and between genders. Any similarity and differences in the depictions of male and female personalities will be discussed.

Characterizing the Effects of Stress Treatments on M. oryzae NADK Deletion Strains

Authors: Alexa Farmer, Nalleli Garcia, Richard A. Wilson, Jessie Fernandez

Nicotinamide adenine dinucleotide kinase (NADK) proteins participate in several essential metabolic reactions, redox sensitive regulation, photosynthetic performance, and reactive oxygen species (ROS) homeostasis in various organisms. In filamentous fungi, NADKs are essential components for maintaining cellular redox balance by regulating the intracellular NADP(H) pool. Our research focuses on Magnaporthe oryzae–the causal agent of rice blast disease–which relies on these proteins to adapt to stressful conditions and effectively infect the host plant. NADKs are closely associated with the pathogenicity of this fungus, and are key components for fungal growth, stress adaptation, and infection-related processes.

Our research aims to characterize the effects of stress treatments on M. oryzae deletion strains lacking NADK genes. We intend to accomplish this by plating M. oryzae mutant strains on hydrogen peroxide plates to induce stress conditions. We will compare the morphological growth of the fungal strains with and without stress treatment to gain a better understanding of how M. oryzae modulates stress responses. By subjecting mutant strains to specific stressors, we intend to assess the impact of NADK gene deletions on fungal growth, development, and pathogenicity. Moreover, we will attempt to explain the molecular mechanisms by which NADK genes contribute to stress adaptation and pathogenicity in M. oryzae, and provide insight into the implications of these NADK gene deletions. Exploring the consequences of NADK gene deletions under various stress conditions provides valuable insights into the underlying molecular mechanisms governing stress responses in fungi.

Analyzing the Morphology of Late-phase Stellar Flares from G-type Stars

Authors: Denise Yudovich, Kai Yang, Xudong Sun

Stellar flares often exhibit a complex light curve featuring a peak-bump morphology. This morphology is characterized by an impulsive profile followed by a late-phase Gaussian bump. Such light curve morphology helps reveal the physics behind the stellar flare dynamic, in particular, plasma heating, evaporation, and condensation. Previous analyses have focused on peak-bumps in M-dwarf stars, while this project focuses on the late-phase (peak-bump) morphology in the flares observed in 234 G-type stars using Transiting Exoplanet Survey Satellite (TESS) data. We specifically target flares from G-type stars to construct an analog of the flares on our Sun. To identify these peak-bumps, we classify these flares from the previously published G-type stars' flare catalog from Crowley et al. 2022. Our findings confirm the presence of the peak-bump morphology in flares from G-type stars; roughly 16% of the flares in our sample are of this type. We further investigate the relationships between the morphological features of peaks and bumps, and find that generally, the peak and bump profiles are related.

Generations on Screen: Analyzing the Generational Differences in Friendships in American TV Shows

Authors: Daniel Buonadonna, Uma Ramaka, Benjamin Korn, Sydney Dick, Amy Pezoldt, Dr. Marina Klimenko

This study analyzes generational and gender differences in friendship through popular TV shows. This topic has implications that could help us better understand factors that influence friendship dynamics, culture, gender, and social influences. For example, Décieux et al. (2018) suggest that as social media becomes more popular, activities like meeting up with friends in person have declined, and having alone time has become more important to young people. Alternatively, Wood et al. (2015) found that young adults may require “constant connectivity” via social media. Such generational changes may also affect the quantity and quality of communication among friends.

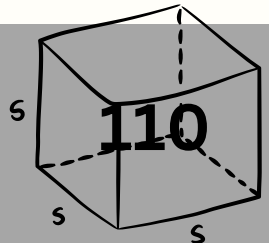
Media, such as TV shows, may reflect certain generational differences in norms and values. We hypothesize that the relationship between audience and media is bidirectional. The audience affects the portrayal of media as well as the media influences the audience. Therefore, our study takes advantage of the media as it reflects a change in social norms to investigate potential changes in friendships as they are depicted in some of the most popular American TV shows, focusing on an adult group of friends. The data that we will present will be our preliminary findings on the study of friendships in The Big Bang Theory, Friends, and How I Met Your Father. These shows were chosen because of their similar structure. Coders were assigned to document every dyadic, verbal interaction where two friends were interacting alone within different scenes. A scene is defined by a self-contained and continuous dialogue between the same two characters in one location. Coders documented every time a character intended to self-disclose personal information, express empathy, provide perspective, express excitement, critique or show disapproval, express appreciation, and/or give a compliment. With this research we aim to understand how friendships have changed over generations through popular TV shows.

Associations Between Violence, Loneliness, and Internalizing Symptoms During Adolescence

Authors: Cassandra Vyazmensky, Cherita Clendinen, and Darlene Kertes

Background: The COVID-19 pandemic and technological advances have amplified the significance of loneliness in mental health, especially for vulnerable populations. Prior studies suggest that young individuals exposed to violence often report increased feelings of loneliness. This research aims to examine whether experiences of violence, in conjunction with loneliness, have a more pronounced impact on internalizing issues. We hypothesize significant interaction effects between violent victimization and loneliness, anticipating heightened effects on internalizing symptoms. Methods: Our study included 1406 adolescents (47.32% male) aged 13-17 (Mage= 14.25, SD= 1.86) from a major metropolitan area in Columbus, Ohio. Participants completed interviewer-assisted self-report surveys. Violence exposure, both witnessed and experienced, was assessed using the everyday discrimination and conflict tactics scales. Loneliness was measured with the Loneliness questionnaire. An internalizing symptoms score was derived from anxiety and depression scores. Regression analysis explored associations between violence exposure, loneliness, and internalizing problems. Results: Consistent with prior research, we found direct effects of experiencing violence ($p < .05$) and loneliness ($p<.05$) on internalizing problems. However, witnessing violence showed no impact on internalizing problems. Additionally, we observed a small yet significant interaction effect, indicating that experiencing violence along with loneliness predicts higher levels of internalizing symptoms ($p < .05$). Discussion: Our results suggest that direct exposure to violence may predict adverse mental health outcomes in adolescents experiencing profound loneliness. These insights can guide the identification of youth particularly vulnerable to heightened mental health challenges due to violence and loneliness. This study underscores the importance of targeted interventions to alleviate the impact of violence and loneliness on adolescent mental well-being.

Liberal Arts and Sciences



Temporal changes in tick parasitism and chytrid infection in the cave-dwelling frog Eleutherodactylus cooki

Authors: Kristin Deaver, Zuania Colón-Piñeiro, Arik Hartmann, Sarah McGrath-Blaser, Orlando Acevedo-Charry, Alberto L. López-Torres, and Ana V. Longo

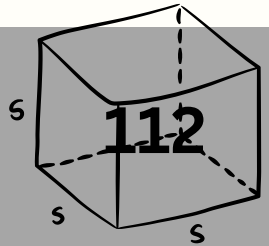
Climate change, habitat loss, and disease are the three most important factors increasing the risk of extinction for amphibians at the global scale. Here, we focus on Eleutherodactylus cooki (E. cooki), a threatened species of cave-dwelling frog endemic to southeastern Puerto Rico, to assess decadal changes in their susceptibility to tick parasitism and fungal infections. We compared previously published data collected in years 2012-2014 to recent data collected in 2021-2023. We found that, although the previous pattern of male-biased tick parasitism is still prevalent, female frogs collected in recent field surveys showed higher burdens of ticks. In contrast, fungal infections decreased over time in frogs from both sexes. These observations highlight potential shifts in susceptibility. We hypothesize that periods of increased droughts and heat stress in the region are influencing the degree of exposure to ticks and the fungal pathogen. During droughts, frogs significantly reduce their activity to conserve water and become more stationary, allowing ticks to attach and feed on the host. In addition, heat stress can directly impact the fungus, as the optimal temperatures for pathogen growth are over 15 degrees lower than the current temperatures experienced throughout their habitats (max. 38°C). Our preliminary results also suggest that environmental changes increasing parasitism could lead to additional mortality of the species, especially for male parental care givers. Our findings contribute to understand how climate change and disease will continue threatening habitat specialists in vulnerable island ecosystems.

Teaching Children to Recall Events in the Past – Secondary Analysis

Authors: Kate Lynne Pudpud, J. Stephanie Gonzalez (PI), Ciobha McKeown, Timothy Vollmer

---

The literature on teaching children to recall events in the past is limited to a handful of studies within behavior analysis. A common discussion point in this research is the numerous variables that can help analyze this response type. For example, the latency to respond to these questions has been considered a potential variable that can provide insight into covert problem-solving. The purpose of this poster is to review several secondary measures that we analyzed in conjunction with the results of successfully teaching participants to recall events in the past. Several measures were considered, including latency, recency variables, and behaviors exhibited during latency. These data provide a behavioral account of covert responses, or thinking, in children as they answer these questions.

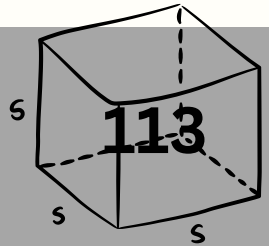


GNN based Line Segment Tracking Optimization

Authors: Povilas Pugzlys, Philip Chang

The high luminosity upgrade to the Large Hadron Collider (LHC) will produce a tremendous pile-up of particle collision data. Track reconstruction is the by far the most resource-costly stage of the Compact Muon Solenoid (CMS) experiment's data processing. Without R&D improvements, the CMS experiment will be unable to meet the projected computing resources allotment for the HL-LHC. As such, there is a need for increased track reconstruction efficiency to meet the resource needs of the CMS experiment. Many current methods are focused on improving sequential CPU-based track reconstruction algorithms. While CPU resources plateau in performance, GPU efficiency continues to improve each year. This parallelizable performance increase along with innovation in machine learning inspired the pursuit of an ML-based line-segment tracking (LST) algorithm. Both hyperparameter and model optimization were employed to improve the efficiency of the convolutional graph neural network (CGNN) model. Future work entails the performance comparison between traditional sequential LST algorithms and this new CGNN approach.

Liberal Arts and Sciences



Unveiling the Generational, Cultural, and Gender Interactions of Friendships on Television

Authors: Kyle Williams, Gianna Degracia, Rachel Grossman, Emily Marton, Amy Pezoldt, Marina Klimenko

This study examines the cultural, gender, and generational differences in friendships between White American and African American characters in popular television series that center around friendships. Komarraju and Cokley (2008) found that African Americans scored higher on horizontal individualism e.g., freedom to express oneself) whereas White Americans scored higher on vertical individualism (e.g., competitiveness). It was predicted that these cultural differences would influence depictions of dynamics among friends on television. Additionally, it was hypothesized that there would be generational differences between television shows because of our constant societal evolution. Our preliminary analyses of the content analyses of friends' communication revealed some gender, cultural and generational differences in communication among friends on television series. For example, it appears that more self-disclosure was found in a show created in late 2000s with all African American cast as compared to another African American show created and aired in the 90s. Male characters across all shows expressed more perspective taking and advice giving as compared to their counterparts. This finding may reflect some of the real-life cultural and generational changes in the norms of maintaining close relationships in the United States.

State-trait anxiety moderates age effects on theory of mind

Authors: Rachel Warren, Dalia El-Shafie, Alayna Shoenfelt, Amber Heemskerk, Tian Lin, and Natalie Ebner

As the population of older adults increases, it is crucial to understand patterns of social-cognitive changes throughout the lifespan to maintain healthy social interactions and behaviors. Notably, previous research suggests that older adults perform worse than younger adults in certain theory of mind tasks (Raimo et. al, 2022), important for deciphering social information and social decision-making. Previous research has demonstrated that specifically social anxiety influences social cognition, including theory of mind (Alvi et. al, 2020). To expand on this, we explored the impact of state-trait anxiety, which is less reliant on social environment and more dependent on intrinsic feelings, on theory of mind in the context of aging. A regression analysis was performed on age group and the Reading the Mind in the Eyes Test (RMET), a well-established theory of mind task, and the modulatory effect of anxiety as measured by the State-Trait Anxiety Inventory questionnaire (STAI). Results indicated that self-reported anxiety negatively influence RMET performance in older adults, but not younger adults. By identifying the risk factors associated with age-related decline in theory of mind, appropriate interventions can be developed to promote healthy aging in these older adults at-risk for greater social cognitive deficits.

Synthesis of novel Quinolinyl-chalcones as potential candidates for the discovery of new Anti-Leishmanial and Anti-Chagas disease drugs

Authors: Mindy Tran, Samantha Boisvert, Jonathan Otero, Simon Lopez

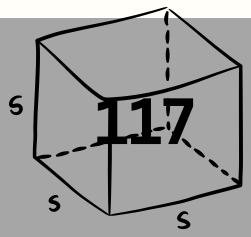
In tropical countries across the world, there are a variety of neglected diseases. These are more commonly known as neglected tropical diseases or NTDs. Some of these diseases are Buruli ulcer, Chagas disease, dengue, podoconiosis, mycetoma, and leishmaniasis. Chagas disease and leishmaniasis have extensive limitations corresponding with the treatments that are being administered. The treatments include highly toxic drugs such as benznidazole, nifurtimox for Chagas, and pentavalent antimonials for leishmaniasis. Chagas disease affects nearly 7 million people found primarily in Latin America and leishmaniasis is exposed to around 350 million people in 88 different countries. Due to the severity of these diseases, more effective drugs must be synthesized. In past studies, chalcones have shown anti-parasitic properties, therefore, this was the main structure used. During this past summer, we were able to synthesize around 15 different chalcones which will be sent soon for biological testing to observe their efficiency as new anti-leishmanial and anti-Chagas drugs.

Preparation of Atomically Smooth $SrTiO_3$ Substrate Surface

Authors: Monique Kubovsky and Amlan Biswas

Using techniques of Atomic Force Microscopy (AFM) and Lateral Force Microscopy (LFM), the surface of $SrTiO_3$ (STO) has been observed and studied. Aside from STO having unique properties, such as superconductivity and quantum paraelectricity, the study of STO is also important because its perovskite structure allows it to be used as a substrate for thin film deposition. To use it as such, the material needs to have an atomically smooth surface with a singly terminated surface that is optimal for a good quality thin film to deposit.

$SrTiO_3$ can have either a TiO_2-terminated surface or an SrO-terminated substrate, which is significant because the termination type determines the order in which the atoms of thin films are deposited on the substrate and the composition and properties of the film. $SrTiO_3$ having a TiO_2-terminated surface means that only the TiO_2 layer is exposed at the surface. This is achieved using water and thermal annealing processes to produce a TiO2-terminated $SrTiO_3$ surface that has a terraced structure with steps that are about the same height as the unit cells of the substrate i.e. atomically smooth. We have annealed samples of $SrTiO_3$ for 30 minutes and 50 minutes at 1000°C after cleaning them with acetone and ethanol and water annealing for 55 minutes at 51-55°C. Using this method, we have obtained atomically smooth, TiO_2-terminated surfaces of $SrTiO_3$ substrates. This project is significant because it focuses on perfecting the two-dimensional interface between the substrate and thin film, which plays an important role in the properties of oxide thin films with implications in oxide electronics, where metal oxides are substituted for traditional silicon.



First records of the Sri Lankan Spotted House Gecko (Hemidactylus parvimaculatus) in Alabama and Florida, USA

Authors: Benjamin Genter and Drew Davis

The diversity of non-native amphibians and reptiles that have become established in Florida highlights the state's proclivity for introduced species. Effective management of non-native species often requires the early detection of species while their range and populations are limited. The Sri Lankan Spotted House Gecko (Hemidactylus parvimaculatus) is a gecko native to southern Asia that was first documented in the United States in 2012, in Louisiana, and was likely introduced through cargo arriving at the Port of New Orleans. Currently, H. parvimaculatus is known to have expanded across a large portion of southern Louisiana and spread into both Mississippi and Texas. Given the establishment of H. parvimaculatus along the western Gulf Coast, as well as the ability of Hemidactylus spp. to spread to new areas by "hitchhiking" on cargo and trucks, we sought to investigate if this species had spread elsewhere in the southeastern United States along major transportation routes. We conducted surveys in southern Alabama and northern Florida at rest areas and truck stops along I-10 and I-75 and collected representative specimens of all gecko species encountered to be deposited at the Florida Museum of Natural History. We collected the first specimens of H. parvimaculatus in Alabama and Florida across a total of nine counties. Given these data, our results suggest an extensive distribution of H. parvimaculatus across northern Florida and Alabama along major interstate routes. Continued surveys are necessary to determine the extent to which H. parvimaculatus is established across the region.

A Structural Analysis of the NGC 1977 Cluster with Gaia DR3

Authors: Sophie Clark and Elizabeth Lada

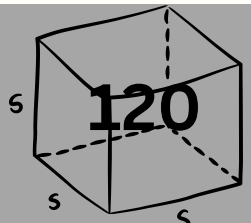
NGC 1977 is a far-ultraviolet radiation environment significantly weaker than that of the famous Orion Nebula Cluster (ONC) a short distance to the south. Because the effects of this type of environment, which may be common in nearby star-forming regions, on circumstellar material and cluster properties has not been extensively studied, NGC 1977 is a region of particular interest for a deeper understanding of star formation processes. The high population of young stars in the area surrounding NGC 1977 introduces a degree of uncertainty in its cluster's extent. Gaia's Data Release 3 allows us to investigate the cluster membership and properties using this new data of unprecedented accuracy. We find that the size of the cluster and the distribution of cluster sources agrees with the discovery of an expanding bubble around the region by Pabst et al. (2022), and that the proper motions of its members support the notion that the cluster could have been formed by feedback from the Orion-BB event hypothesized by Großschedl et al. (2020).

Secularism in Deaf Education: Understanding Religious Influences in the American Oralism and Manualism Movements

Authors: Elizabeth Riotto & Dr. Anna Peterson

The study of Deaf education is a fairly unexplored and new area of research, yet there is evidence in literature on Deaf history that illustrates significant religious impacts on the creation of Deaf education in the United States. Educating the Deaf community – that which is considered a unique ethnic group by modern scholars and is distinguished by capitalizing the 'D' in 'Deaf' – through formalized institutions was thought to help Deaf people overcome communication barriers and find the word of God, thus saving their souls and affirming religious missionaries in their quest to spread the Gospel. The religious foundations of Deaf education and the subsequent manualism movement have therefore been researched by historians and scholars of deafness, yet the oralism movement of the 20th century has not yet been explored from a similar religious lens. Drawing on sociological, historical, and religious literature, this research aims to further explore the impact of religion on both the manualism and oralism movements in the United States, as well as discuss the role of educational and religious institutions on the development and evolution of Deaf culture. In this, a framework of secularism is used to analyze why manualism was nearly eradicated in Deaf schools by the oralism movement and how the Christian church was in some ways fundamental to preserving American Sign Language (ASL) in the United States.

Liberal Arts and Sciences

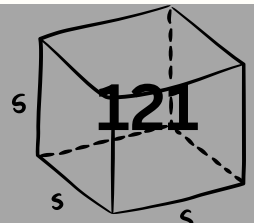


3D Modeling of Berlin Heart Devices: Mitigating Pediatric Anxiety in Congenital Heart Disease

Authors:Sneha Suresh, Vahini Srikakulapu, Utsav Sharma, Saketh Damera, Ayush Jain, Sanandan Ojha, Arun Chandran

The Berlin Heart is a state-of-the-art ventricular assist device (VAD) that significantly advances congenital heart disease treatment by providing external mechanical support to a failing heart to sustain life until heart transplantation. Caring for a patient in the CICU remains a complex process with the potential for multiple limiting medical, educational, and psycho-social factors that typically require a vast interdisciplinary team to manage. Our study looked specifically at the utility of a 3D-printed model of the Berlin VAD system in expanding understanding of the purpose and lifestyle changes that the Berlin Heart brings and its effectiveness in instilling greater confidence and less anxiety regarding the surgical procedure. Lower anxiety levels in pediatric patients improve their prognosis. Furthermore, enhancing their understanding of managing their condition using the Berlin Heart can help prevent unexpected complications. Due to the cost-effective nature of the 3D model production, the overall replicability of the study is also cost-efficient. At its core, this study exemplifies the power of demonstration and modeling to alleviate mental health stresses on patients and patients' families. Still, more importantly, its strength lies in health education. This foreshadows the possibilities of health education and how its uses can be expanded to other complex procedures in the future. A more robust understanding of the procedures and their effects on the patient also allows for a more educated approach to receiving healthcare.

Medicine



A Positive Allosteric Modulator of the M5 Muscarinic Acetylcholine Receptor Improves Motor Deficits in a Mouse Model of Parkinson's Disease

Authors:Morgan Kaplan, Tiffany Curry, Sarah Garan, Dominic Hall, Nicole Chambers, Mark Moehle

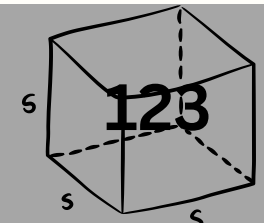
Parkinson's disease (PD) is characterized by death of nigral dopamine (DA) neurons and motor symptoms such as slowness of movement (bradykinesia) and difficulty initiating movement (akinesia). Standard treatment is DA replacement therapy with L-DOPA; however chronic treatment results in abnormal involuntary movements called L-DOPA-induced dyskinesia (LID). Another way to increase DA release is by targeting Gq-coupled M5 muscarinic acetylcholine (ACh) receptors on nigral DA neurons using a positive allosteric modulator (PAM). PAMs change the shape of the M5 receptor so that ACh is more likely to bind, increasing intracellular calcium, and promoting DA release from nigral DA neurons. We used the hemiparkinsonian mouse model which has 90-95% DA neuron loss. In our first experiment we examined the effects of M5 PAM on PD motor deficits and L-DOPA-mediated motor improvement. In our second experiment, we investigated the effects of M5 PAM on LID. Overall, M5 PAM improved motor behavior, specifically bradykinesia. M5 PAM decreased the time spent per trial in the Erasmus ladder but did not affect forepaw akinesia. Excitingly, treatment with PAM did not affect dyskinesia. Our findings suggest that the M5 receptor may offer a promising avenue for PD treatment by enhancing motor function without exacerbating dyskinesia.

Molecular Mechanisms of Risky Decision-Making with Mice Pilot Study

Authors:Isabelle Rodriguez, Rachel F. Eloy, Angie Cordova, Emily V. Tuliao, Chelsey Leveque, Gabriel Maldonado, Paola Giusti-Rodriguez

The American Psychological Association defines risky behavior as a pattern of unnecessarily engaging in activities or behaviors that are dangerous or highly subject to chance. Risk-taking behavior is a feature of many neuropsychiatric disorders, including schizophrenia, substance use disorder, and attention deficit/hyperactivity disorder; consequently, maladaptive risk-taking can negatively impact life outcomes. Expanding research on the neurogenetics of risk-taking behavior can contribute to future research to increase the quality of life for those with neuropsychiatric disorders. However, the genetic mechanisms of murine risk-taking have not yet been explored using the Risky Decision-making Task. The objective of the study is to gain insight on the molecular machinery behind risk-taking behavior by examining gene expression and other epigenomic features in the basolateral amygdala (BLA) and nucleus accumbens (NAc) following completion of the murine version of the Setlow Risky Decision-making Task (RDT). By adapting this Setlow assay to mice, we can determine the feasibility of replicating a variety of behavioral features with RDT. The first component of the procedure is a series of behavioral tasks, where C57BL/6 J mice (N=12) can choose between a small, safe reward and a large reward accompanied by the risk of footshock. After establishing the mice as either risk takers or risk averse, tissue punches will be taken from the BLA and NAc of the two groups to perform bulk RNA sequencing to identify differences in transcription related to risky-behavior. Regarding the behavioral component, a decrease in preference for the large reward stimulus and an increase in preference for the small reward stimulus is expected; however, this trend will be less pronounced for the risk takers Moreover, differential gene expression in the BLA and NAc of risk-taking subjects compared to risk-averse subject is anticipated.

Medicine

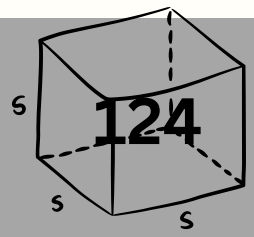


Cannabinoid Receptor 2-Selective Compounds Alter Macrophage Phagocytosis

Authors:Jazmyn E. Coronado, Hannah Staley, Ann Titus, Valerie Joers

Cannabinoid Type 2 receptor (CB2) is found in immune cells and activated microglia, increased in AD and PD patient brains, and has been preclinically evaluated as a possible neuroprotective target. The genetic removal of CB2 has shown reduced amyloid pathologies in AD models, suggesting that altering CB2 has direct effects on the clearance of aggregated proteins. This experiment aims to investigate the impact of CB2 selective compounds on myeloid cell phagocytosis. We hypothesize that CB2 signaling regulates the phagocytosis of immune cells. To test this, we utilized the RAW 264.7 macrophage cell line challenged with lipopolysaccharide (LPS) and treated with CB2 selective ligands (HU308, SR144528, SMM-189) before performing a functional E. coli phagocytosis assay 24 hours post-LPS. Additionally, immunocytochemistry (ICC) for CD68 and Lamp-1 was performed to evaluate inflammation and phagocytosis. The results of this study indicate that CB2 selective compounds, regardless of the mechanism of action, increase RAW cell phagocytosis in a dose-dependent and ligand-dependent manner. The inverse agonist, SMM-189, exhibited a notably enhanced additive effect compared to other CB2 ligands, suggesting its potential as a superior compound for enhancing phagocytosis. Concerning the ICC conducted, the quantitative analysis of the fluorescent signal from microscopic images revealed no statistically significant differences between the conditions. Upon visual examination, discernible dissimilarities in spatial distribution exist among certain groups. Cells stimulated with SMM-189 exhibit fluorescence concentrated predominantly around the nuclei, in contrast to cells stimulated with the inhibitor cytochalasin D or exposed solely to LPS, where the fluorescence appears dispersed throughout the entire cell body. Further investigations are warranted in the proteasome and lysosomal systems to elucidate the underlying pathways involved in CB2-regulated phagocytosis and the potential therapeutic implications of CB2 modulation in the context of protein aggregation as found in AD and PD.

Medicine



Rapid single-step generation of human neurons from pluripotent stem cells using an all-in-one inducible dual transcription factor system.

Authors:Reece Tappan, Aravindraja Chairmandurai and Matthew J LaVoie

Direct neuronal differentiation of human fibroblasts or induced pluripotent stem cells (iPSCs) using various transcription factors has allowed for rapid differentiation of human neurons. Neurogenin-2 (Ngn2) mediated differentiation of cortical neurons from iPSCs using two lentiviral constructs has been widely used. Although promising, it is limited due to variable conversion efficiencies & mitotic cell contamination. The objective of this study was to substitute the use of two lentiviral constructs with a single virus, containing all the essential transcription factors (TFs) for efficient & uniform differentiation of neurons from iPSCs. We used a new all-in-one lentiviral system (Addgene #127289) to induce differentiation of iPSCs into neurons using two TFs, Ngn2 & Ascl1. The all-in-one inducible lentiviral construct consisted of a tetOn system cassette (rtTA, reverse tetracycline transactivator, driven by the UbC promoter), a Ngn2:2A:Ascl1 cassette (controlled by the TRE tight promoter), & a puromycin resistance gene (driven by the PGK promoter). Isogenic wild-type LRRK2, G2019S LRRK2+/-, & R1441C LRRK2+/- iPSCs were cultured in mTeSR medium in a 12 well plate. Cells were transduced with the lentiviral construct, passaged for expansion, & frozen as stocks. After transduction, cells were selected for puromycin resistance using concentrations ranging from 0.75 to 10 µg to enrich for cells to be differentiated. Using our standard protocols, these cells were then plated, & induced to differentiate with doxycycline (2 µg/ml), & grown until DIV 21. Immunocytochemistry (ICC) was performed using βIII-tubulin (1:500), & cells were visualized by confocal microscopy. ICC confirmed the all-in-one lentiviral construct not only improved neuronal yields, but also induced a homogenous yield. The morphology & differentiation efficiency of our generated neurons were highly unique contrasted to the induced neurons traditionally generated using the two lentiviral constructs. Further characterization of these neurons will provide an improved toolkit for iPSC derived neuron platforms.

Prevalence of depression within the LGBTQ+ community in rural versus urban areas: a systematic review

Authors:Elie Haddad, Zainab Nawaz, John Basile, and Ajay Mittal

Members of the LGBTQ+ community disproportionately face mental health issues across the United States. Current research demonstrates that there is a disparity in the mental health of those in rural versus urban areas. This has been seen largely due to different attitudes towards mental healthcare and the LGBTQ+ community, as well as varying access to mental health resources and social networks. The social and political climate surrounding the LGBTQ+ community has shifted significantly over the last decade, with the legalization of gay marriage, increased LGBTQ+ representation in the media, and the rising demand for LGBTQ+ specific healthcare. Specifically our study focuses on rates of depression as a quantifiable measure of mental health disparities. Studies have illustrated that depression, compared to other mental health disorders, leads to especially increased rates of self-harm, substance abuse, and suicide. The purpose of this systematic literature review is to compare the rates of depression among the LGBTQ+ community in rural versus urban areas. We aim to observe trends in the rates of depression based on factors including population density, the number of mental health practitioners in an area, and local attitudes toward the LGBTQ+ community. It is imperative that we analyze these trends to identify gaps in mental healthcare for this community so that effective solutions can be integrated. Further research could lead to changes in healthcare policies and training that will improve mental healthcare for LGBTQ+ people in all geographical areas of the United States.

CTLA-4 Risk SNP

Authors: Alexander Pearce, Leeana Peters, Todd Brusko

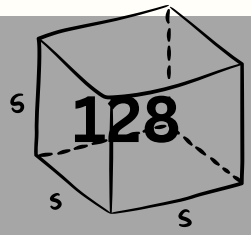
Type 1 Diabetes development is preceded by significant genetic risk. One such variant which has been identified to confers risk is the single nucleotide polymorphism (SNP) within cytotoxic T-lymphocyte-associated protein 4 (CTLA-4). CTLA-4 is a checkpoint molecule that is constitutively expressed on Regulatory T cells and acts to down-regulate T cell activation. Our lab has generated preliminary data showing that a missense/coding variant of CTLA4 (rs3084723) contributes to an increase in CXCR5+ T helper subset frequency in tissue. Thus, we are interested in understanding how this SNP, or other linked SNPs, may affect T cell phenotype and function. In our study, we are using novel SNP editing tools to isogenically investigate the role of CTLA-4 in conventional T cells and regulatory T cells. Via flow cytometry and phosflow experiments, we can determine the effects the CTLA-4 SNP has on T cell activation, differentiation, and functionality. Preliminary results suggest that the risk SNP down-regulates CTLA-4 expression, which could result in delayed or ineffective regulatory T cell suppression of auto-reactive T cells and exacerbate autoreactive T cell function.

Role of the nucleus reuniens in communication between the hippocampus and medial prefrontal cortex during the Paired Associates Learning task

Authors: Aden Baksh, Riley Braden, Cristina Besosa, Sara Burke, Andrew Maurer

The prevalence of mental health and mood disorders has increased in recent years, but targeted therapeutic developments have been slow to emerge. A critical step in improving outcomes for those suffering from mental illness is to expand our knowledge of the dynamics of neural signatures that could be indicative of these disorders, especially in brain areas commonly affected. The primary aim of this project is to understand the role of information transfer between the hippocampus (HPC) and medial prefrontal cortex (mPFC) during the Paired Associates Learning (PAL) behavioral task. Disrupted coordination of the HPC-mPFC circuit is a common feature of many psychiatric disorders such as anxiety, bipolar disorder, and schizophrenia (Gray and McNaughton, 2000; Roozendaal et al., 2009, Frías et al., 2014), so exploring this circuit in animal models using a clinically-relevant touchscreen task like PAL will give us a directly translatable paradigm to humans that can allow for improved therapeutic testing. One site, the nucleus reuniens (RE), receives input from and projects to both the HPC and mPFC, suggesting it could be a site of information transfer between these areas (Dolleman-van der Weel et al., 2019). We will inactivate this thalamic nucleus with the GABA-A agonist muscimol via cannula injections of both male and female Long-Evans rats and measure the effect on our behavioral task. Preliminary data shows impaired PAL performance after muscimol injections, suggesting an important role of the RE in this associative memory task. Future aims for this project include cholinergic modulation of RE through injections of acetylcholine agonists and antagonists. Our ultimate goal is to find behavioral markers of HPC-mPFC circuit engagement using the PAL task which has direct relevance to humans suffering from mental disorders.

Medicine

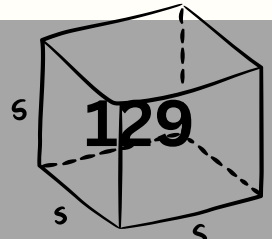


Optimization of Cellular Constructs in 3D Bioprinting: Material Comparison for Optimal and Functional Smooth Muscle Incorporation

Authors: Jordan Harrow, Katie Cuadrado, Maher Saadeh, Martin Tomov, Vahid Serpooshan, Holly Bauser-Heaton

The United States has the largest population of Brazilian immigrants compared to any other nation, and this number has been steadily rising over the past decade. (Guarino, 2023) Along with their food and culture, Brazilian immigrants have brought their language to North America, creating a population of young Portuguese Heritage Speakers (PHS). PHS are born to at least one Portuguese speaking caregiver, are bilingual, and receive the majority of their education in English. As with all heritage speakers, they are unique because they normally learn Portuguese as a first language, yet slowly transition to English as their dominant language overtime. This impacts their language use in a unique way that differs from bilingual or second-language acquisition populations. In particular, PHS unique understanding of both their native and dominant cultures and languages provides them with competency in both English and Portuguese. (Flores, 2015) While communicating in different environments, PHS commonly code switch, where “words from two languages are used within a single discourse” (Yow et al., 2017) Though research indicates code switching within populations of heritage speakers is informed by this proficiency of both languages, there is a gap in research regarding how and why Heritage Speakers code switch. (Flores, 2015) The purpose of this research poster is to examine the prevalence of code switching in PHS populations in the United States and under what circumstances it occurs. Further directions will include a survey for PHS on code switching tendencies.

Medicine



Regional differences of actin cytoskeleton and effector proteins in the kidney of human alpha- 1 antitrypsin overexpressing mice

Authors: Erika S. Galban, Niharika Bala, Sihong Song, and Abdel A. Alli

Renal epithelial sodium channels (ENaC) play a crucial role in maintaining total body salt balance and blood pressure regulation. The alpha-1 antitrypsin (AAT) protein inhibits proteases that cleave and activate ENaC in the kidney. In addition, AAT inhibits proteases that cleaves actin cytoskeleton proteins known to regulate renal ENaC. Previous studies have shown human alpha-1 antitrypsin (hAAT) mice have significantly lower blood pressure compared to wild-type mice. We hypothesized there are differences in regional protein expression of actin cytoskeleton proteins and effector proteins between the active and inactive phases of hAAT overexpressing mice. Differences in protein expression of multiple actin cytoskeleton and effector proteins in the kidney cortex and medulla were measured by Western blotting and immunohistochemistry. The activity of kinases and proteases were measured by ELISA using kidney cortex and medulla tissue lysates. Total myristoylated alanine-rich protein kinase C substrate (MARCKS) protein expression was greater in renal medulla and renal cortex tissue lysates from mice euthanized during the active phase compared to the inactive phase. A protein kinase C (PKC) activity assay showed greater overall PKC activity in both medulla and cortex samples from mice euthanized during the active phase compared to the inactive phase. In conclusion, data from this study suggest the function of MARCKS and PKC is greater in the kidney during the active phase of hAAT mice which presumably correlates with changes in actin cytoskeleton dynamics and the function of associated membrane proteins including ENaC.

Diagnostic Rate of Fine Needle Biopsies for Pancreatic Lesions at UF Health Gainesville

Authors: JGrace Barney, David Hernandez Gonzalo MD, and Aleksey Novikov MD

Introduction:

Endoscopic ultrasound (EUS) is often chosen as an effective method for diagnosing pancreatic malignant lesions. Previous studies showed fine needle aspiration of the pancreatic masses to have a diagnostic yield between 68% and 77%. Recently, trials of EUS with newer fine needle core biopsies (FNB) showed an improved yield reaching into the low 90%.

Hypothesis:

Our institutional diagnostic rate of EUS-FNB at UF is approximately 90%.

Materials and Methods:

We reviewed all endoscopic ultrasounds with biopsies from May 1st, 2022 to May 31st, 2023. We obtained an index list of cases using EPIC by finding patient records that had both an ICD-10 code associated with presence of pancreatic lesion (K85.90, K85.91, K85.92, K86.0, K86.1, K86.9, K86.8, K86.81, C25.0-C25.0, R93.3, R17, and R18) and a CPT code associated with a biopsy (43242 and 43238). Additionally, we searched the UF pathology reporting system for the word “pancreas”.

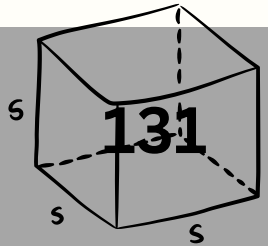
Results:

We identified 153 patients. 6 patients who underwent EUS for non-pancreas-related indication were excluded. Among 147 patients who underwent EUS for a proper indication, 134 were biopsied. 103 of the 134 (76.9%) biopsies were diagnostic. 31 of 134 patients had non-diagnostic initial EUS. Of the 147 patients who underwent EUS, 16 underwent a follow up EUS and 15 were re-biopsied. 8 of these 15 biopsies (53.3%) resulted in a diagnosis and 7 were non-diagnostic again. 3 of the 16 patients had a third EUS, which resulted in all three being biopsied and 2 out of the 3 (66.6%) being diagnostic.

Conclusion:

Overall, the first pass rate of diagnostic FNB at UF was found to be 76.9%. Notably, pancreatic lesions included solid and cystic lesions. Further work will focus on factors associated with non-diagnostic sampling of the pancreatic lesions.

Medicine



Exploring the Interactions Between Metabotype Groups and Placental Functionality

Authors: Dominick Lemas

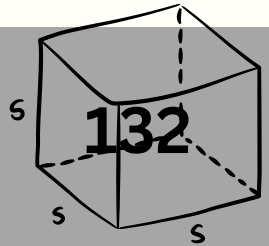
In the beginning of the 21st Century, the world observed remarkable growth in In the United States, approximately 1 in 3 adults are overweight, posing a significant public health challenge with profound implications for cardiovascular disease risk. Yet, the repercussions of obesity extend beyond the individual, significantly affecting maternal health during pregnancy, leading to complications such as gestational diabetes and preeclampsia [source]. Our study aimed to investigate metabotypes, distinct metabolic profiles influenced by factors like environment, diet, and physical activity, to address these concerns. We hypothesized that understanding the metabolic milieu of pregnant women and offering tailored interventions could mitigate pregnancy-related conditions.

We conducted a comprehensive study involving pregnant women across various weight categories, including normal weight, overweight, and obesity, analyzing their dietary metabolites to discern patterns. Our findings revealed a noteworthy result: mothers classified in higher metabotype categories (statistically significant at $p<0.05$) exhibited a reduced risk of conditions like preeclampsia, common in pregnancy. This suggests the potential of metabolic profiling and personalized interventions in enhancing maternal outcomes.

However, our study constitutes just a part of the broader picture, highlighting metabotypes as a powerful tool for metabolic analysis and intervention. To expand on these promising findings, we plan to delve into cell cultures and employ additional experimental techniques. These approaches will offer deeper insights into how various metabolites impact both the pregnant mother and the developing fetus.

In conclusion, our study underscores the importance of metabotypes in shaping the health of pregnant women and their offspring. It emphasizes the potential of personalized metabolic interventions to mitigate risks associated with maternal obesity and related complications. As we further explore this field through advanced techniques, we aim to contribute to a healthier and safer pregnancy experience for both mothers and their children.

Medicine



Knockdown of C17ORF58 on PTCL-NOS Lymphomas and Other Hematological Malignancies

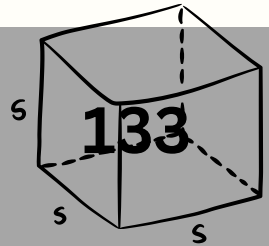
Authors: Reem Abdelghany, Julián Tobon, Gene Pozas, Emma Noel, Jacob Fingeret, Jana Opavska, Rene Opavsky

Lymphomas, cancers originating from lymphocytes, are primarily driven by oncogenic mutations. A subtype of lymphomas, Nodal Peripheral T-cell Lymphomas “not otherwise specified” (PTCL-NOS) are the most common type of T-cell lymphoma (TCL), accounting for 1 in 3 cases, and being notably resistant to conventional chemotherapy. Understanding the genes essential for the growth of these lymphomas is required in developing therapeutic options for these aggressive cancers.

Using RNAseq data on PTCL-NOS, we identified 400 genes that were overexpressed genes compared with normal samples. After omitting genes considered essential to cells, we conducted shRNA knockdown on them in T8ML-1, a PTCL-NOS cell line, revealing potential target genes which killed the cells, including TRIP13, C17ORF58, and others. When down regulating these genes in a normal fibroblast cell line (HEK 293T), it was found that C17ORF58 didn’t impact cell proliferation, while the other genes affected the cells negatively. On the other hand, when C17ORF58 was downregulated in other T-cell lymphoma and leukemia cell lines (Hut78 and Jurkat, respectively), apoptosis occurred. C17ORF58 has been found to play a role in maintaining collagen-containing extracellular matrices. Cell cycle assays suggested that the knockdown of TRIP13 and other genes resulted in G2-M arrest, while the knockdown of C17ORF58 resulted in apoptosis. Further analysis of public RNAseq data has shown that C17ORF58 is also overexpressed in many other T-cell lymphomas and leukemias, and tissue expression data indicates the gene is generally overexpressed in reproductive tissues. Further investigations into its typical role in normal cells and whether it is involved in other hematological malignancies are currently underway.

With its down regulation not affecting normal cells and killing malignant cells, as well as its novelty, C17ORF58 has proven to be a promising gene for further study and eventual therapeutic targets.

Medicine



Effect of Metformin on GNAQ mutant Uveal Melanoma

Authors: Lauren E. Hellewege, Gianluca A. Medigovic, Katelyn R. Raburn, Jonathan D. Licht, Richard L. Bennett

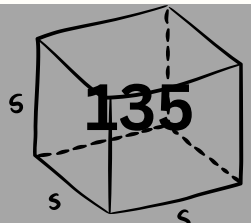
Uveal (eye) melanomas (UM) originate from the melanocytes within the uvea, which consists of the iris, ciliary body, and choroid. The tumors resulting from uveal melanoma develop from normal melanocytes and often metastasize to the liver. Almost all UM harbor an initiating mutation in the G□q signaling pathway, most commonly in the GNAQ gene. Prior work in the lab has identified the lipoic acid biosynthesis pathway and regulation of reactive oxygen species as a GNAQ-mutant UM dependency. We hypothesize that GNAQ mutation may disrupt autophagy in uveal melanoma cells. To test this hypothesis, we treated UM cell line Mel202 with Metformin, a drug that is used for diabetes but is also able to trigger autophagy, a process that recycles proteins and balances the cells energy response. We utilized live cell imaging to measure both proliferation and apoptosis to determine whether metformin would kill MEL202 uveal melanoma cells. Our proliferation assays utilized the red fluorescent nuclei of the MEL202 line. Annexin V Green Dye was utilized for apoptosis assays. These results are expected to point the way to an improved molecular understanding of uveal melanoma that may be used to develop new and more effective treatments.

Metabolic Interactions of KSHV and STING using Mass Spectrometry

Authors: Erin Clifton, Zhe Ma, Elizabeth Flammer, Timothy Garrett

Stimulator of interferon gene (STING) is a cyclic GMP-AMP synthase signaling pathway able to induce immune defenses in response to both microbial and host-derived DNAs. The STING pathway plays a crucial role in innate immunity against viral infections, but also exhibits an antitumor role through the triggering of intrinsic cell killing or T-cell activation. However, the STING pathway can become silenced by viral infections such as Kaposi's sarcoma-associated herpesvirus (KSHV), contributing to the development of KSHV-associated cancers. The metabolic changes regarding the interaction between STING and KSHV are very understudied; therefore, the purpose of this project is to investigate the relationship between STING and KSHV associated cancers using untargeted metabolomics, with the goal of identifying potential chemicals capable of upregulating and downregulating the STING pathway. The relationship between STING and KSHV-associated cancer was investigated using laboratory grown mock B-cells and primary effusion lymphoma (PEL) cells. PEL is a B-cell malignancy associated with KSHV, most often found in immunocompromised patients such as those with HIV. Untargeted metabolomics was performed on both the B- cells and PEL cells, in which cell extractions were conducted to obtain the metabolites analyzed with Liquid Chromatography- Mass Spectrometry (LC-MS). Using Metaboanalyst software, the resulting LC-MS spectral data was processed to compare the abundance of metabolites within the PEL and B-cells. The resulting data displayed distinct differences in the regulation of metabolites between the control B cells and KSHV-associate PEL cells; however, these are preliminary results of the study. Currently, cell extractions of the samples are being rerun on MS-MS to enable the specific identification of metabolites with large fold change differences between the B-cells and PEL cells.

Medicine

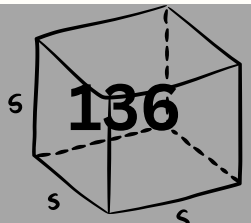


Spatial & Metabolic Profiling of the Tumor Microenvironment in Glioblastoma

Authors: Miruna Anica, Diana Feier, Aryeh Silver, Avirup Chakraborty, Changlin Yang, Dongtao A Fu, Christina Von Roemeling, Maryam Rahman, Matthew Sarkisian, Jianping Huang, Jeffrey Harrison, Duane A. Mitchell, and Loic P. Deleyrolle

Glioblastoma (GBM) is the most aggressive form of brain cancer, with only 6% of patients surviving for 5 years or longer post-diagnosis. There is a dire need to better understand tumor heterogeneity and the tumor microenvironment (TME) to develop therapies that effectively target the interaction between tumor and immune cells. Our group has characterized two cell populations, fast-cycling cells (FCCs) harnessing aerobic glycolysis, and treatment-resistant slow-cycling cancer stem cells (SCCs) engaging in lipid metabolism. Murine and human glioma tissues were analyzed using geospatial profiling techniques, where it was found that SCCs induce an immunosuppressive microenvironment by recruiting macrophages and MDSCs, where the FCC microenvironment is upregulated with cytotoxic T cells. Microscopy and flow cytometry were utilized to better understand the mechanisms by which SCCs reshape their milieu by recruiting tumorigenic immune cells. SCCs have been observed to induce lipid transfer from macrophages, thereby increasing fatty-acid uptake to provide a survival advantage in the nutrient-deplete environment characteristic of GBM. These mechanisms play a critical role in the progression of GBM and treatment-resistant tumors. The insights generated from this project uncover fundamental principles of the emerging connections between the tumor microenvironment, cell metabolism, anti-tumor immunity, and associated therapeutic vulnerabilities. These insights delineate potential therapeutic effects of disrupting SCC-induced metabolic pathways to shape a TME that is more responsive to treatment. Our future work will focus on further elucidating the communicative pathways between SCCs and macrophages.

Medicine

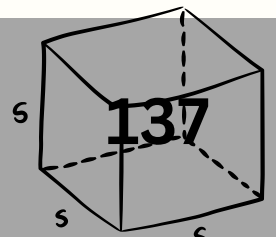


Effects of TNNI3K on Myocarditis in Novel Translational Mouse Model

Authors:Nick Farahani, Lauren Parrow, Jake Ricci, Kelsey Tjen, Henry Sucov, Katelyn Bruno

Myocarditis, inflammation of the heart muscle, is a frequently underdiagnosed disease and is a leading cause of sudden death from heart failure in children and adults under age 50 in the US and worldwide. Previous studies have identified cardiac troponin i3 kinase (TNNI3K) as a potential candidate to control susceptibility to viral myocarditis. We hypothesized that mice with TNNI3K will have increased resistance to viral myocarditis. We utilized a TNNI3K full knockout (KO) mouse, a mouse that expresses a kinase-dead form of TNNI3K (KD), and a wild-type mouse with normal TNNI3K activity (WT). To test our hypothesis, male mice were infected with coxsackievirus B3 (CVB3), and 10 days after infection, % inflammation was assessed to determine myocarditis severity. Additionally, gene expression of viral peptide genomes, immune cells, and immune cell pathways was assessed. TNNI3K WT and the KD group had higher expression of TNNI3K as compared to the KO group, confirming accurate mouse cohorts. TNNI3K KO mice had reduced IFN expression in the heart compared to WT mice. The TNNI3K KD group had increased CVB3 viral peptide genomes compared to the WT group. Both the KD group (88.3%) and the KO group (95.3%) had significantly increased percent inflammation, indicating more severe myocarditis compared to WT mice (74.8%). The increase in inflammation in the KD group compared to the WT group was due to increased gene expression markers for macrophages, neutrophils, CD4+ T cells, and the inflammasome pathway in the heart. We found that normal levels of TNNI3K expression may play a protective role against acute myocarditis by activating anti-viral cytokine, IFN, which decreases viral replication and reduces immune cell infiltration to the heart, suggesting that TNNI3K may be a potential therapeutic target for myocarditis treatment. Further investigation of the mechanisms by which TNNI3K protects against myocarditis is needed.

Medicine



Optimizing Reporters to Monitor Translation Fidelity in Culture Cell

Authors:Saumya Sahay, Riku Nagai, Pitchaporn Akaphan, Kotaro Fujii

Surprisingly, about 15% of nascent proteins contain errors including stop codon readthrough (SCR) and amino acid misincorporation (aaMI). Proteins that contain errors unfold easily, which can create protein aggregates and lead to neurodegeneration. Therefore, translation fidelity has significant health implications. However, the factors involved in translation fidelity are still greatly unknown. Previously, we have observed a correlation of translation fidelity and the complexity of proteome between species; and further elucidated that a eukaryotic-specific ribosomal domain has an important role in increasing translation fidelity. Detecting error products proves to be difficult because of their low amount, especially when translation fidelity becomes higher. To overcome this issue, we optimized reporter constructs.

Traditional reporter constructs utilize Renilla luciferase (Rluc) and firefly luciferase (Fluc) in a tandem reporter with stop codons in the middle or a single nucleic acid substitution at the active site of Fluc. This allows for monitoring of SCR or aaMI respectively. Essentially, active Fluc would only be produced when there is a translational error. Fluc activity generally has been used to detect translation errors, even if the activity is much lower compared to Rluc or Nano luciferase (Nluc). We have already tested multiple luciferase combinations and found that detecting errors by Nluc provides the highest sensitivity to monitor SCR. To create reporter monitoring aaMI, a single nucleic acid substitution can be inserted at the active site of Nluc to kill the activity. However, there is no known Nluc active site. Within this project, Nluc mutagenesis was performed based on the interaction site of Nluc and its substrate. We have found a few candidate sites that have reduced activity by amino acid substitution, suggesting the potential active sites of Nluc. Further research will develop optimized aaMI reporter constructs, and we will discuss potential applications of these new reporters.

Audiovisual Sensory Stimulation and the Modulation of the Basal Ganglia in Parkinson's Disease Deep Brain Stimulation Patients

Authors: Phuong Ton, Dake Liu, and Yousong Ding.

Nitroreductase-CB1954 [5-(aziridin-1-yl)-2,4-dinitrobenzamide] is a promising gene-directed enzyme-prodrug therapy (GDEPT) for the treatment of a variety of cancers. This strategy uses a nitroreductase in cancer cells to convert the non-toxic CB1954 prodrug into the cytotoxic hydroxylamine products, whose metabolites then kill tumor cells. The major advantage of this therapy includes its ability to target both dividing and nondividing cancer cells, independent of the cell cycle. Human DT-diaphorase (NAD(P)H dehydrogenase) is able to activate CB1954, but its low efficiency has significantly hindered the further development of GDEPT for cancer management. Indeed, since 2008, there has been no further update about this gene-directed enzyme-prodrug therapy. To address this critical issue, we aimed to advance the GDEPT by enhancing the CB1954 activation efficiency of a bacterial nitroreductase from the human commensal bacterium Haemophilus influenzae (HiNfsB). To achieve the objective, we docked CB1954 into the active site of HiNfsB, whose structure we recently determined, to identify key residues for the substrate binding. W71 was then selected for site-directed mutagenesis to screen for mutants with improved nitroreduction activities. The substrate consumption in the enzyme reaction was monitored by HPLC and the products were identified in LC-MS analysis. Our current results showed that HiNfsB shows a higher activity in activating CB1954 than the well-characterized NfsB homolog from E. coli. In addition, several mutants (e.g., W71A and W71F) showed the increased activities on activating CB1954 comparing to the wild-type HiNfsB. Our preliminary results demonstrated that HiNfsB is a promising candidate for further developing nitroreductase/CB1954 GDEPT, and W71 is a key residue for further improving the enzyme's catalytic efficiency on CB1954.

Determining Region-Specific Microglial Gene Expression Changes in PLCG2 P522R Variant Carriers

Authors: Ann Titus, Hannah Staley, Malú Tansey

Alzheimer's disease (AD), characterized by the accumulation of beta-amyloid plaques and neurofibrillary tau tangles, is anticipated to impact 13 million Americans by 2050. While research has primarily focused on disease progression and treatments, recent studies highlight the undeniable involvement of the immune system in AD development. Microglia, the frontline defenders in the central immune system, exhibit dual effects based on genetic variants. The P522R variant in the phospholipase C gamma 2 (PLCG2) enzyme gene has emerged as protective in AD, enhancing microglial phagocytosis and inflammation. This peculiar variant's ability to be both inflammatory and protective is crucial given inflammation's connection to AD-associated cognitive decline.

The protective role of P522R suggests its impact before cognitive decline onset, indicating potential differences in the inflammation pathway. To probe the preclinical function of this variant, 10 female mice brains, both with and without the variant, were dissected at 5 months. Brain regions (cortex, hippocampus, and striatum) were isolated, and gene expression was analyzed using qPCR. Various genes associated with inflammation and activated/homeostatic microglia were examined to understand regional immune cell function differences. In exploring major inflammatory pathways (IL-10, IL-6, and TNF expression), IL-10 levels were too low to quantify. Notably, no significant differences were observed between variant and nonvariant mice in IL-6 and TNF expression, indicating consistent regional gene expression compared to wild-type mice. Future experiments will involve inflammatory stimulants like lipopolysaccharide, enabling assessment of inflammatory gene expression in these brain regions under immune-activated conditions, providing valuable insights into the complex interplay between genetics, immune response, and AD progression.

Medicine **140**

Monoclonal Antibody Blockade of CD226 Decreases Spontaneous Diabetes in the NOD Mouse by Diminishing T Cell Cytotoxicity and Augmenting Treg Suppressive Capacity

Authors: Matthew E. Brown, Puchong Thirawatananond, Lindsey K. Sachs, Kayla Q. Nguyen, Sonali Vijay, Elise J. Kern, Collin C. Lahde, Melanie R. Shapiro, Todd M. Brusko

Immunotherapeutics that modulate T cell activation represent a crucial component for inhibiting the autoimmune pathogenesis of type 1 diabetes (T1D). Here, we present a novel strategy for reducing diabetes incidence in the NOD mouse using a monoclonal antibody (mAb) to block the T1D-risk associated T cell costimulatory receptor, CD226. Notably, female NOD mice treated with 600 µg of α-CD226 between 7-8 weeks of age showed reduced insulitis at 12 weeks and decreased disease incidence at 30 weeks compared to isotype-treated mice. Ex vivo analysis performed five weeks post-treatment revealed α-CD226 mAb persists in vivo, reducing the availability of CD226 on CD8+ T cells and Tregs. α-CD226 inhibited the proliferation of both CD4+ and CD8+ T cells in vitro and ex vivo. Splenocytes treated with α-CD226 exhibited a more immunoregulatory cytokine profile with decreased IFN-γ and increased IL-10 production. This phenotype was further corroborated by 51Cr-release assays. Ex vivo phenotyping of FOXP3+Helios+ Tregs revealed increased CD25 expression, with Tregs displaying suppression of CD4+ T cell responders in vitro. These data suggest that CD226 blockade both reduces T cell cytotoxicity and improves Treg function, with important therapeutic implications for the prevention or suspension of T1D.

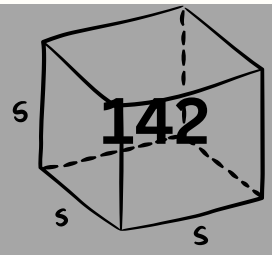
Medicine 141

Genetic deficiency of adropin enhances stroke-induced neurogenesis in mice

Authors: Valerie Cabrera, Changjun Yang, Lei Liu, Jonathan Larochelle, John Aaron Howell, Rachel Gunraj, Sofia Stansbury, Eduardo Candelario-Jalil

Stroke is the second leading cause of death and the third leading cause of disability worldwide. Neural precursor cells, seen in the lateral subventricular zone (SVZ) and the subgranular zone (SGZ) of the dentate gyrus (DG), contribute to brain repair after stroke by proliferating and migrating towards lesions. Adropin is a highly-expressed peptide in the brain that helps maintain endothelial barrier function. Our findings have demonstrated that adropin provides neuroprotection in young and aged mice following ischemic stroke by reducing infarct volume and blood-brain barrier (BBB) damage. However, the effects of adropin on neurogenesis after stroke have not been examined. In this study, we investigated whether adropin modulates poststroke neurogenesis. Male 10 to 12-week-old wild-type (WT) and adropin-deficient (Enho-/-) mice underwent 35 min of right middle cerebral artery (MCA) occlusion, while sham-operated animals received the same procedures except for MCA occlusion. After 7 days, mice were euthanized, and brains were perfused. Then brains were stained with Nestin and doublecortin (DCX), cell markers for neural progenitor cells and migrating neuroblasts, respectively, and Ki67, a marker of cell proliferation. Double immunohistochemical staining shows that adropin is colocalized with Nestin in primary cultured neural stem cells. Compared with sham-operated animals, stroke induces a dramatic increase in the number of Nestin/Ki67- and DCX/Ki67-double immunoreactive cells in the SVZ and the SGZ in the WT mice. Compared to the WT controls, genetic deficiency of adropin (Enho-/-) further upregulated the neurogenic response in the SVZ and SZG after ischemic stroke. This could be attributed to the increased permeability of the BBB and larger infarct size caused by a lack of adropin, leading to worse strokes and an elevated need for neurogenesis after stroke. These results have implications for adropin as a protective treatment against ischemic stroke.

Medicine



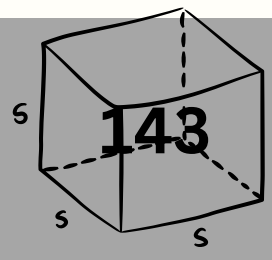
Racial Ethnic Disparities in Post–Lung Transplant Outcomes

Authors: Abhinav Penmetcha, Omolola Suleiman, Divya Patel, Jason Cory Brunson

Lung transplantation is a thoracic procedure where a patient's lung is replaced with a donor's lung. As donor lungs are limited, an organizational system was implemented in 2005 in which waitlisted patients are prioritized by a score calculated from several aspects of the patient's health. This score, along with other dimensions of health, is predictive of outcomes after transplant including survival time. However, as with other health outcomes, social determinants may also play a role. Of these determinants, the race/ethnicity of the patient is of particular interest as there is limited literature investigating its role as a predictor of survival.

Our goal in this project is to construct a mediator model describing the relationship between race/ethnicity, a curated set of covariates, and post-transplant outcomes. We conducted a literature review to identify determinants of post-transplant outcomes and integrated the studies from this review into a causal framework involving four variable sets: race/ethnicity, social determinants, health factors, and outcomes. We now aim to evaluate the relationships between these variable groups guided by our causal framework through a mediation survival analysis. In doing so, we hope to quantify the mediating role of social determinants on any racial-ethnic outcome differences.

Medicine 143



Roles of MBNL Proteins in Primary Mouse Neural Stem Cells in vitro

Authors: Mackenzie P Mekler, Benjamin M Kidd, Maurice S Swanson

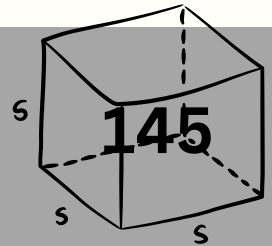
Myotonic dystrophy type 1 (DM1) is the most common type of adult-onset muscular dystrophy. This is a genetically inherited disorder caused by CTG repeat expansions in the DMPK gene. These are then transcribed into toxic repetitive RNAs that cause sequestration of muscleblind-like (MBNL) splicing factors. This sequestration causes adult to fetal RNA splicing shifts in the transcriptome. This is a multisystemic disease where the muscle tissue has predominantly been studied, however, the central nervous system (CNS) pathology is understudied. DM1 patients have many neurological symptoms including insomnia, excessive daytime sleepiness, memory deficits, and early onset of cerebral atrophy. In this study, we examine how neural stem cells (NSCs) may be impacted in disease in order to further understand the cause of these neurological symptoms. We utilized primary neural stem cells derived from various mouse models to study the effects that loss of MBNL proteins or presence of toxic RNA have on proliferation and differentiation into astrocytes and neuroblasts. We find that MBNL1 and MBNL2 are both expressed in the nucleus of NSCs. Preliminary data shows that combined loss of both MBNL1 and MBNL2 is detrimental to both proliferation and differentiation. Further experiments will investigate how toxic RNA may be impacting these phenotypes as well.

The Role of snaR-A non-coding RNA in Cellular Processes

Authors: Jessi Effinger-Morris1,2, Tianqi Li2,3, Mingyi Xie2,3,4

A large portion of RNAs that exist in cells are non-coding RNAs. These RNAs do not code for a protein but have important roles in gene regulation and are often implicated in cancer. The snaR family of non-coding RNAs are highly structured with conserved sequences1,2. snaR-A is the most abundant of this family and has been shown to interact with the RNA-binding protein NF90. NF90 is a protein that has been implicated in various cellular processes including RNA metabolism. snaR-A is upregulated in several tissues and immortalized cell lines, indicating a possible role in cell proliferation and cancer cells. The function of snaR-A is ambiguous, as well as the biological function of its interaction with NF90. It has been shown to associate with ribosomes but the function this plays in the cell is unknown. We will study the function of snaR-A in the cell by generating tetracycline conditional knockdowns of the snaR-A transcript, targeting the promoter and body of snaR-A using a dCas9 lentivirus system. This knockdown will be conducted in immortalized cell lines 293T and MCF7 due to their high expression of snaR-A, and MDA-MB-231 due to it's low expression of snaR-A. We will observe the phenotypic effects of this knockdown in the cells to identify the role snaR-A may play in cellular processes and possibly cancer. This project seeks to identify the role of snaR-A interactions in cells and provide a better understanding of the pathological mechanisms.

Medicine

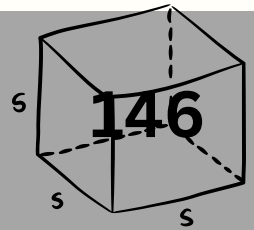


Role of BRD4 in Uveal Melanoma

Authors: Gianluca A. Medigovic, Lauren E. Hellwege, Katelyn R. Raburn, Jonathan D. Licht, Richard L. Bennett

Amidst the varying manifestations of cancer, uveal melanoma has proven itself to be one of the most difficult to grapple with based on its location, frequency, and limited treatment options. It occurs in the middle layer of the eye known as the uveal tract, making surgery or radiation therapy extremely difficult without compromising the eye. It is the most common primary malignant tumor of the eye in adults, with an exceptionally low survival of under a year after metastasis. In both metastasized and baseline forms of uveal melanoma, a notable mutation that occurs in the majority of cases is on the GNAQ gene which encodes the G-protein alpha subunit. Prior work in our lab has identified members of the Bromodomain and Extraterminal (BET) protein family as important chromatin regulators for growth of GNAQ mutant uveal melanoma. We hypothesize that the pharmacological agent JQ1 that targets BET domain proteins may disrupt growth of uveal melanoma cells. JQ1 is a BET inhibitor that disrupts these proteins from stimulating RNA Polymerase II. JQ1 will competitively displace one of the BET family proteins known as BRD4, suppressing transcription and significantly inhibiting tumor growth. We utilized live cell imaging to measure both proliferation and apoptosis of uveal melanoma cell line MEL202. Our proliferation assays utilized red fluorescent labeling of nuclei and Caspase 3/7 Green Dye was utilized for apoptosis assays. These results are expected to improve our molecular understanding of uveal melanoma, which may be used to develop new and more effective means of inhibiting tumor proliferation before metastasis can take root.

Medicine



The Use of a REV-ERB Synthetic Agonist for T Helper 17-Based Cancer Therapy

Authors: Alexandria Wilson, Isabelle Cote, and Matthew Hayes

There is a direct relationship between inflammation and cancer. Inflammation can be divided into two categories: acute inflammation and chronic inflammation. Acute inflammation is short-lived, while chronic inflammation progresses slowly and exists for an extended period. Chronic inflammation causes damage to cell DNA and alters the way cells replicate and divide, which promotes cancerous tumor growth. Unresolved infections, for example, result in chronic inflammation and account for more than fifteen percent of malignancies globally. Th17 cells are a subset of T cells known to play a key role in driving inflammation. Th17 cells tend to accumulate within the tumor microenvironment, and, while their role in tumorigenesis is complex, they promote tumor growth in many cancer types. The REV-ERBs are a class of nuclear hormone receptors that was recently identified as a modulator of Th17 cell development. This experiment demonstrates that the use of a REV-ERB agonist reduces inflammation through the Th17 molecular network. We used qPCR to test the effects of a REV-ERB agonist on the relative expression of genes associated with Th17 cell differentiation and resulting inflammation. We used samples of mouse microglial cells (BV2 cells) cultured in a variety of conditions. When cultured in the presence of lipopolysaccharides (LPS), bacterial toxins, BV2 cells undergo an inflammatory response. The BV2 cells co-treated with LPS and a REV-ERB agonist expressed these genes (Il-1β, Il-6, Ccl2, Cox-2, Tnfα) to a lesser extent than the BV2 cells treated with LPS alone; thus, the REV-ERB agonist counteracted the effect of the LPS. These results indicate that REV-ERB agonists are worthy of future research into their utility as a means of cancer prevention and treatment

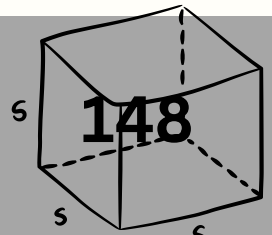
Viral hippocampal overexpression of the myokine Irisin attenuates the behavioral and memory deficits associated with Alzheimer's Disease pathology in a mouse model.

Authors: Jacob A. Borukhin, Lorena M. Ragonesi, Jonah Juergensmeyer, Adrian Requejo, Erin Kang, Rodrigo Tomas, Jeremy McIntyre, Karina Alviña.

As of 2023, Alzheimer's disease (AD) is one of the fastest growing neurodegenerative diseases in the US, impacting over 6.7 million citizens over the age of 65. With a growing elderly population, the search for a cure or treatment for this disease is increasingly urgent. Irisin, an exercise-induced myokine, could serve as a potential intermediary to attenuating the negative behavioral impacts faced by aging populations through the positive effects of exercise. Irisin's effect as a potential treatment for AD could allow for improvements in spatial awareness and memory as well as a decrease in anxiolytic tendencies; however, Irisin's fundamental role in preventing the cognitive decline of AD populations has not been fully established. In the present study, we aimed to examine the neurobehavioral effects of virally overexpressing Irisin in the mouse hippocampus of an AD transgenic mouse line (TgCRND8). Using 12–15-month-old male CRND8 mice, both transgenic (Tg) and non-transgenic (NTg), we stereotaxically injected an adeno-associated virus (AAV) vector containing the Irisin sequence (or scrambled sequence as control) directly into the hippocampus (bilaterally). After two months, spatial memory and exploratory behaviors were assessed using the novel object recognition (NOR)/open field (OF) test and Y-Maze tests.

Our results showed that Irisin overexpression in the hippocampus of CRND8 mice led to improved spatial memory performance, but only when tested at short intervals between training and testing. We also observed a decrease in anxiolytic behaviors such as rearing and grooming in mice injected with Irisin-AAV compared to scramble controls. Overall, our findings provide evidence to support the idea that Irisin could serve as potential therapeutics to attenuating the neurodegenerative behavioral effects of AD and could serve as a prospective treatment.

Medicine



Inter-rater reliability of an adapted version of the Selective Mutism Interaction Coding System-Revised as applied to children on the autism spectrum

Authors: Sydney Haskin, Chloe Asper, Emily Aman, Corey Lieneman, Reeva Morton, Cheryl McNeil, Sharon Phillips

Parent-Child Interaction Therapy (PCIT) is an evidence-based treatment used to effectively manage disruptive behaviors in children aged two to seven years (Eyberg & Funderburk, 2011). PCIT has been successfully applied to cases of autism spectrum disorders (ASD) in children, a neurodevelopmental disorder that impacts 1 in 36 American children aged 8 years old (ToMaenner et al., 2023). ASD is characterized in the DSM-5-TR by functional impairments in social communication and restrictive and repetitive behaviors and interests (RRBs) (American Psychological Association, 2022). While the severity of difficulties in language development in youth with ASD differs widely amongst individuals, there is a need for interventions which target verbal communication. PCIT has been effective in increasing verbal communication in other disorders, including cases of selective mutism, an anxiety disorder characterized by lack of speech in specific contexts, despite normal communication in others (Catchpole et al., 2019). PCIT-SM, utilizes behavior techniques to promote child speech and decrease avoidance (Cotter et al., 2018). Within PCIT-SM, parent and child communication are coded using the Selective Mutism Interaction Coding System-Revised (SMICS-R). SMICS-R, a tool adapted from DPICS, uniquely emphasizes childrens' responses to prompts rather than compliance (Cotter et al., 2018). The approach, while since revised, has demonstrated good inter-rater reliability (Carpenter et al., 2015). The current study seeks to further the knowledge on inter-rater reliability in SMICS-R, and extend the coding system to PCIT with ASD populations. By examining the inter-rater reliability, this study can confirm the utility of SMICS-R as a reliable tool. Furthermore, the application of SMICS-R coding in ASD samples could emphasize the role PCIT has on language development in children with ASD.

AAV-mediated gene therapy treatment to rescue the cardiac and neurological phenotypes in two frataxin-deficient conditional mouse models for the treatment of Friedreich's Ataxia.

Authors: Matthew Rojas, Megan Pope, Kayla Mandolini, Denise Cloutier, Barry Byrne, Manuela Corti

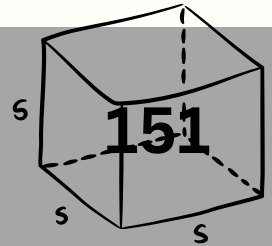
Friedreich Ataxia (FA) is a rare autosomal recessive degenerative disease affecting nearly 1 in 50,000 individuals in the United States. FA is caused by an abnormal trinucleotide repeat in the FXN gene sequence. The FXN gene encodes a mitochondrial protein called frataxin which is involved in the creation of iron-sulfur clusters that are necessary for electron transfer and thus ATP production. Deficient frataxin causes cellular dysfunction and eventually cell death in neurological and cardiac tissues. FA patients slowly lose coordination of voluntary movements, and develop difficulty of walking and general clumsiness (i.e. ataxia). Most of the patients also develop life-threatening cardiac dysfunction. A subgroup of patients develop scoliosis, pes cavus, diabetes, deafness, and visual problems. The use of recombinant adeno-associated-virus (rAAV)- mediated gene therapy is a valuable strategy to deliver the human frataxin gene in both the nervous and heart tissues. Our unique AAV construct uses an endogenous frataxin promoter and desmin enhancer element to control expression in the heart and nervous tissues. Our hypothesis is that our AAV construct will rescue the cardiac and neurological phenotype in FA mice. Current FA mouse models cannot express both cardiac and neurologic FA symptoms as the mice die due to heart complications prior to neurologic symptoms being observable. We bred 2 conditional knockout/knock-in mouse line models, Mck-Cre for cardiac specific and Pvalb-Cre for neurologic specific, using the Cre-Lox recombination system. Phenotypically-normal parental mouse strains from Jackson Laboratory were crossed to create the desired altered mouse lines, which were then genotyped using standard PCR and RT-PCR assays. The next step for this project will be to inject the AAV construct in these animal models and evaluate the rescue of both the cardiac and the neurological phenotypes.

First Pediatric Viral Myocarditis Animal Model

Authors: Lauren Parrow, Logan Macomb, Danielle Beetler, DeLisa Fairweather, Katelyn Bruno

Myocarditis, inflammation of the heart muscle, results from the activation of the innate and acquired immune responses and is a leading cause of sudden death in children and young adults. Our study compares how myocarditis differs between the pediatric and adult populations. We hypothesized that myocarditis would have sex-specific differences in the manifestation and severity similar to the adult model, but the mechanisms of disease would vary between ages. Prior to this study, there were no mouse models for pediatric myocarditis, but a large percent of patients with myocarditis are children. We infected 3 to 4-week-old male and female BALB/c mice with heart-passaged CVB3 intraperitoneally (ip) on day (d) 0 for the pediatric model and 8-week-old mice for the adult model. Disease severity was evaluated during acute myocarditis (d10 pi) and body weight, heart weight and tibia length, blood, hearts, pancreas, and spleens were then harvested from the anesthetized mice. H&E staining was used to quality myocarditis histologically and qRT-PCR was utilized to assess immune cell populations and pathways. Two distinct groups were found in the pediatric population: a mild, mainly vessel-related inflammatory presentation and a severe myocardial inflammation with sections of necrosis in the tissue. Sex differences were found in the adult population, with increased disease in males, driven by testosterone, but not in the pediatric population. When assessing differences found in the pediatric population, we found that the inflammation level correlated to the mouse's size, suggesting that less mature/younger mice may have increased risk of severe disease. These differences were seen in macrophages, T-cells, and the complement and inflammasome inflammatory pathways. Developing a pediatric translational mouse model allows the ability to create effective targeted diagnostics and treatments.

Medicine



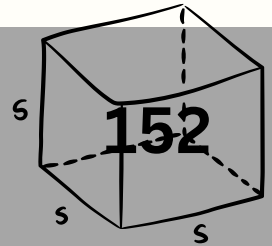
The impact of human DNA Ligase IIIα active site mutations on the efficiency of nick sealing for mismatched and damaged DNA ends

Authors: Julia Moncrieff, Mitch Gulkis, Melike Caglayan

DNA ligases repair breakages and interruptions in DNA's phosphodiester backbone that form as a result of DNA synthesis on the lagging strand in DNA replication as well as during recombination and repair. The accuracy of DNA ligation or nick sealing reaction depends on the Watson-Crick base pairing between 3'-OH and 5'-ends surrounding the nick site. The modifications such as mismatched nucleotides or damaged DNA ends that could arise from DNA polymerase-mediated incorporations during the prior DNA synthesis step of the damage repair process, can lead to genomic instability if not proofread properly. Human DNA ligase III functions in nucleotide repair, single-strand break repair, and base excision repair. Alternative splicing of the mRNA of the LIG3 gene produces the two isoforms of DNA ligase III - DNA ligase IIIα and DNA ligase IIIβ. DNA ligase IIIα repairs the mitochondrial DNA and is involved in DNA replication in the absence of DNA ligase I. The wild type of DNA ligase IIIα can seal nicks between Watson-Crick base pair matches but recognizes and does not repair gaps in DNA between mismatched nucleotides.

Previous X-ray crystallography study demonstrated that two active site residues in DNA ligase I, Phe(F)635 and Phe(F)872, contribute to DNA end alignment for catalysis. This study is exploring how DNA end alignment and corresponding active site resudies F487 and F717contribute to efficiency of ligation by DNA ligase IIIα for nick sealing of damaged and mismatched ends, which remains unknown. The F487A and F717A mutants interfered with the DNA ligation reaction resulting in a slower reaction time and lower product yield compared to the wild type enzyme. This study will provide an insight into the mechanism of nick sealing by DNA ligase IIIα that function in nuclear and mitohcondrial DNA repair.

Medicine



Role of Methionine Aminopeptidases in Translation

Authors: Olivia Milam, Kotaro Fujii

Most protein synthesis begins with Methionine (AUG), however 70% of initiator methionine (iMet) will be co-translationally cleaved-off by Methionine Aminopeptidases (MetAPs), which are conserved across three domains of life. Eukaryotes have two MetAPs. It has been shown that overexpression of MetAP is associated with shorter survival times for Pancreatic cancer (MetAP1) and Liver cancer (MetAP1 and MetAP2). These overexpressions may enable highly active mRNA translation in cancer. However, functional differences and substrate specificity between MetAP1 and MetAP2 is unknown. Our previous work identified the role of MAP1 but not MAP2 gene in translation fidelity in S.cerevisiae. The first aim of this project is deciphering whether Map1 and Map2 proteins have different functions in translation fidelity. We have observed that map1Δ strain increases translation errors but not map2Δ strain. Overexpression of MAP1 in map1Δ strain rescues translation fidelity phenotype however, MAP2 overexpression fails. However, the expression level of Map2 protein remains much lower than Map1 even from an overexpression construct from MAP1 promoter, suggesting post-transcriptional control to adjust the level of Map2. Further investigation is underway to achieve overexpression of Map2 to the same level with Map1 protein. To further identify specific substrates of Map1 and Map2 as well as substrates critical for translation fidelity, we are developing novel methods to monitor iMet processing and identify iMet retained N-terminal peptide using Click chemistry with a clickable methionine analog. Understanding of MetAP specificity in translational fidelity will help to design novel strategies of MetAP inhibition and reduce off-target effects.

Proteomic analysis identifies multiple effector proteins that may contribute to elevated blood pressure in alpha-1 antitrypsin knockout mice

Authors:Marcus Costa, Lauren P. Liu, Carlos Lugo, Sihong Song, and Abdel A. Alli

It is known that human alpha-1 antitrypsin (hAAT) overexpressing mice have lower systolic blood pressure and less renal epithelial sodium channel (ENaC) protein expression and proteolysis compared to wild-type mice. Here we hypothesized AAT knockout (KO) mice have elevated blood pressure that can be normalized by benzamil treatment. We performed tail cuff blood pressure studies to measure changes in systolic blood pressure during the active and inactive cycles after benzamil or vehicle treatment. We conducted a proteomic study to identify differentially expressed proteins between AAT KO and wild-type mice. Benzamil treatment significantly reduced systolic blood pressure in both the active and inactive phases of AAT KO mice compared to controls. Mass spectrometry-based proteomics detected 685 proteins that were unique to the AAT KO group and 583 proteins that were unique to the wild-type group. Among these proteins cullin-4A, c-reactive protein, and kelch-like protein 15 were down regulated in the AAT KO group compared to the wild-type group. Taken together, these data suggest a role for ENaC in the elevation of blood pressure in AAT KO mice and identified various effector proteins that are differentially regulated in the AAT KO kidney that may be mechanistically important in the regulation of blood pressure.

Enhancing Patient Comprehension and Procedural Preparedness through a 3D-Printed Model of Supraventricular Tachycardia (SVT) Pathophysiology and Treatment Modalitiess

Authors: Ella Mendelowitz, Sydney Sylvester, Nina Fiedler, Julie Han, Izabela Zmirska, Sneha Suresh, Utsav Sharma, Mohammad Al-Mousily

Managing Supraventricular Tachycardia (SVT) requires intricate surgical interventions, elucidating feelings of pre-operative anxiety for pediatric and adult patients, potentially stifling the impact of the surgery regarding recovery and outcomes. This study proposes using a customized 3D-printed model of the heart exhibiting the specific pathophysiological features of SVT in bolstering patients' understanding of their condition and impending surgical strategies, thereby aiming to reduce preoperative anxiety and enhance procedural preparedness. The model emphasizes the aberrant conduction pathways characteristic of SVT and the surgical access points, providing a tangible, visual representation of the disorder and the therapeutic approach.

Creating the SVT model involved meticulously importing a pre-existing heart structure from Solidworks into Onshape for necessary modifications. The representations of the additional atrial opening utilized in surgical correction and the aberrant conduction loop contributing to SVT were critical to the model. Enhancements for user interaction included the incorporation of handles for manipulation ease and a protective box housing essential circuitry while also serving as a stand. The model's distinctiveness was further augmented by integrating customizable LEDs, programmed via Arduino, to simulate the erratic electrical activity in SVT. These LEDs, powered by an independent battery source, were strategically placed to illuminate the model without the necessity of penetrating multiple material layers, thus offering an accurate, dynamic display of cardiac electrical conduction in SVT.

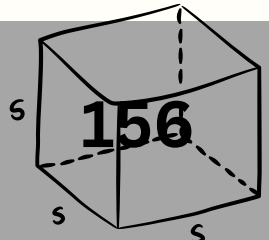
Our hope for the interactive 3D model is to improve patients' grasp of SVT significantly, and the operative procedure can substantially lower anxiety levels, which is paramount for pediatric cases. The cost-effective nature of 3D printing makes this approach replicable and scalable, highlighting the immense potential of such educational tools in healthcare settings as mechanisms to reduce patient anxiety.

Exogenous Ketone Body Therapy to Support Cognitive Performance in Advanced Age

Authors: Fapianey Alexandre, John Thompson, Cory Watson, Sara Burke

Glucose is a sugar molecule metabolized by the body as the main energy source of the brain. As our brains age, their ability to utilize glucose decreases, resulting in cognitive deficits. Ketone metabolism, however, remains the same across the lifespan, and the brain will break down ketones for energy in the absence of glucose. Inducing ketosis (a non-pathological increase of ketone levels in the bloodstream) helps mitigate the neuronal stress that is associated with normal aging by providing the brain with an alternative energy source to glucose. Ketosis is typically achieved by a high-fat, low carbohydrate ketogenic or “keto” diet. Since older populations face difficulty maintaining a strict ketogenic diet, our study investigates whether, with an otherwise normal diet, exogenous ketone supplementation will induce ketosis and whether this ketosis will mitigate age-related cognitive decline. We hypothesize that animals, particularly aged animals, receiving the supplement will perform better than their control counterparts on behavioral-cognitive assessments. Four groups of Fischer-344 brown Norway hybrid rats (young females, young males, aged females, and aged males) the supplement, and ketone levels were recorded at 0, 2, 4, and 24 hours postprandial after 1, 4 and 7 days on the supplement. Supplementation was found to achieve ketosis levels comparable to those derived from a keto diet. Animals then underwent assessments of spatial learning, memory, and visual discrimination via mnemonic description and navigation tasks. In a pilot cohort of animals, statistical comparison to controls showed improvements across all groups receiving the supplement, leading us to speculate that cognitive performance is enhanced in old age as a result of an exogenous ketone supplement to a normal diet. Behavioral assessments of a second and third cohort of rats are under way to determine whether firm statistical conclusions can be drawn of the supplement’s efficacy in aged animals.

Medicine **156**



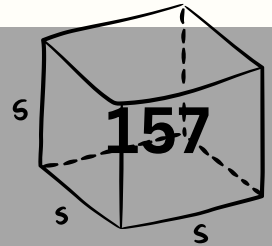
Engineering Genomics Database to Facilitate Artificial Intelligence in Cancer Research

Authors: Arlen Larry Gyden, Nicole Ambroise, Dr. Julio Duarte, Dr. Mohammed Gbadamosi, Dr. Zehra Ordulu, Dr. Petr Starostik, Dr. Kimberly Newsom

Next-generation sequencing (NGS) is an effective way to identify driver mutations and guide precision medicine strategies for oncology treatments. The Molecular Diagnostic Laboratory at the University of Florida is a reference laboratory for the Southeast United States and receives approximately one thousand oncology samples each year. NGS is performed on each sample, and the variant data is stored as a variant call file (VCF). Unfortunately, this data is not easily searchable or linked to any relevant clinical information. Thus, the range of diagnostic insights obtained from this data is limited.

The goal of this project is to develop the infrastructure to house our clinical NGS data as well as pertinent de-identified clinical data, such as gender, age, tumor type, tumor grade, overall and disease-free survival. Establishing the infrastructure for this data will contribute to improved health outcomes by strengthening laboratory quality metrics and providing visualization and analysis of our cancer genomics data. Curation of this data will help bridge the gap between research and practice in the healthcare system by merging the relevant clinical data with genomics data. Once this data is unified and searchable, this database will have far-reaching utility, including the ability to correlate outcomes as well as leading to the use of artificial intelligence deep learning algorithms for variant classification, phenotype-to-genotype correspondence, and disease risk prediction.

Medicine

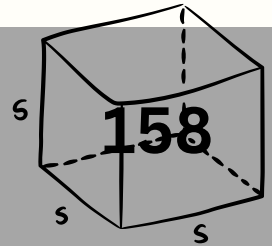


Mapping the social brain: investigating competition behavior through c-fos expression in mice

Authors: C. De Paula Cunha Almeida, A. Li, E. Wright, A. Chambers, M. Cum, R. Iwata, J. Santiago Perez, N. Pallida-Coreano

In social species, survival and success hinge on complex group dynamics. A fundamental way in which social species interact is via competitive behaviors which shape their group dynamics into dominance hierarchies. Mice form social hierarchies in lab setting, making them a good model for studying the neural circuits underlying social competition behavior. This study aimed to identify differences in brain activity associated with social competition to direct future investigation of the neural mechanisms that drive competitive interactions. To investigate this, we employed a reward-based social competition assay to simulate competitive scenarios between mice in an operant chamber. The assay required two mice to be present in the chamber simultaneously, where they would compete for a food reward associated with an auditory cue. This setup ensured that the mice had to engage in direct competitive interactions for access to the reward. We examined c-Fos immunoreactivity, a marker of neuronal activation, across brain regions implicated in social behaviors. CD-1 adult male mice (n=14) were trained to associate an auditory cue with a food reward. Immediately prior to perfusions, half of the mice engaged in the reward-based competition assay, while the other half received cues and rewards in isolation as a control.To assess brain activity, we focused on key brain regions: the medial prefrontal cortex (mPFC) regions, including the infralimbic cortex (IL), anterior cingulate cortex (ACC), and prelimbic cortex (PL), as well as subcortical regions, the basolateral amygdala (BLA), mediodorsal thalamus (MD), lateral hypothalamus (LH), and ventral CA1 of the hippocampus (vCA1). Preliminary findings from our study revealed that all subregions of the mPFC exhibited increased c-Fos expression during social competition compared to the condition in which mice received the reward alone. Although we did not observe overall differences in c-Fos expression in subcortical regions between the two conditions, we found a correlation between social rank and c-Fos expression in the MD and BLA.

Medicine

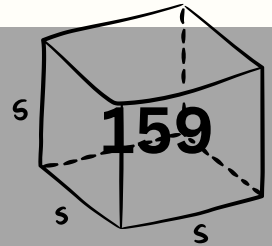


Assessing the of role ventral tegmental area dopamine neurons in risky decision making

Authors: Carolina Cruz-Wegener, Wonn S. Pyon, Mojdeh Faraji, Max S. Gotlin, Caitlin Orsini, Charles J. Frazier, Jennifer L. Bizon, Barry Setlow

Risky decision making is a process in which an individual considers the potential losses or punishments involved in a set of choices, in order to optimize rewards while mitigating negative repercussions. Studies have demonstrated the ventral tegmental area dopamine (VTA-DA) neurons as being necessary for signaling whether an outcome is better than or worse than expected; however, it is unclear how VTA-DA neuron activity plays a role in decision making under the risk of explicit punishment. To assess the functional role of VTA-DA neurons in this form of risky decision making, transgenic tyrosine hydroxylase (TH)-Cre rats expressing a Cre-dependent calcium sensor (GCaMP8m) were trained on a risky decision-making task (RDT). Rats were given discrete choices between a small, “safe” reward (a single food pellet) and a larger, “risky” reward (two food pellets), which was accompanied by ascending risks of a mild footshock (0%, 25%, 75%). A second set of TH-Cre rats expressing Cre-dependent halorhodopsin within VTA-DA neurons underwent training in the RDT and, upon reaching stable baseline behavioral performance, received temporally-specific optogenetic inhibition of their VTA-DA neurons during risky decisions to assess causal relationships between VTA-DA neuron activity and risk-taking behavior. Results demonstrate that VTA-DA neuron activity shows valence directionality, sensitivity to differences in shock intensity, and differential responses to punishment contingencies. Inhibition of VTA-DA neurons during large reward outcomes when they were unpunished reveals a statistically significant reduction in selections of the large risky reward, indicating a causal role in VTA-DA neuron activity in promoting risky choices. These findings supplement the current understanding of the roles of VTA-DA neurons in behavior and lay the foundation for future investigation of dopaminergic signaling and risky decision-making behavior in the context of aging.

Medicine



An Optimized Method for Preparation of Mouse Fecal Suspensions

Authors: Sukhman Sidhu, Dorothy Ware, Preethi Sudhakara, Ajisha Alwin, Gurjit S Sidhu, Gary P. Wang

Commensal gut microbiota plays a pivotal role in host protection against many enteric pathogens. Conventional as well as ex-germ-free mice are extensively used as a model to study gut microbiota. However, methods to prepare mouse gut microbiota suspensions are still not optimized. Mice produce limited amount of fecal material with a high amount of insoluble material, which interferes with subsequent experimental procedures. Using microbiology, next-generation sequencing and bioinformatics tools, we were able to optimize some parameters for preparing mouse fecal material suspension. We were able to generate sufficient amount of suspension from a limited amount of fecal material. The suspension prepared with the new approach was relatively free from insoluble suspended particles and can be directly used for subsequent procedures. Moreover, 16S rRNA gene sequencing revealed that more species were present in the mouse fecal suspension prepared with the improved method.

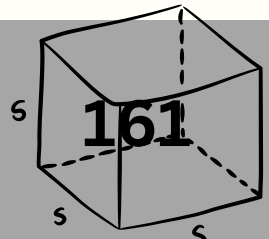
Medicine 160

Organization of Midbrain Dopaminergic Input to the Tubular Striatum

Authors: Anamaria Cotelo, Natalie L. Johnson, Minghong Ma, Daniel W. Wesson

Dopamine (DA) is a potent neuromodulator with widespread effects on sensory processing. The tubular striatum (TuS, also known as the olfactory tubercle) receives dense DAergic input from the ventral tegmental area (VTA). This VTA→TuS DAergic pathway mediates odor preference and other naturalistic reward processes. Additionally, phasic DA release in the TuS influences odor valence, and ongoing work in our lab is uncovering influences of DA release into the TuS on sniffing behavior. To better understand where VTA DAergic neurons innervate the TuS, we injected a cre-dependent anterograde AAV encoding synaptophysin tagged with mRuby into the VTA of DAT-Cre male and female mice. This allows for visualization of fluorescent puncta, indicative of synaptic terminals, in regions that receive midbrain DA input. We quantified fluorescent puncta throughout the anterior to posterior span of the TuS along with neighboring striatal structures. Our preliminary results indicate a topographical arrangement of DAT neuron input to the TuS, with a great portion of synaptic input arriving in the anteromedial TuS. To confirm that VTA neurons synapse onto TuS neurons, we next injected an anterograde transneuronal AAV encoding Cre into the VTA of Ai9 (tdTomato Cre reporter) mice. We observed robust tdTomato expression in first order downstream targets of the VTA, including the TuS. Together, these results inform the neuroanatomical organization of VTA DAT→TuS circuitry and provide a foundation for future studies investigating causal manipulations of DA's effects in the TuS.

Medicine



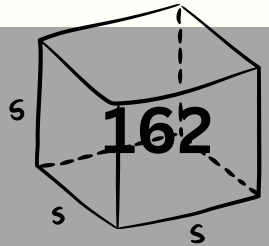
Current Status of the Phase IIA Trial of Dichloroacetate in Glioblastoma Multiforme

Authors: Priya L. Sambasivan, Puranjay Shori, Carolyn O. Dirain, and Peter W. Stacpoole

Glioblastoma multiforme (GBM) is the most malignant brain tumor in adults. Standard treatments of debulking surgery, followed by chemotherapy and radiation therapy offer limited survival benefits. The Warburg effect, where cells prioritize glycolysis over oxidative phosphorylation (OXPHOS) in the presence of oxygen, characterizes GBM. This shift is associated with the upregulation of pyruvate dehydrogenase kinase (PDK), inhibiting the phosphorylation of the pyruvate dehydrogenase complex (PDC) E1a subunit (PDHA1). Dichloroacetate (DCA), an investigational drug and the prototypic PDK inhibitor, acts in mitochondria to reset cellular homeostasis in various congenital and acquired metabolic disorders. Inhibition of PDK in cancer cells by DCA restores PDC activity, reverses the Warburg effect and induces a caspase-mediated selective apoptosis of tumors. Extensive pre-clinical research and early clinical trials in patients with recurrent GBM and other brain tumors indicate that DCA may be a safe and uniquely effective metabolic therapy for GBM.

This study is a multicenter, open label Phase IIA trial of oral DCA in 40 surgical patients with recurrent GBM who have debulking surgery planned. Patients are genotyped based on GSTZ1 haplotype to establish safe dosing regimens and randomized so half receive DCA for one week prior to surgery; all patients receive DCA after surgery. Tumor tissue obtained at surgery is assessed for phosphorylated PDC protein expression, apoptosis, and intratumoral biochemical correlates such as PDK1-4, HIF-1α, VEGF, GSTZ1, & PCNA. Plasma samples are collected before, during and after surgery and during DCA dosing to determine DCA and lactate level. To date, 17 patients have been successfully enrolled. Initial findings from 5 no DCA and 5 DCA patients show lower phosphorylated PDHA1/total PDHA1 ratio in the more necrotic (T1, contrast-enhanced) tumors from patients with DCA pre-dosing, suggesting a shift towards aerobic cellular respiration. Additional analyses and sample collection are currently underway.

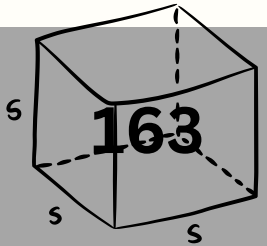
This study is funded by FDA R01FD007271.



Analyzing Structure-Activity Relationships for Novel Therapeutics Targeting Chemoresistance in Liver Cancer

Authors: Kenneth Kho, Danmeng Li, Satyamaheshwar Peddibhotla, and David A. Ostrov

Hepatocellular carcinoma (HCC), the most prevalent liver cancer, ranks as the second leading cause of cancer-related deaths globally. The objective of this study is to identify innovative approaches for overcoming chemotherapy resistance in liver cancer treatment. Current first-line treatments for HCC involve multiple kinase-inhibiting drugs like sorafenib and lenvatinib. However, their efficacy is limited to a subset of patients and often leads to severe side effects and resistance. CXCR6 is a cell surface protein thought to play a pivotal role in driving tumor progression. Given that CXCR6 signaling activates intracellular pathways that bolster cell survival and resistance to chemotherapy-induced cell death, we hypothesized that drugs targeting CXCR6 could effectively combat chemotherapy resistance in HCC. SBI-457, a first-in-class small molecule antagonist of CXCR6, was developed to enhance the effectiveness of sorafenib in targeted therapy by blocking CXCR6 signaling-driven chemoresistance pathways. This suggests that this small molecule antagonist could serve as an innovative therapeutic approach for HCC. The primary objective of this study was to establish the structure-activity relationships (SAR) within the SBI-457 lead series. Molecular docking was employed to analyze the interaction between structural components of SBI-457 and CXCR6 activity. It involved mapping intermolecular contacts with CXCR6, calculating molecular docking scores using AutoDock Vina and PyMOL, and identifying docked poses correlating with functional activities of the lead series. These findings are consistent with prior research, highlighting the importance of hydrogen bonding interactions with specific residues (R228, S229, and K231) that stabilize the trimethoxybenzamide group in SBI-457 and analogous active compounds, emphasizing the significance of proximity to TM6 for antagonist activity. In summary, this study represents significant progress towards the optimization of a novel drug designed to combat chemotherapy resistance in the treatment of HCC.



Understanding COVID-19 Vaccine Perceptions Among Parents of Differing Socioeconomic Backgrounds through Health Literacy

Authors: Rachana Kandru, Mansi Patel, Rujuta Kansara

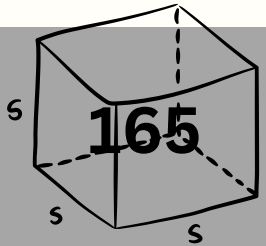
Vaccines act as an effective measure against the outbreaks of major diseases and, therefore, are a highly regarded form of protection in the field of public health. Currently, there is controversy surrounding parental decisions about childhood vaccination. Much of this controversy stems from misinformation and negative perceptions around the COVID-19 vaccines. With the rise of the COVID-19 pandemic, the COVID vaccine was rapidly created and dispersed, stoking new waves of vaccine hesitancy, and igniting sects of the anti-vaccine movement. Parental hesitancy to vaccinate their children has become a significant public health concern during the COVID-19 pandemic. Studies have identified a range of factors that may contribute to parental vaccine hesitancy. This literature review aims to explore the relationship between parental vaccine hesitancy and both socioeconomic status and health literacy. We aim to focus on the factors that contribute to vaccine hesitancy amongst parents from varying socioeconomic backgrounds by examining the effects of health disparities and health literacy. It is crucial to address the concerns of parents and ensure that they have the information and resources they need to make informed decisions about the COVID-19 vaccine for themselves and their children. The purpose of this literature review, with an emphasis on health disparities, is to discuss and analyze the impacts of educational background and socioeconomic status that contribute to differing vaccine perceptions amongst parents.

Robust Astrocyte Activation in Response to Cryptococcus neoformans Brain Infection in Mice

Authors: Adrian Requejo, Melissa E. Munzen, Luis R. Martinez, and Karina Alviña

VThe encapsulated fungus Cryptococcus neoformans (Cn) is the causative agent of cryptococcosis. Despite aggressive antifungal treatment, immunocompromised patients are highly susceptible to develop and die from cryptococcal meningoencephalitis (CME). The polysaccharide capsule of Cn greatly affects the host immunity and its main component, glucuronoxylomannan (GXM), enhances fungal brain infection. Cn enters the brain via cerebral capillaries and crosses the blood brain barrier (BBB) utilizing diverse mechanisms. However, there are important knowledge gaps regarding underlying brain cell responses and the consequences of this fungal infection for brain function. Astrocytic activation in response to various central nervous system insults is fundamental for brain homeostasis. Reactive astrocytes are associated with destructive cryptococcal brain lesions and high accumulation of GXM in tissue from patients with CME. Therefore, we hypothesized that as Cn colonizes brain tissue during infection, there is a close interaction between Cn and astrocytes that modulates distinct intracellular pathways in both cells. To test this hypothesis, we first used a mouse model of Cn infection and quantified the number of reactive astrocytes using immunohistochemical techniques. Compared to uninfected controls, infected mice had significantly more activated astrocytes surrounding Cn lesions. In addition, using an in vitro model of astrocytic cells exposed to GXM, we observed a significant increase in the expression glutamatergic transporters and receptor subunits. Similarly, we found that the Cn capsule enlarges, and genes involved in capsule formation are increased in Cn cells exposed to astrocytes. We are currently expanding these findings to fully determine the molecular and cellular mechanisms underlying the astrocytic response during CME. Identifying mechanisms by which Cn interacts with astrocytes will provide novel insights into the neurotropism of this deadly infection. This information may also offer new avenues for combating CME, a disease that kills ~200,000 people per year.

Medicine

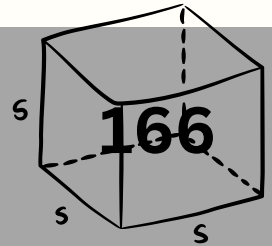


Gnal is Widely Expressed in Murine Brain Tissue

Authors: Allison Comite, Anika Heuberger, Elisabeth Martin Castosa, Preston Wagner, Ignacio Gallardo, Dominic Hall, Michael Millet, Nicole Chambers, Mark Moehle

The heterotrimeric G-protein α subunit, Gαolf, acts to transmit signal from G-protein coupled receptors (GPCRs) to stimulate adenylyl cyclase mediated production of cyclic adenosine monophosphate (cAMP). Multiple mutations in the GNAL gene, which encodes for Gαolf, have now been identified as causative for adult-onset focal dystonia. Dystonia-linked GNAL mutations can disrupt GPCR signaling cascades of the direct basal ganglia motor pathway, resulting in pathogenic signaling hypothesized to be the primary cause of motor symptoms in patients. However, the published patterns of Gαolf expression outside the context of the striatum are sparse, conflicting, and often lack cell type specificity. Here, we use RNAScope in-situ hybridization to quantitatively characterize Gnal RNA expression in brain tissue from C57BL/6J mice. We observed widespread expression of Gnal puncta throughout the brain, showing Gαolf is expressed in more brain structures and cell types than previously accounted for. Cerebellar Purkinje cells displayed the highest average number of Gnal transcripts on a single cell basis. Subsequent Gnal knockout in Purkinje cells led to abnormal intracellular cAMP levels and downstream cAMP-dependent enzyme activation. This data suggests Gαolf signal transduction is necessary for homeostatic cAMP production in the cerebellar Purkinje cell layer. Within the striatum, we quantify Gnal expression levels between interneuron populations, as well identify cell types that comparatively express more Gnas RNA. Our characterization provides a more detailed understanding of Gα signaling in the striatum than previously known.

Medicine

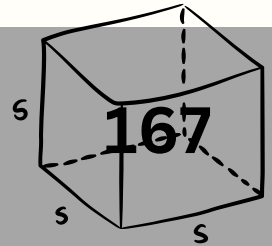


Organization of the actin cytoskeleton and its role in the function of NPRC and EnNaC proteins in mouse aortic endothelial cells

Authors: Leah Kessler, Niharika Bala, Ling Yu, Abdel Alli

The C-type natriuretic peptide receptor (NPRC) and the endothelial sodium channel (EnNaC) both play an important role in the regulation of blood pressure, but their mechanisms of control aren't fully understood. The activation of NPRC by ligand binding negatively regulates EnNaC activity in aortic endothelial cells, and both NPRC and EnNaC associate with the actin cytoskeleton. To further understand this relationship, we investigated whether different mechanisms of disruption of the actin cytoskeleton affect the function of NPRC and EnNaC in mouse aortic endothelial cells (mAoEC). Performing Co-immunoprecipitation Western blot studies showed the association between NPRC and EnNaC with the actin cytoskeleton protein myristoylated alanine-rich C-kinase substrate (MARCKS) was lowered after treating mAoEC with cytochalasin E compared to vehicle treatment. Sucrose density gradient assays and Western blot analysis also showed cytochalasin E treatment compared to vehicle treatment reduced MARCKS abundance in lipid raft associated fractions. Additionally, patch clamp studies in mAoEC showed overexpression of a MARCKS mutant construct where the third serine residue in the effector domain of the protein was mutated to aspartic acid resulted in a decrease in EnNaC activity when compared to overexpression of wild-type MARCKS. Taken together, these results contribute to our understanding on how reorganization of the actin cytoskeleton regulates the function of NPRC and EnNaC in mAoEC.

Medicine

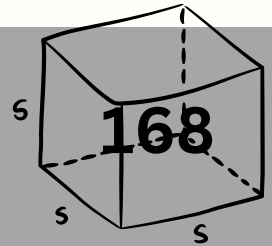


Quality Improvement in Pediatric Single-Location MRI: Immersive Therapeutic Play Preparation Using a Mock Scanner as a Low-Cost Replacement for Sedation

Authors: Dawson Veghte, Shreya Mathur, Ansh Parikh, Hannah Kennedy, Ania Kelegama, Jacob Surges, Cole Dooley MD

This project attempts to understand the benefit of immersive therapeutic play preparation using an interactive model MRI scanner as a low-cost replacement for sedation or anesthesia to improve quality of care in pediatric single-location MRI. Specifically, we aim to better understand the benefits of Certified Child Life Specialist (CCLS) facilitated therapeutic play preparation involving an interactive model MRI scanner, with and without the effects of an immersive, themed environment to the MRI suite via an undersea-themed paint skin to the walls and scanner. Our approach centers around combining established preparation methods, such as preparatory books and an interactive model MRI scanner, with a newer, immersive approach within the imaging department at Shands. We hypothesize that patients who undergo this preparation strategy will be able to undergo MRI without sedation or anesthesia and yield clinically-viable scans at a success rate of > 90%. Our ultimate goal is to use these methods to reduce anxiety and anesthesia/sedation rates in children undergoing a single-location MRI at UF Health Shands Children's Hospital to improve quality of care and patient safety outcomes.

Medicine



Investigating the Relationship between Interferons and Cryptosporidium parvum Infection of Intestinal Epithelial Cells

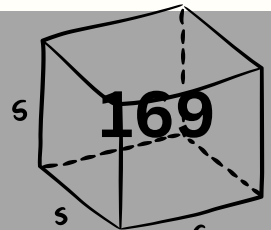
Authors: Victoria Karaluz, Zina M. Uckeleley, Josmar Polanco, Steeve Boulant, Megan Stanifer

Cryptosporidium parvum (C. parvum) is a eukaryotic single-celled enteric pathogen that causes intestinal inflammation and diarrhea and can cause potentially life-threatening disease in immunocompromised individuals. C. parvum enters the intestinal tract by ingestion and is activated by bile acids or other compounds in the stomach of the host, allowing the parasite to invade intestinal epithelial cells (IECs).

Interferons (IFN) are cytokines produced by IECs as the main defense against viruses and other pathogens. IFNs are produced in response to the detection of a pathogen and upon secretion and binding to their receptor, IFNs facilitate the expression of IFN stimulated genes (ISGs) that are key to the cellular defense against pathogens. Not much is known about the specific IFN response to C. parvum infection and current reports have had contradicting results. This project aims to further understand the complicated interactions between host cell IFN and C. parvum infection susceptibility. C. parvum replication in IECs was measured using qRT-PCT in IFN KO cell lines, IFN receptor KO cell lines, and IFN treated cells. We found that C. parvum infection of T84 IECs induces production of IFNL2/3, but not IFNL1 or IFNB1. Similarly, cells lacking IFNL2/3 displayed an increased replication of C. parvum. However, IFNL2/3 pretreatment of wild type cells did not reduce infection burden, while IFNB1 pretreatment leads to an increase in C. parvum replication.

These results point to an anti-infection role of IFNL2/3 and pro-infection role of IFNB1 in C. parvum infection. We aim to further investigate the mechanism by which different types of IFN interact with C. parvum to either promote or defend against infection. This research provides a broader understanding of the complex interactions between IFNs and eukaryotic enteric pathogens within the diverse microbiome of the gut.

Medicine

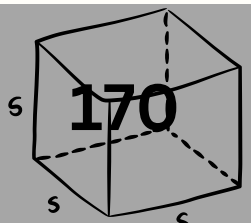


The Ubiquitin Ligase Itch Inhibits mTORC1 activation by Purine Nucleotides in B Cells

Authors: Diondre Reyes, Simon Coroza, Peter Kim, Macaul Crici, and Emily Moser

Severe immune dysregulation occurs in patients with rare loss-of-function mutations in the gene encoding the ubiquitin ligase Itch. 14 patients have been identified, presenting with chronic lung disease, various forms of organ-specific autoimmune diseases, and high levels of autoantibodies, but how Itch prevents autoantibody formation is not known. In normal protective antibody responses, B cells are quiescent until they are activated by foreign antigen or danger signals. Activated B cells remodel their metabolism to support rapid growth and cell division. The mechanistic Target of Rapamycin Complex 1 (mTORC1) is the metabolic hub of the cells that integrates signals from growth factors (e.g., antigen) and nutrient availability (e.g. purines and amino acids) to regulate cell growth. Peripheral lymphocytes from patients with more common autoimmune diseases, such as rheumatoid arthritis, display abnormally high mTORC1 activity, but why this occurs is unknown. Mice with Itch deficiency develop autoimmune disease similar to patients, and using this murine model, we have previously reported that Itch limits mTORC1 activity in activated B cells. Our published proteomics data have demonstrated higher protein levels of the purine salvage pathway enzyme, Purine nucleoside phosphorylase (PNP) in activated Itch deficient B cells. This led us to hypothesize that Itch suppresses mTORC1 activity in B cells by reducing the availability of purines. We now show that B cells activate mTORC1 in response to purines, and Itch inhibits this response. Further, we have determined that PNP protein levels are dynamically regulated in B cells, and Itch promotes PNP degradation. Finally, using patient-derived lymphoblastoid cell lines (LCLs), we demonstrate that human activated B cells also rely on purines to activate mTORC1. Understanding the regulatory role that Itch has on purine-dependent mTORC1 activation can provide new targets for the design of therapies that reduce autoantibodies in Itch-deficient patients and those with mTORC1-associated autoimmune diseases.

Medicine



Optimization for the NOTCH1 Knockdown in BeWo Choriocarcinoma Cells, a Model of Syncytiotrophoblast

Authors: Haley Strauch, Alyssa Tipler, Helen Jones

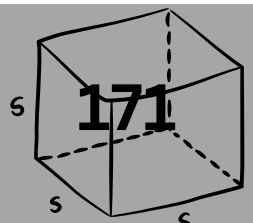
Introduction: Congenital heart defects (CHD) are the most common birth defect in the United States. Pregnancies complicated with CHD have been linked to improper development/function of the placenta. NOTCH1 mutations are more common in CHD patients than in the general population. This study aims to optimize a protocol for a NOTCH1 knockdown using siRNA in BeWo choriocarcinoma cells as a model of cytotrophoblast and evaluate the role that NOTCH1 plays in placental development.

Methods: BeWo cells were maintained in F-12 Ham Complete Growth media tat 37°C and 5% CO2. BeWo cells were plated at 200,000 cells per well of a 6-well plate and cultured overnight. Media was changed to minimal media and Lipofectamine optimization performed: increasing volumes from 2ul of lipofectamine were complexed with 2ul of NOTCH1 or scramble siRNA and added to cells. Six hours after transfection, fetal bovine serum (FBS) was added to the cells. 48 hours later cells underwent either crystal violet assay to assess cell proliferation or RNA extraction using the Qiagen RNeasy Plus Mini Kit. Following RNA extraction and cDNA conversion qPCR was performed to evaluate NOTCH1 knockdown.

Results: BeWo proliferation was seen best at a concentration of 2ul of Lipofectamine compared to 4ul of Lipofectamine. In the NOTCH1 siRNA KD cells there was a 41% percent reduction in NOTCH1 expression compared to cells treated with scramble siRNA.

Discussion: NOTCH1 is a crucial pathway during early pregnancy that impacts trophoblast cells and transport pathways in the placenta. Optimizing the knockdown of NOTCH1 helps develop a model of dysfunctional placentas, which can be used for future experiments investigating specific mechanisms of disrupted NOTCH1 in cytotrophoblast differentiation.

Medicine



Acceptability of HPV Take Home Screening: A Qualitative Study of Black Women Living with Type II Diabetes and Social Vulnerability

Authors: Yashaswini Meduri and Rahma Mkuu

Introduction: Human papillomavirus (HPV) causes 99.7% of cervical cancer cases. HPV tests are the most sensitive screening method to detect cervical cancer. Despite this, women living in high social vulnerability areas (poverty), black women, and women with type 2 diabetes (T2D) are less likely to be screened for cervical cancer. They are also more likely to be diagnosed at later stages and die from cervical cancer. Furthermore, black women have a higher rate of T2D diagnosis compared to other racial groups. HPV self-sampling has been shown to increase screening rates by decreasing cervical cancer screening barriers among under-screened women. However, there is a gap in the literature in identifying the acceptability of HPV self-sampling among black women with T2D living in poverty.

Methods: Qualitative semi-structured interviews were conducted with 29 black women with T2D living in communities with high social vulnerability. The Health Belief Model informed the development of the interview guide to gather data on the acceptability of HPV self-collection.

Results: Three main themes aligned with the Health Belief Model: (1) HPV self-collection provides a comfortable alternative to in-clinic HPV testing (perceived benefits); (2) HPV self-collection would result in awareness of current HPV status (health motivation); and (3) Women were concerned about collecting their sample accurately (perceived barriers).

Conclusion: Black women with T2D living in communities with high social vulnerability identified multiple benefits of cervical cancer screening through HPV self-collection. However, women are also concerned about their ability to collect their samples correctly. Our findings call for future studies focusing on improving knowledge and sample collection skills for HPV self-collection among black women with T2D residing in underserved communities with high social vulnerability.

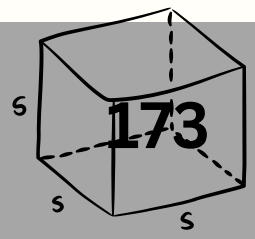
Optimization of Haloferax volcanii for the expression and purification of poly-histidine tagged halophilic proteins

Authors: Manasa Addagarla, Karol Sanchez, Julie Maupin-Furlow

Haloferax volcanii has emerged as a promising platform for the production of halophilic proteins. However, a challenge in the purification process of histidine-tagged proteins arises from the interference caused by the Nickel Insertion Protein (NIP, 52 kDa), particularly when dealing with proteins of similar size. The utilization of nickel columns and resins for the rapid purification of recombinant histidine-tagged proteins inadvertently leads to the co-purification of NIP due to the presence of its natural histidine tag—a phenomenon notably observed in cell lysates from minimal media.

In this study, we address this issue by genetically deleting the Nickel Insertion Protein gene, resulting in the creation of an optimized strain that can be used for protein purification without interference. This innovation not only offers a solution to the co-purification challenge but also enables the selective purification of the specific polyhistidine-tagged proteins. Consequently, this advancement serves to enhance the utility of H. volcanii for both basic scientific research and diverse biotechnological applications.

Medicine

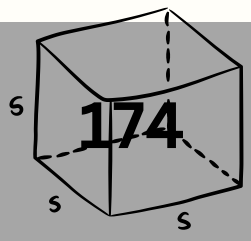


NeurAnalyzer: A Graphical MATLAB Analysis Suite for Olfactory-Behavioral Neuroscience

Authors: Andy Chavez, Natalie Johnson, Sarah Sniffen, Daniel Wesson

As new sensors and other technologies are developed and then used in olfactory neuroscience research, the amount of data to analyze increases substantially. Fiber photometry is a very popular technique used in murine models to record receptor activity in specific brain regions using genetically encoded fluorescent protein indicators. Collecting fiber-photometric data in parallel with whole-body plethysmography respiratory data enables the discovery of meaningful relationships between respiratory patterns and the stimulation of specific brain regions. However, these analyses can be difficult to implement because of the following challenges: the learning curve associated with preprocessing and feature extraction, as well as the cumbersome process of standardizing the data. To improve this problem, I present NeurAnalyzer, a MATLAB suite for processing respiratory and fiber-photometric data obtained from Tucker Davis Technologies (TDT) instruments. The components of the suite are two graphical user interfaces (GUIs) that streamline the preprocessing, visualization, user-curation, and waveform feature extraction of respiratory and photometric data. One app focuses on respiratory power analysis, while the other focuses on detecting stimulus-evoked events and relating them to their corresponding fiber-photometric data. The suite's algorithms have been validated using the TDT program Spike. The tool, being a GUI, is accessible to scientists with no programming background and can be edited by advanced users.

Medicine



Human Alpha-1 Antitrypsin Reduces Renal Inflammation and Hypertension Induced by Salt-loading Through Regulation of Heat Shock Protein 70

Authors:Van-Anh L. Nguyen, Yunus E. Dogan, Niharika Bala, Sihong Song, and Abdel A. Alli

-

Heat shock proteins (HSP) play in important role in the protection against inflammation through multiple mechanisms. The alpha-1 antitrypsin (AAT) protein is known to have anti-inflammatory responses and reduce blood pressure in salt-sensitive hypertensive animals. We hypothesized that the administration of human alpha-1 antitrypsin (hAAT) reduces high blood pressure after salt-loading Sv129 wild-type mice in a mechanism involving the regulation of HSP70. Sv129 mice were salt-loaded to induce hypertension and then administered recombinant hAAT or vehicle. Blood pressure was measured by the tail-cuff method and immunoassays were performed to assess changes in the expression of various proteins in the kidney. The administration of hAAT significantly reduced systolic blood pressure in hypertensive Sv129 mice. Immunostaining and Western blot analysis showed a decrease in renal injury and inflammatory markers in Sv129 mice treated with hAAT. Transforming growth factor-beta (TGF-beta) and HSP70 but not HSP90 protein expression was augmented in the kidney of hAAT treated Sv129 mice. Taken together, hAAT may be efficacious in normalizing blood pressure and mitigating kidney damage associated with hypertension.

Establishing a Ewing Sarcoma Mouse Cell Line

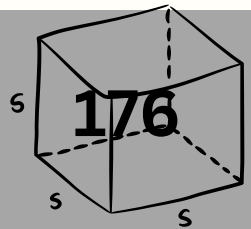
Authors: Rabideau CR, Qdaisat S, Mendez-Gomez H, Sayour EJ, Ligon JA.

Background: Ewing sarcoma (ES) is the second most common bone cancer in children and is marked by the EWS-FLI1 gene fusion in 85% of Ewing sarcomas. Despite advancements in chemotherapy for localized disease, metastases and local recurrence occur in 30-40% of cases. Current treatments for recurrent disease can be harsh for pediatric patients, leading to debilitating conditions. Mouse models are pivotal for pre-clinical testing, but establishing ES in these models has been historically challenging.

Objective: To develop a cell line in mouse models that accurately represents metastatic disease in the lungs, paving the way for future immunotherapy evaluations.
Methods: We designed and utilized an EWS-FLI1 piggyBac system to transfect the murine osteosarcoma K7M2 cell line. This process was followed by multiple rounds of GFP cell sorting, with subsequent cultures performed to achieve a high percentage of positive cells, ensuring the successful establishment of an EWS-FLI1+ cell line for modeling ES in mice.
Results: The most common breakpoints for EWS-FLI1 fusion were between exon 9 and exon 5 respectively based on 31 samples from the PeCan database. This informed the PiggyBac vector design for which we used a strong promoter, the EWS-FLI1 gene, and another promoter region with the GFP gene flanked by two LoxP sites. After the transfection of cells but prior to sorting, the images showed approximately 2-5% of the cells were GFP positive. After the first round of flow cytometry, images showed approximately 50% of cells were GFP positive. Another round of flow cytometry showed approximately 100% of cells were GFP positive.

Conclusion: Utilizing the EWS-FLI1 piggyBac system and strategic GFP cell sorting, we have made significant progress in modeling ES in mice. This advancement provides a promising platform for assessing new immunotherapy options for pediatric patients with recurrent or metastatic ES.

Medicine



Examining Microglial Iron Uptake: An Investigation into Neuronal Subarachnoid Hemorrhage Damage

Authors:Danielle Dichoso, Elizabeth Klaas, Koji Hosaka, Brian Hoh

Subarachnoid hemorrhage (SAH) is indicated by mass bleeding within the subarachnoid space, usually induced by traumatic brain injuries or aneurysmal ruptures. SAH bleeding is largely associated with high mortality rates, with median case-fatality rates at 27-44%. Previous studies established that neuronal iron reuptake is associated with SAH's neural injury cascade. Despite SAH's severity, current knowledge of iron cascade developmental mechanisms is limited.

My hypothesis is that SAH induces the presence of excess iron in the brain and this iron is taken up by microglia. This could initiate a ferroptotic injury cascade that leads to neuronal death, causing neurocognitive and behavioral functioning issues. This study is aimed at bridging unknown SAH injury mechanisms and neurobehavioral repercussions.

This study examined cerebral tissue from murine models to analyze microglial iron uptake levels using immunofluorescence staining. C57BLJ/6 mice underwent surgical brain injections with analogous blood to simulate intracranial aneurysm-induced SAH models. Post-operative mice underwent neurocognitive tests, and their harvested brain tissue underwent immunofluorescent staining.

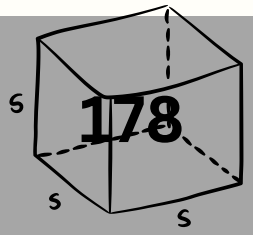
Results propose a major correlation between microglial iron reuptake and worsened neurobehavioral outcomes via ferroptosis. Future studies could investigate the use of pharmaceutical methods to remove this excess iron before neuronal damage to limit long-term impairment.

A Mathematical Model of Multiple Myeloma to Simulate the Effects of Certain Combination Therapies

Authors: Giuseppe Scibilia and Helen Moore

Multiple myeloma (MM) is a disease composed of malignant plasma cells which primarily reside in the bone marrow. The malignancy is caused by either a set of specific chromosomal translations, or aneuploidy in a plasma cell. MM leads to the formation of bone lesions, releasing potentially harmful amounts of calcium ions into the bloodstream and increasing bone resorption. As MM progresses, it benefits more and more from the bone marrow microenvironment. Factors expressed and secreted by cells which normally control diseases surprisingly end up boosting the spread and proliferation of MM cells. Long term disease may be lethal to the patient. To this date, there is no treatment option to fully cure MM. Combining information from literature sources, we developed a model that captures interactions and dynamics in cell populations. Our goal is to use mathematical equations which represent the changes in cell populations and simulate effects of different combination therapies on the disease. Through this process, we hope to find a potential combination regimen that can be used to reduce the population of MM cells to zero, thus eradicating the disease. If this is impossible, then we will attempt to find the combination treatment which yields the best possible results for the patient. In this poster we will include more background from the literature as well as our own model and future workflow.

Medicine

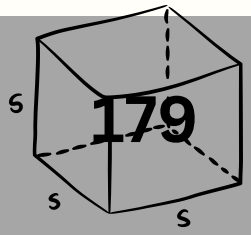


Investigating the Role of VP1/VP2 and pH in AAV5 Genome Ejection

Authors: Victoria Zembrzuski, Keely Gliwa, Antonette Bennett, Mavis- Agbandje McKenna, and Robert McKenna

Adeno-associated virus (AAV) is a single stranded DNA virus that can infect various animal species, including humans. AAVs are nonpathogenic to humans and therefore have become one of the leading viral vectors for gene therapy. In an attempt to improve vector efficiency, researchers work to better understand the viral life cycle. Infection by AAV is initiated by receptor/coreceptor binding and endocytosis into the cell. Once in the cell, the AAV makes its way to the nucleus. The viral capsid first experiences a transition from early endosome to late lysosome which is mediated by pH (pH 7.4 - 4). Viral escape from the lysosome is facilitated by the externalization of viral protein 1 unique region (VP1u). VP1u has a phospholipase domain (PLA2) which externalizes with VP1u. Both are essential to lysosome escape. The viral capsid then traffics to the nucleus where DNA will be released in a process called genome ejection. Genome ejection is an important step in delivering the therapeutic gene for replication and expression, but the exact mechanism is still unclear. This study aimed to develop mutants of the serotype AAV5. AAV capsids are made up of viral structural proteins VP1, VP2, and VP3. Through site-directed mutagenesis we were able to create a capsid containing only VP3. We present the in vitro characterization of genome ejection for AAV5 and AAV5-VP3 using a thermal assay that triggers DNA release prior to capsid denaturation. Using this assay, we investigate the potential role of VP1/VP2 and pH in genome ejection. Our data implies that VP3 only capsids retain their DNA at higher temperatures and release DNA later than capsids containing VP1, VP2, and VP3.

Medicine



Monocytic Myeloid-Derived Suppressor Cells Facilitate the Resolution of Lung Ischemia-Reperfusion Injury by Regulating Neutrophil Infiltration and Activation

Authors: Makena Woolet-Stockton, Victoria Leroy, Denny Joseph Manual Kollareth, Ashish K. Sharma

Introduction. The mechanisms of post-lung transplant ischemia reperfusion injury (IRI) resolution has yet to be elucidated. This injury is characterized by infiltration and activation of neutrophils (PMNs). Our study examined the role of an immunosuppressive cell, monocytic Myeloid-Derived Suppressor Cells (M-MDSCs) in modulating PMN activity during lung IRI.

Methods. A murine hilar ligation IRI model was used in Balb/c (WT) and cebpb-/- (MDSC deficient) mice. After IRI (1hr lung ischemia followed by 6- or 24hrs of reperfusion; 6- or 24hr-IRI), bronchoalveolar lavage (BAL) fluid and left lungs were collected for analysis. Lung tissues were embedded in paraffin, sectioned, and stained with Ly6G antibody to identify PMNs. PMNs were quantified via QuPath software from five random high power fields (HPF) per sample at 20x magnification. Myeloperoxidase (MPO) levels were analyzed via ELISA in BAL fluid. Groups were compared using ANOVA or t-test and presented as mean SEM.

Results. Lung injury was observed after 6hr-IRI (inflammation phase) that was significantly attenuated after 24hr-IRI (resolution phase) in WT mice. This was demonstrated by the quantification of neutrophil infiltration, which revealed a significant increase after 6hrs compared to 24hrs in WT mice (3.8x10^3±7.7x10^2vs. 9.0x10^2±2.5x10^2 PMNs/HPF; p=0.008; n=5/group). PMN infiltration remained elevated in cebpb-/- mice at 24hr-IRI compared to 6hr-IRI (2.2x10^3±2.9x10^2 vs. 2.1x10^3±3.9x10^2 PMNs/HPF; ns; n=5/group). MPO expression in BAL of WT mice exhibited an increase at 6hrs compared to 24hrs (5.1x10^3±3.4x10^2 vs. 1.5x10^3±1.4x10^2pg/mL; p<0.001; n=5/group). MPO in Cebpb-/- mice remained elevated after 24hr-IRI compared to 6hr-IRI (3.6x10^3±2.2x10^2 vs. 3.2x10^3±2.7x10^2 pg/mL; ns; n=5/group).

Conclusions. Our results indicate that M-MDSCs facilitate the resolution of lung IRI via decreasing neutrophil infiltration and activation.

PDHA1 Phosphorylation in Sciatic Nerves of Rats Treated with Dichloroacetate and Docosahexaenoic acid

Authors: H.L. Liyanarachchi, P. Shori, C.O. Dirain, N.A. Calcutt, and P.W. Stacpoole

Background: Dichloroacetate (DCA) is an investigational drug for the treatment of both congenital and acquired metabolic diseases. DCA activates the pyruvate dehydrogenase complex (PDC), the rate-limiting enzyme of aerobic glucose oxidation, by inhibiting PDK-phosphorylation of the PDC E1a subunit (PDHA1), thereby maintaining PDC in its unphosphorylated, active state. The single factor limiting the therapeutic potential for DCA is reversible peripheral neuropathy (PN). Oxidative damage appears to be a key event underlying PN, and antioxidants, such as docosahexaenoic acid (DHA), may protect against DCA-induced PN.

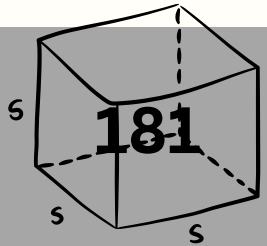
Objective: To evaluate if co- administration of DCA and DHA does not alter the therapeutic action of DCA.

Methods: Twenty-seven adult female Sprague-Dawley rats were randomly divided into three groups (N=9 per group): Control+DHA rats received daily DHA at 50 mg/kg. DCA rats received daily DCA at 500 mg/kg. DCA+DHA rats received daily DCA at 500 mg/kg and DHA at 50 mg/kg. DCA and DHA were delivered via oral gavage. After 14 weeks of treatment, rats were euthanized. Total and phosphorylated PDHA1 (pPDHA1) in sciatic nerves were measured by Western blotting.

Results: Total PDHA1 was not different between the three groups ($p=0.86$). DCA and DCA+DHA-treated rats have lower levels of pPDHA1 ($p=0.015$ and $p=0.002$) and pPDHA1/total PDHA1 ratio (both $p<0.001$) compared to Control+DHA rats. Phosphorylated PDHA1 and pPDHA1/total PDHA1 ratio were not different in DCA and DCA+DHA-treated rats ($p>0.05$).

Conclusion: DHA, an antioxidant that may mitigate DCA-induced PN, does not impact PDHA1 phosphorylation levels, ie, does not interfere with DCA's therapeutic action.

Medicine

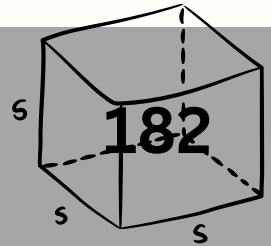


Investigating the stress counteracting effects of exercise in female mice

Authors: Ashmitha Satish, Charmi Desai, Erin A. Kang, Jacob Borukhin, Sophia Moret, Jonah Juergensmeyer, Karina Alviña

Stress is known to trigger anxiety-related behaviors and impair memory functions dependent on the hippocampus. On the other hand, exercise can release beneficial myokines like Irisin, offering neuroprotection. We recently showed that exercise exerts stress counteracting effects in male mice, but its impact on female mice remains unexplored. In this study we used young adult female wild-type mice and divided them into sedentary and exercise groups. Exercise consisted of daily 20-minute swimming sessions for 20 consecutive days, while the control group remained sedentary. After exercise, all mice underwent a combined open field (OF) and novel object recognition (NOR) tests with two identical objects (NOR1). Then, they were randomly assigned to either 3h restraint stress (stress) or to be returned to their home cage (control) before a second OF/NOR test with one novel object (NOR2). Both NOR1 and NOR2 were videotaped, and behavioral analysis conducted using video tracking software and manual scoring. Our results showed that exercise did not prevent body weight gain during daily swimming. Similarly, exercise did not reduce anxiety-like behaviors before stress and overall, it seemed less effective as a stress counteracting agent in females than in male mice.

Medicine



Differences in composition, diversity, and function of the fecal microbiota of post-menopausal breast cancer patients compared to healthy, age-matched controls

Authors: Nadia Kabbej BS, John Sommerville, Coy Heldermon MD, PhD

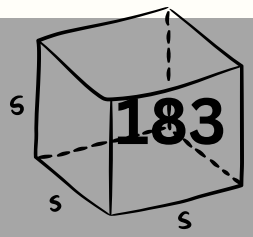
Introduction: Gut microbiota are a community of organisms colonizing the intestinal tract with essential roles in immune function, gut epithelial integrity, and metabolite production. Hypothesis: When the gut microbiota environment is negatively altered, termed dysbiosis, detrimental alterations in these functions can occur, which may predispose an individual to breast cancer development.

Methods: To understand the relationship between dysbiosis and breast cancer development, fecal microbiota samples were collected from 27 post-menopausal breast cancer patients of varying hormone receptor statuses (ER+, Her2+, ER+Her2+, or ER-Her2-) who had not yet begun chemotherapeutic treatment. Samples were also collected from 25 healthy, age-matched, post-menopausal controls. All samples were sequenced using 16srRNA sequencing. Breast cancer and control samples were then compared for significant (P<.05) alpha and beta diversity differences between groups.

Results: There was a significant difference in alpha diversity amongst all breast cancer types and healthy controls (P=.0104) and amongst ER+HER2- breast cancer and health controls (P=.00153). Healthy controls exhibited a higher mean Shannon index than breast cancer patients, thus higher within sample diversity. At the beta level, significant differences existed between all breast cancer types vs. controls (P = .01199) and ERpos_HER2neg breast cancer vs. control (P = .008991). Further analyses were conducted to identify specific taxa of microbiota which differed between groups. Specific genera with functions in breast cancer development were identified, including Ruminococcae, a B-glucuronidase producing bacteria, Akkermansia, a gut microbiota implicated in gut barrier dysfunction, and Parvimonas, a cell cycle regulator.

Conclusion: Overall, this study adds to our knowledge of gut microbiota and its function in breast cancer development and provides insight into the potential mechanisms responsible for their relationship.

Medicine



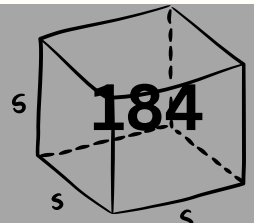
183

Evaluating the Functionality of Gene-Edited Antigen-Specific Tregs for the Treatment of T1D

Authors: Oluwagbemisola Awonusonu, Alexander Pearce, Matthew Brown, Kyle B. Madrid, Thinzar Myint, Todd Brusko

In healthy individuals, a subset of regulatory T cells (Tregs) suppresses self-reactive immune cells, thereby protecting pancreatic beta cells. Our work seeks to enhance the functionality of Tregs in the context of T1D by using gene-editing to enhance Treg activation and migration to sites of inflammation.To accomplish this, lentiviral transduction was used to generate Tregs expressing a preproinsulin (PPI)-directed T cell receptor (TCR). Following 14 days of in vitro expansion, PPI-TCR+ Tregs were characterized using flow cytometry to assess activation and lineage markers. After 24 hours, we observed increased activation in Tregs expressing moderate and high-affinity PPI-TCRs, whereas low-affinity PPI-TCR+ Tregs showed no differences from PPI-TCR (polyclonal) Tregs. We further examined the proliferative capacities of these PPI-TCR+ Tregs after 4 days of antigen-specific stimulation and identified significant increases in proliferation for PPI-TCR+ Tregs compared to polyclonal Tregs. Finally, we used in vitro suppression assays to measure CD8+ and CD4+ T responder proliferation by flow cytometry and observed that PPI-TCR Tregs demonstrated improved suppressive capacity compared to polyclonal Tregs after four days of co-culture.This data suggests PPI-specific TCRs can improve in vitro Treg suppressive and proliferative capacity during antigen-specific stimulation with potential implications for adoptive cell immunotherapies.

Medicine



Sigma Receptor Ligands Prevent COVID Mortality In Vivo: Implications for Future Therapeutics

Authors: Reed L. Berkowitz, Andrew P. Bluhm, Glenn W. Knox, Christopher R. McCurdy, David A. Ostrov and Michael H. Norris

The emergence of deadly coronaviruses follows a periodic pattern, which suggests a recurring cycle of outbreaks. It remains uncertain as to when the next lethal coronavirus will emerge, though its eventual emergence appears to be inevitable. New mutations in evolving SARS-CoV-2 variants have provided resistance to current antiviral drugs, monoclonal antibodies, and vaccines, reducing their therapeutic efficacy. This underscores the urgent need to investigate alternative therapeutic approaches. Sigma receptors have been unexpectedly linked to the SARS-CoV-2 life cycle due to the direct antiviral effect of their ligands. Coronavirus-induced cell stress facilitates the formation of an ER-derived complex conducive for its replication. Sigma receptor ligands are believed to pre-vent the formation of this complex. Repurposing FDA-approved drugs for COVID-19 offers a timely and cost-efficient strategy to find treatments with established safety profiles. Notably, diphenhydramine, a sigma receptor ligand, is thought to counteract the virus by inhibiting the creation of ER-derived replication vesicles. Furthermore, lactoferrin, a well-characterized immuno-modulatory protein, has shown antiviral efficacy against SARS-CoV-2 both in laboratory settings and in living organisms. In the present study, we aimed to explore the impact of sigma receptor ligands on SARS-CoV-2-induced mortality in ACE2-transgenic mice. We assessed the effects of an investigational antiviral drug combination comprising a sigma receptor ligand and an immuno-modulatory protein. Mice treated with sigma-2 receptor ligands or diphenhydramine and lactoferrin exhibited improved survival rates and rapid rebound in mass following SARS-CoV-2 challenge compared to mock-treated animals. Clinical translation of these findings may support the discovery of new treatment and research strategies for SARS-CoV-2.

Salt-loading Induces Both Glomerular and Tubular Damage in Adult Diabetic db/db Mice

Authors: Steven P. Thomas, Niharika Bala, and Abdel A. Alli

Hypertension is known to exacerbate diabetic kidney disease. Diabetic db/db mice recapitulate human pathophysiology and are an established model of type 2 diabetes. Also, db/db mice are salt-sensitive and develop profound hypertension after salt-loading. Here, we hypothesized salt-loading induces glomerular and tubular dysfunction in adult diabetic db/db mice. The tail cuff method was used to measure systolic blood pressure in conscious mice. Mice were subject to metabolic cage studies for urine collection. The expression of glomerular and tubular kidney injury markers in kidney cortex lysates, formalin fixed kidney sections, and urine from diabetic db/db mice and wild-type mice was assessed by Western blotting, enzyme-linked immunosorbent assay, and immunohistochemistry. Protein expression of monocyte chemoattractant protein-1 (MCP-1), osteopontin (OPN), and ED-1 (CD68) was elevated in the diabetic db/db kidney compared to the healthy wild-type kidney. Other biomarkers associated with renal pathophysiology were augmented in the diabetic db/db kidney. Taken together, our study suggests high salt-induced hypertension secondary to diabetes leads to rapid kidney dysfunction which may be mitigated by limiting salt in the diet.

Purification of Mesenchymal Stem Cell Extracellular Vesicles

Authors: Genesis Rodriguez, Shannon Wallet, and Robert Maile

Over 450,000 individuals a year suffer from burn injuries in the United States. Burn patients experience dysfunctional immune responses that can lead to shock, organ failure, and susceptibility to infection. It is crucial to find a therapeutic that can restore a homeostatic immune response after burn injury. Recently, researchers have discovered that Mesenchymal Stem Cell Derived-Extracellular Vesicles (MSC-EVs) have immunomodulatory qualities, and are currently being assessed as a potential therapeutic for various diseases. In Dr. Maile's lab, we are exploring the EVs' therapeutic effects on the immune system after burn injury.

A necessary first step was to develop a standard protocol for isolating pure MSC-EVs from MSCs. We grew multiple flasks of Human MSC (HMSC) until about 70% confluency and pooled 200 mL of supernatant. The supernatant was centrifuged at 2,000g (20 minutes), 10,000g (30 minutes), and 21,000g (60 mins) consecutively and the supernatant was removed at each step. Then, pellets (impure EVs) were combined into one tube (2mL). We utilized a reusable size-exclusion column (qEV2, Izon Inc) to isolate EVs in conjunction with an Izon Automatic Fraction Collector. We flushed the column with 25mL of buffer (filtered water), added 2mL of EV sample, and 12.1mL of buffer. We collected 6 x 2mL fractions according to the manufacturer's instructions. The column was then flushed with water and sodium hydroxide and stored in 20% ethanol. To determine the fractions that contained purified MSC-EV, we then performed Nanotracking analysis (ZetaView Quatt 5). We confirmed that this protocol yielded an average of 7.7x10^9 EV/ mL in the first four fractions, which were then combined to form our stock of MSC-EV for use in further experiments, including adding to immune cells isolated from burn patients to determine if EVs can improve their immune response in vitro.

Rational design of the mu opioid receptor agonist, LG94, introduces a bias for G-protein cellular signaling and analgesia with reduced clinical liabilities in mice.

Authors: Tsai B1, Eans SO1, Varga BR2, Ople R2, Wang H2, Li Q2, Bernhard S2, Appourchaux K2, Che T2, Katritch V3, Majumdar S2, McLaughlin JP1

Mu-opioid receptor (MOR) agonists provide excellent pain treatment. But with respiratory depression and high abuse potential as adverse effects, research is centered on developing novel opioids that produce antinociception without side effects. All three opioid receptors are G-protein coupled receptors (GPCRs) that activate two main pathways, the G-protein and/or the ß-arrestin pathways. Research suggests that opioid analgesia is mediated by G-protein signaling, whereas ß-arrestin signaling generates respiratory depression, addiction, and tolerance to morphine, another MOR agonist. Accordingly, opioids with “biased agonism” to preferentially activate the G-protein pathway may create antinociception without the negative side effects associated with ß-arrestin signaling. Utilizing advanced molecular modeling of the MOR, LG94 was rationally designed to be a MOR biased agonist and synthesized. We hypothesize that LG94 will show MOR-mediated G-protein signaling with limited ß-arrestin-2 signaling to result in reduced opioid side effects while maintaining full antinociception. The TANGO cellular signaling assay revealed LG94 activates G-protein signaling as a full MOR agonist without significant activation of ß-arrestin signaling. For mouse testing with the 55°C warm-water tail-withdrawal assay (WWTW), LG94 produced full antinociception mediated by the MOR and an ED50 (and 95% CI) of 9.57 (7.55-12.1) mg/kg, s.c., 3.4-fold less potent than morphine. However, LG94 displayed no psychostimulation and significantly less respiratory depression with supratherapeutic doses of 50 mg/kg, s.c.. Furthermore, LG94 when compared to morphine caused minimal withdrawal symptoms induced by naloxone following chronic administration and no conditioned place preference (CPP) indicating reduced abuse potential. In conclusion, our results with LG94 demonstrate the therapeutic potential of opioid biased agonists for safer pain relief.

Integrated Genomics and Transcriptomics Analyses Using HapMap Cell Lines Reveal Novel Modulators of Cellular Response to Cyclophosphamide

Authors: Elizabeth Molchan, Mohammed O. Gbadamosi, Neha Bhise, Taraswi Mitra Ghosh, Oluwaseyi Olabige, Changlin Yang, Duane Mitchell, Brooke Fridley, Jatinder K. Lamba

Cyclophosphamide (CTX) is a chemotherapeutic agent used for breast cancer treatment. In clinical settings, patient responses to CTX are heterogeneous, however, most studies have focused on the influence of genomic variation on CTX metabolism, not on cellular sensitivity. We hypothesized that single nucleotide polymorphism (SNPs) influence both CTX metabolism and cellular sensitivity, contributing to variable survival outcomes in breast cancer patients (BC). We generated phosphoramide mustard (PM) sensitivity data, the active metabolite of CTX, as measured by IC50 values, for 53 HapMap cell lines. Using this data alongside cell genotype data, we performed a genome-wide association study (GWAS) to identify novel SNPs associated with PM sensitivity. We used transcriptomic data for our cell lines and BC patient data from The Cancer Genome Atlas to explore the functional and clinical implications of our findings. The IC50 values ranged from 3.6 to 125.8 uM and in GWAS analyses, we identified 143 SNPs located in 38 genes that were significantly associated with PM IC50 at $P < 10\text{-}4$. The KIAA0586 locus contained the top 4 SNPs associated with PM sensitivity. In survival analyses, increased expression was protective in CTX-BC patients (HR = 0.45, P = 0.03), but had no effect in other BC patients. A chromosome six hotspot included 5 SNPs associated with PM resistance ($P < 3x10\text{-}5$) and differential expression of 15 genes, 3 of which were significantly associated with lower 5-year survival in CTX-BC patients. rs226928 was associated with increased MYLK4 expression, and MYLK4 expression was positively correlated with PM IC50 ($\rho = 0.35$, P = 0.011) and associated with significantly reduced 5-year survival in CTX-BC patients (HR = 3.00, P = 0.03). Taken together, we report several novel SNPs that influence the expression and activity of genes associated with PM sensitivity, and gene expression in turn influences survival.

Quantification and Analysis of General Anxiety Disorder (GAD) Clinical Trial Kava Capsules via High-Performance Liquid Chromatography (HPLC)

Authors:Alexander Scala, Jessica Mamallapalli, and Chengguo Xing

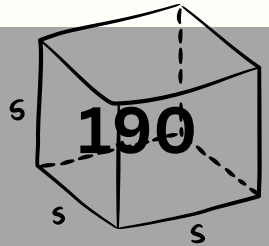
---

Kava (Piper methysticum) is a native Pacific Island crop with numerous health benefits including relaxation, anxiety management, and lung cancer risk reduction. Kava supplement capsules aim to promote positive physiological effects in patients. Varying abundance levels of present kava chemical analytes, or kavalactones, can influence targeted physiological effects, emphasizing the importance of standardized capsule composition to ensure maximal therapeutic benefits. General Anxiety Disorder (GAD) clinical trials are pivotal in supporting the relaxation properties of kava, as well as alternative studies aiming to prove beneficial future applications.

Determination of the kavalactones' concentrations in clinical kava capsules through

High-Performance Liquid Chromatography (HPLC) is necessary to supplement clinical trial results and findings. Quantitative analysis of kava capsules supports the study's rigor, as well as establishes the correlation between kavalactone concentration and potential health benefits. HPLC analysis of the capsules containing the six major kavalactones confirms chemical stability and ensures the absence of potentially harmful analytes. Study rigor is ensured by capsule kavalactone concentrations present in fixed amounts to prevent inconsistent physicochemical effects influenced by variations in kavalactone doses.

Pharmacy

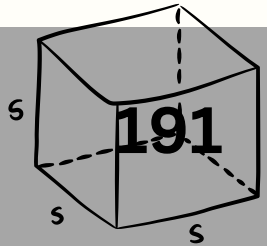


Boosting Low-dose Chemotherapy with PARP Inhibitor for Treatment of Acute Myeloid Leukemia

Authors:Madeline Huberman, Bowen Yan, Olga Guryanova

Acute Myeloid Leukemia (AML), one of the most common types of adult leukemia, accounts for 30% of cases. The elderly population typically has a poor prognosis with a remission rate of 15% in patients over 60 compared with 40% in those under 60. Secondary Acute myeloid leukemia (sAML) can occur in patients undergoing treatment for other cancers, accounting for 10-30% of AML cases. Treatment options are effective but require high doses of chemotherapy, which these two groups find difficult to tolerate. Cytarabine, a commonly used chemotherapy to treat AML, causes direct DNA damage to cancer cells. Cells damaged by Cytarabine rely on the PARP enzyme for recovery, suggesting that PARP inhibitors, such as olaparib, would be effective in boosting low-dose chemotherapy regimens. This study aims to test the effectiveness of different concentrations of this combined treatment in AML cell lines. Multiple cell lines of AML were subjected to different concentrations of cytarabine or olaparib as single-agent treatment, as well as different combinations of these two drugs. Combination treatment with Cytarabine and olaparib was more effective and produced lower cell viability than single-treatment Cytarabine. The data showed a dose-dependent response through increased effectiveness with increased concentration of olaparib. Western blotting protein studies have also been performed to identify biomarkers. Specifically, samples were blotted for cleavage of PARP, indicating apoptosis, gamma-H2AX, indicating double-strand breaks in DNA, and GAPDH as a loading control. Preliminary data shows that cells subjected to the combination treatment exhibit increased DNA damage and apoptosis. This suggests that the efficacy of low-dose Cytarabine, which tends to be more toxic than olaparib, could be boosted by this secondary drug to create an effective treatment option for weaker AML patients, including the elderly and those with sAML.

Pharmacy

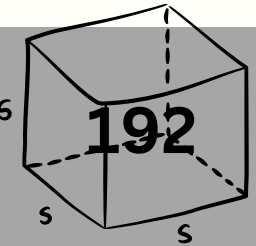


Bovine placental-Derived Collagen Type 1/3: A novel Bio-Ink for 3D Bioprinting and Organoid Development

Authors: Fabiana Mastantuono, Samantha Ali, Mei He

This research project is driven by the potential advantages of bovine placenta-derived collagen, specifically collagen type 1/3 (COL 1/3). Placental tissues are recognized for their regenerative properties and unique biochemical composition, which features an abundance of growth-promoting factors, extracellular matrix proteins, and key cellular signals, rendering them suitable candidates for advanced biomaterial development. The study involves the isolation of COL 1/3 from bovine placenta through a pepsin digestion process. It also investigates the in vitro compatibility of COL 1/3 with human lung epithelial (Beas2B) cells, utilizing a combination of 2D cytocompatibility assays and MTT tests to assess viability and performance. This comprehensive assessment is complemented by Scanning Electron Microscope analysis, confirming the characteristic collagen morphology while providing precise measurements of pore size and thickness. Additionally, the study extends into a microfluidic device-based 3D in vitro model, encompassing a comparative analysis between COL 1/3 and commercially available bovine tendon collagen in a standardized sprouting assay. This analysis quantifies the number of sprouts per spheroid, using Human Umbilical Vein Endothelial Cells (HUVECs) as a metric of biological functionality. The ultimate objective is to leverage COL 1/3-derived spheroids as bio-ink for 3D bioprinting, with the aim of creating precise and biomimetic organoid models. This research aims to compare the quality and performance of organoid models constructed using COL 1/3-derived spheroids with those built using commercially available bovine collagen. By capitalizing on the regenerative potential of placental tissues and the unique composition of placental-derived COL 1/3, this study has the potential to advance the field of 3D bioprinting and biomedical modeling since it presents a transformative opportunity in the development of highly effective, biocompatible, and regenerative solutions for tissue engineering, organoid modeling, and ultimately, regenerative medicine.

Pharmacy 192



Synthesizing a Small Molecule Guanylyl Cyclase A Receptor Positive Allosteric Modulator to Increase Cyclic Guanosine Monophosphate Production

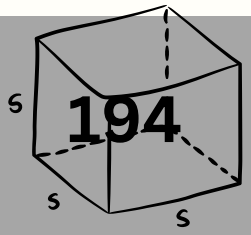
Authors: Shayan Abbas, Siobhan Malany, Satyamaheshwar Peddibhotla

The proportion of deaths due to CVD has drastically increased, and CVD is the leading cause of death globally. The guanylyl cyclase A receptor (GC-A), which is activated by the natural ligands atrial natriuretic peptide (ANP) and b-type natriuretic peptide (BNP), plays an important role in regulating blood pressure, sodium excretion, and other cardiovascular functions. GC-A carries out its cardioprotective role by producing cellular secondary messenger, cyclic guanosine monophosphate (cGMP). Currently, there is no small molecule that targets GC-A to increase cGMP production. We have performed high throughput screening of the NIH Molecular Libraries Small Molecule Repository to identify small molecule GC-A positive allosteric modulator (PAM) scaffolds. We have recently reported the synthesis, medicinal chemistry, and structure-activity relationship (SAR) studies on a 2-aminobenzothiazole based hit series that led to the development of a small molecule lead, MCUF-651. MCUF-651 binds to GC-A selectively to enhance the binding of ANP to the GC-A receptor and increased ANP-mediated cGMP production in human cardiomyocytes, adipocytes, and renal cells. MCUF-651 based leads are currently in preclinical development targeting cardiovascular disease. We are also developing an alternative chemical scaffold based on an isoxazole core. Our SAR plan and details of synthesis of analogs and purification studies to support hit-to-lead studies around the isoxazole series will be presented. The discovery of a small molecule GC-A PAM is significant because it is a crucial step towards developing therapeutic agents for cardiovascular diseases (CVD) and decrease the global burden of death attributed to CVD and its risk factors such as hypertension, renal dysfunction, and obesity.

Engineering a Nitroreductase From Haemophilus influenzae To Improve Its Efficiency in Converting the Anti-Cancer Prodrug CB1954

Authors: Phuong Ton, Dake Liu, and Yousong Ding.

Nitroreductase-CB1954 [5-(aziridin-1-yl)-2,4-dinitrobenzamide] is a promising gene-
directed enzyme-prodrug therapy (GDEPT) for the treatment of a variety of cancers. This strategy uses a nitroreductase in cancer cells to convert the non-toxic CB1954 prodrug into the cytotoxic hydroxylamine products, whose metabolites then kill tumor cells. The major advantage of this therapy includes its ability to target both dividing and nondividing cancer cells, independent of the cell cycle. Human DT-diaphorase (NAD(P)H dehydrogenase) is able to activate CB1954, but its low efficiency has significantly hindered the further development of GDEPT for cancer management. Indeed, since 2008, there has been no further update about this gene-directed enzyme-prodrug therapy. To address this critical issue, we aimed to advance the GDEPT by enhancing the CB1954 activation efficiency of a bacterial nitroreductase from the human commensal bacterium Haemophilus influenzae (HiNfsB). To achieve the objective, we docked CB1954 into the active site of HiNfsB, whose structure we recently determined, to identify key residues for the substrate binding. W71 was then selected for site-directed mutagenesis to screen for mutants with improved nitroreduction activities. The substrate consumption in the enzyme reaction was monitored by HPLC and the products were identified in LC-MS analysis. Our current results showed that HiNfsB shows a higher activity in activating CB1954 than the well-characterized NfsB homolog from E. coli. In addition, several mutants (e.g., W71A and W71F) showed the increased activities on activating CB1954 comparing to the wild-type HiNfsB. Our preliminary results demonstrated that HiNfsB is a promising candidate for further developing nitroreductase/CB1954 GDEPT, and W71 is a key residue for further improving the enzyme's catalytic efficiency on CB1954.



Increasing Extracellular Vesicle Transfection through Electroporation with AuNPs

Authors: Ana Dogan, Nina Erwin, Xiaoshu Pan, Mei He*

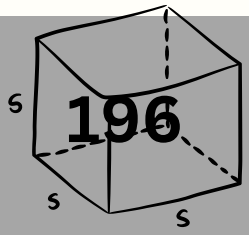
Advancing drug delivery method plays an important role in reducing toxic side effects and maximizing drug efficacy by (i) increasing target specificity and (ii) decreasing drug degradation. Extracellular vesicles (EVs), which are natural carriers released by all living cells, are gaining attention for usage in drug delivery due to their various advantageous properties, including (i) cargo protection from enzymatic degradation, (ii) tissue-specific targeting, and (iii) high biocompatibility. One of the leading methods for cargo transfection into EVs is electroporation, which utilizes short duration of voltage pulses to create temporary pores on the EV surface membrane, during which the cargo can enter. This process is limited by the maximum voltage EVs can withstand for pore formation and cargo encapsulation. We aim to investigate optimized cargo loading into EVs specifically through the addition of gold nanoparticles (AuNP) to the electroporation process. It has been shown that AuNP can increase the loading into cells during electroporation by allocating the electric voltage onto the cell surface, allowing more pore formation without increasing the total voltage applied. Due to similar surface properties, we hypothesized that AuNPs would provide a similar increase in transfection of EVs. To test this hypothesis, we electroporated green fluorescence protein (GFP) into EVs with the introduction of AuNPs. Fluorescence analysis through Cytation 5 revealed that the AuNPs increased the amount of GFP transfected into the EVs. Assessment with Nanoparticle Tracking Analysis and Transmission Electron Microscopy showed that the AuNPs did not significantly change the size, concentration, zeta potential, or morphology of the EVs, compared to the native EVs without electroporation, for retaining the EV originality and integrity. Overall, AuNPs have the capacity to increase drug transfection into EVs, allowing high-efficiency packaging for specific drug delivery to enhance therapeutic functions.

Should children with disfluency be encouraged to become bilingual?

Authors: Sarah Hemani, Shantzie Samayoa, Laurynn McGee, Dr. Sharon DiFino

Children who experience disfluency generally encounter repetition of sounds, syllables, or words; prolongation of sounds; and interruptions in speech known as blocks. People with disfluency are able to organize and convey their thoughts but have difficulty with the flow of their speech. Currently, more than 3 million Americans, or 1 percent of the population, stutter. Should children with disfluency be encouraged to become bilingual? Do monolingual children with disfluency experience the same difficulties that bilingual children do or do bilingual children have more difficulty as they navigate learning two languages while stuttering? This literature review investigates whether or not children should be encouraged to become proficient in more than one language regarding if such proficiency will hinder the child's progress in overcoming disfluency. While previous research has shown that children who are bilingual tend to be over-identified as having a disfluency issue, this review highlights how being bilingual does not cause disfluency, and instead such over-identification can be attributed to issues with measuring contextual vocabulary. Children in this literature review are defined as being 18 years of age or younger. The databases used are PubMed and Linguistics and Language Behavior Abstracts (LLBA). The research methods of this literature review include an overview of ten research articles to investigate the potential gains or consequences of bilingualism in regard to disfluency.

Public Health and Health Professions



Trends in Xylazine-Involved Overdose Emergency Medical Services Dispatches in the United States, 2022–2023

Authors: Portia Ludwig, Nicole D. Fitzgerald, Andrew McCabe, Linda B. Cottler

Background: Xylazine, a veterinary sedative, has infiltrated the United States illicit drug market and is increasingly observed in drug overdoses. As an emerging substance, there is a lack of current available data on the characteristics of populations exposed to xylazine.

Methods: Data on xylazine-involved drug overdoses comes from the National Drug Early Warning System partnership with the emergency medical services (EMS) data-sharing platform biospatial.io. Records of overdose EMS dispatches with xylazine-related terms used in the electronic patient care report ("xylazine" or "tranq") were extracted from 43 states between September 1, 2022 and September 30, 2023 (n=249). We examined how counts of xylazine-involved overdose dispatches changed monthly over the study period and used available patient demographic and geographic information to describe the population of those exposed to xylazine.

Results: A steady increase in xylazine-involved overdose dispatches was observed since September 2022, with the highest count of xylazine dispatches recorded in August 2023 (n=50). Based on available patient demographic information, the majority of xylazine-involved overdoses occurred among males (57%), those aged 30–39 years (41%), and White individuals (63%). Six states recorded >10 xylazine dispatches over the study period, 83% of which were located in the Northeast. Pennsylvania reported the highest total count of dispatches involving xylazine (n=69).

Conclusions: Although EMS provider data is presently limited in capturing the full involvement of xylazine in overdose incidents, the rapidly changing illicit drug market and continued emergence of adulterants such as xylazine underscore the importance of using real-time data to understand the characteristics of those exposed to xylazine. Results can inform future research and harm reduction efforts.

The common genetic variants that impact the anatomical structure and function of the philtrum with children with non-syndromic cleft lip with and without palate (nsCL/P).

Authors:Nora Habib

Background:
The genetic variants of nsCL/P have been understudied for the past several decades, with more recent studies revealing its strong linkage with the Interferon regulatory factor 6 (IRF6) and 8q24 genome. However, as studies progress, the difficulty faced isolating genomes across multiple cohorts continues. Most studies have analyzed individuals with European ancestry and their genetic history tied to IRF6 and 8q24, but the majority of individuals with the health condition belong to an Asian descent. The genetic variants of cleft lip with and without palate seem to be unique on an individual basis with a variety of genes influencing the abnormal growth and structure of the philtrum.

Sample Data:
The data used in this review paper will be derived from the University of Floridas' Smathers Database using the academic search premier with key phrases "genetic variants of cleft lip and palate" and "anatomical structure".

Results:
After reviewing 17 academic journals and identifying a range of genomes that influence nsCL/P, the strongest correlation presents between IRF6 and 8q24 with a variation of 20+ genomes that modify the anatomical development of the philtrum. These include SEC24D, SUPT4H1, WNT5B, GPC4, MSX1, WDR11, SEPTIN9, PHGDH, GEMIN3, DROSHA, DGCR8, GEMIN4, PIWIL1, XPO5, DICER, Pax6, Pax9, TGFB3, TGFA, BMP4, and CDH1, with other relevant studies proving a strong association with SNPs and miRNA. These genomes remain variable on a case by case study.

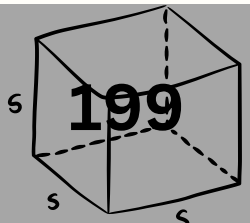
Conclusions:
Understanding the genetics involved in nsCL/P remains ongoing. The main isolated genomes currently are IRF6 and 8q24 in the majority of cases; this does not remain uniform across multiple cohorts. A variety of associated factors seem to play a role in the abnormal development of the philtrum.

Sublethal TCDD Exposure During Zebrafish Development Produces Multigenerational Abnormalities in Ovarian Histology and Gene Expression

Authors: Emma Cavaneau*, Amelia Paquette*, Camille Akemann, Danielle Meyer, Tracie Baker

2,3,7,8 -Tetrachlorodibenzo-p-dioxin (TCDD) is a widespread pollutant that has endocrine disrupting effects and has been linked to reproductive disease. Zebrafish (Danio rerio) are an excellent model organism for studying the transgenerational effects of TCDD. Previous work found that exposing juvenile male zebrafish to 50 ppt TCDD during reproductive development led to transgenerational effects in the testes. The goal of this work is to investigate the histological and transcriptomic effects of developmental TCDD exposure on the ovarian tissue of exposed fish (F0 generation) and subsequent generations (F1 and F2). For histological analysis, the whole ovary area and the area of atretic cells were quantified using ImageJ v.1.53t in μm^2. The percent of atretic area in each ovary section was calculated, and the data from both experimental groups were compared using a Welch's t-test (significance indicated at $p < 0.05$). Transcriptomic analysis was performed using Lexogen Bluebee software and Ingenuity Pathway Analysis to examine the functional pathways altered by differential gene expression. Increased oocyte atresia was found to be multigenerational, persisting into the F1 generation of indirectly exposed fish. The transcriptomic dysregulation of ovarian reproductive pathways spanned all three generations with the F2 generation being the most dysregulated, indicating a transgenerational effect on ovarian function. These outcomes both correlate with our transgenerational findings of reduced fertility and implicate epigenetic mechanisms in mediating these persistent effects. Overall, this research helps further the understanding of sex-specific mechanisms of TCDD-induced heritable reproductive disease.reproductive health across generations.

Public Health and Health Professions

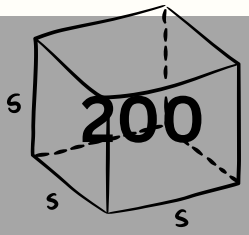


Neurobehavioral Effects of Sublethal TCDD Exposures in F0 and F1 Zebrafish Generations

Authors: Brianna Vo, Amelia Paquette, Gabrielle Gonzalez, Emma Cavaneau, Danielle Meyer, Chia-Chen Wu, Tracie Baker

Exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), an environmental endocrine disruptor and model AhR agonist, is linked to multiple morphological abnormalities as well as behavioral deficits, namely neurobehavior. We observed these effects of TCDD exposure in zebrafish, an NIH-validated model species for studying developmental and generational toxicology. After sublethal TCDD exposure (50 pg/ml) at both 3 and 7 weeks post fertilization (wpf) for 1 hour each, the novel endpoint of anxiety-like behavior was investigated. At 12 months post fertilization, exposed and control adult fish cohorts were evaluated for exploratory behaviors in a 5-minute novel tank test. The tanks were observed from top and side views; from each view, the tank was divided into 2 zones. For each view, data was collected for the following parameters: total distance moved; total transitions between tank zones; time spent in preferred zone; latency to less preferred zone; total rapid transitions; and number of fish with ≥1 transition. While there was no significant difference in total distance traveled, two endpoints were significant: Exposed females had a shorter latency before leaving the preferred bottom zone of the tank, and exposed males displayed less thigmotaxis than control counterparts. Moreover, exposed fish of both sexes displayed trends towards less inhibited behavior for other parameters. Finally, both fish cohorts were spawned to assess neurobehavior in their indirectly exposed or control F1 larval offspring. At 5 days post fertilization (dpf), the total distance traveled was measured in alternating light: dark periods. Exposure-lineage fish showed hyperactivity in both light and dark periods compared to controls. In conclusion, these findings suggest that sublethal TCDD exposure can contribute to increased exploratory behavior in directly exposed adults and increased hyperactivity in the second generation young.

Public Health and Health Professions



Language Barriers: Accessing Primary Healthcare by Balkan Immigrant Populations in the United States

Authors: Ramila Odzakovic, Trish-Ann Parkinson, Sharon Difino

The Balkan peninsula is a region located in southeastern Europe, which consists of the following countries: Serbia, Croatia, Bosnia & Herzegovina, Montenegro, Kosovo, Albania, North Macedonia, Bulgaria, Romania, Slovenia, northern Greece, and western Turkey. One of the most large-scale political conflicts in the Balkans transpired after the dissipation of the former republic of Yugoslavia in the early 1990s. The Yugoslavian wars were characterized by wars of independence, political corruption, and ethnic cleansing (Finlan, 2004).

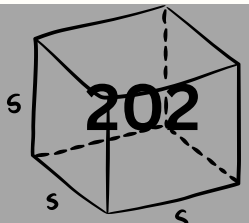
After the series of political conflicts in the 90s subsided, the United States experienced an influx of refugees and immigrants, many of whom arrived without any prior knowledge of the English language. Consequently, many older migrant populations today face challenges accessing primary healthcare services due to language barriers. As a result, the senior migrant population may encounter difficulties when undertaking essential tasks such as scheduling appointments, understanding medical instructions, and expressing their health concerns effectively. This study focuses on the experiences of Balkan immigrants residing in the United States, specifically those affected by the Yugoslavian wars, hailing from countries such as Serbia, Croatia, Kosovo, and Bosnia & Herzegovina. The purpose of this study is to analyze how language barriers within the Balkan immigrant population can interfere with access to primary healthcare services. We intend to use a traditional literature review that focuses on older adult migrant populations. Data will be collected from Balkan communities across the United States to capture potential regional and ethnic distinctions.

Sublethal Dioxin Exposure in Developing Zebrafish Leads to Adult Onset and Transgenerational Skeletal Effects

Authors: Ashley Guarino, Danielle Meyer, Brianna Vo, Dayita Banerjee, Tracie R. Baker

2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is a known endocrine disruptor and developmental toxicant in many vertebrates. TCDD is the most potent ligand to the aryl hydrocarbon receptor (AhR), a transcription factor known to play a role in bone formation and remodeling. Our lab has previously shown that zebrafish exposed to low levels of TCDD (1h; 50 pg/mL) at 3- and 7-weeks post-fertilization exhibit defects in the cranial and axial skeleton in adulthood. These outcomes, particularly kinks in the vertebrae, were observed in the subsequent F1 and F2 generations from the TCDD-exposed founders, indicating these effects are transgenerational. In general, transcriptomic analysis focused on bone growth and maintenance is less extensive compared to other endpoints of TCDD exposure. This is due in part to the mineralized matrix of bone tissue making RNA isolation difficult. Different methods tailored to the effective homogenization of bone tissue and extraction of RNA were developed and tested using variations of guanidine-based sample lysis and silica-membrane purification. Lysis reagents combined with homogenization using an electronic mortar and pestle have yielded the most consistent and promising RNA yields from zebrafish vertebral and jaw tissue, and RNA quality has improved through the utilization of fibrous tissue kits. Future modifications to these methods will ensure an optimized, effective procedure capable of producing high-quality RNA samples from zebrafish bone. After finalizing an appropriate method, RNA isolation and transcriptomic analysis will follow, with the goal of gaining insight into the mechanisms by which TCDD exposure in developing zebrafish produces scoliosis in adulthood and subsequent generations..

Public Health and Health Professions



Exploring the Link between Childhood Obesity and Excessive Screen Time Use in the United States: A Systematic Review

Authors: Dominic Lucas, Marijus Maksvytis, Tessa Santelli

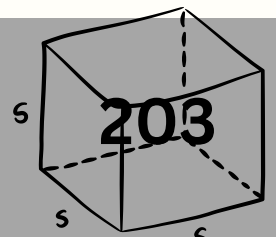
Background: In an increasingly digital era, excessive screen time has become an alarming concern in children. Concurrently, the United States is witnessing an unprecedented surge in childhood obesity, necessitating an exploration into the relationship between screen activities and weight-related problems in children. This study aims to comprehensively analyze the association(s) between childhood obesity and excessive screen time use among children in the U.S. through evaluation and critical assessment of comparative studies addressing the issue.

Methods: Our sources were obtained from select databases (Google Scholar, Pubmed) with limitations regarding language and location, excluding the prominence of date. Specific words used for our collection included "excessive screen time," "obesity," "children/adolescents," and other terms associated with the correlation between screen time and obesity in children/adolescents. Our criteria for assessment of particular literature called for studies that evaluated children/adolescents longitudinally and/or analyzed how specific determinants may have incited the presence of obesity.

Results: Our initial analysis suggests a noteworthy association between the variables under investigation, which may indicate a positive correlation. Particular studies highlighted that children aged 4-11, spending more than 2 hours daily on screens, exhibited increased prevalence of unhealthy eating habits and reduced physical activity, contributing to a spike in childhood obesity. A longitudinal study involving 7,105 adolescents, each having a daily screen time of up to 3 hours, discovered that 43% of these participants were classified as obese in adulthood, emphasizing the lasting impact of early excessive screen exposure.

Conclusion: The findings emphasize the need for comprehensive public health initiatives to raise awareness about the effects of excessive screen time on children's health. Implementing evidence-based strategies aimed at active lifestyles and balanced screen time is crucial to curbing the escalating rates of childhood obesity.

Public Health and Health Professions



A Preliminary Analysis of Concussion Underreporting in Aging and Dementia Research

Authors: Sarah Garfield1, Madison McGuire,1 Emily F. Matusz2, Olivia M. Emanuel2, Shannon Y. Lee2, Jessica Bove2, & Breton M. Asken2

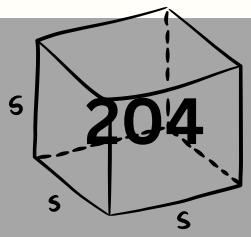
Background:
History of concussion, especially repeated concussions, is associated with poor later-life neurological health. Understanding the role of concussion in brain health first requires accurate detection of prior injuries. We evaluated how older adults with neurodegenerative disease changed their reporting of prior concussions after being provided a formal concussion definition.

Methods:
We studied 167 participants (age = 70.1±8.3, 61% male, 96% white/Caucasian) from the Fixel Institute for Neurological Disorders diagnosed with a range of neurodegenerative conditions (Alzheimer's disease, Parkinson disease, etc.) who completed a comprehensive head trauma survey (Boston University Head Impact Exposure Assessment).Participants first estimated the number of lifetime concussions they sustained. Then, a formal definition for concussion was provided and participants were asked again to estimate their number of concussions. We report descriptive data and compare the pre- and post-definition concussion estimates using a Wilcoxon signed-ranks test.

Results:
Fifty-six (33.5%) participants reported having a concussion pre-definition, which increased to over 60% post-definition. Frequency of repeated (2+) concussions also notably increased from pre-definition (18%) to post-definition (39%). Self-reported concussion history significantly increased after providing a formal definition for concussion (pre-definition: mean±SD=1.1±2.4,; post-definition:mean±SD=2.0±3.3; p<.001). About one-third (32.6%) increased their concussion frequency estimate after being given a definition.

Conclusion:
Many studies likely underestimate concussion history in older adults. Our results highlight the importance of providing a formal definition of concussion in clinical and research settings. Improving consistency of concussion history collection across studies will help minimize the risk of underreporting.

Public Health and Performance

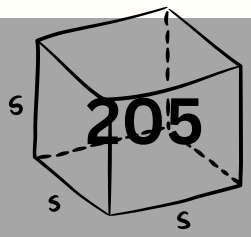


Investigating How Inadequate Guidelines Hinders Breast Cancer Screening Adherence in Transgender Patients

Authors: Shantzie Ponce, Layla Rucker, Frederik Kates

Background: Transgender individuals, whose gender identity differs from their assigned sex at birth, often undergo gender-affirming interventions, including cross-sex hormone (CSH) therapy and gender-affirming surgeries (GAS). These interventions alter the breast tissue and breast cancer risk, which lead to challenges in establishing screening guidelines.
Methods: This literature review sought a comparison of guidelines relevant to transgender healthcare, including those from the Fenway Health, UCSF Center for Transgender Health, and NCCN Guidelines. These guidelines were then utilized to evaluate the adherence of transgender patients to breast cancer screening recommendations. Transgender patients were categorized into subpopulations based on the ACR Appropriateness Criteria specific to breast cancer screening for transgender individuals. This classification provided a more detailed analysis of the transgender population. This was used to organize and analyze the scope of the existing guidelines and their conformity with ACR Appropriateness Criteria.
Results: The data revealed that among MtF (male-to-female) individuals adhering to screening guidelines, 2% and 22.7% underwent top surgery before age 40 and 50, respectively, based on NCCN and USPSTF guidelines. Adherence rates for those who had top surgery before age 40 and 50 were 44.9% and 50%, respectively. In contrast, FtM (female-to-male) individuals, with hormone use at ages 50-52 and 50 and older, showed adherence rates of 7.1% and 47.6%, respectively, based on Fenway and UCSF guidelines.
Conclusion: The data underscores that breast cancer screening rates for transgender FtM individuals are notably 24.1% lower than the national screening rates for cisgender women. Adherence to breast cancer screening in transgender patients is influenced by the lack of consensus and specificity in current guidelines, absence of gender identity documentation, and access to inclusive care. These findings emphasize the need for more tailored guidelines that consider the unique healthcare needs of transgender individuals.

Public Health and Performance



Characterizing the Gap in CDC Information on Eating Disorders: Prevalence, Risk Factors, and Implications

Authors: Anita Beijer, Lucy Rieger, Brooke Denicola, Frederick Kates, and Pooja Sharma

Background: Eating disorders (EDs) represent a life-threatening public health issue, marked by their association with the highest mortality rates among all mental disorders, affecting approximately 9% of the U.S. population. Given the prevalence of EDs, associated risk factors, and implications for health disparities, it is imperative to comprehend the underlying physiological and developmental factors involved. This understanding is vital for formulating effective intervention and prevention strategies within a public health context. Despite recent increases in the prevalence of EDs and their profound impact on physical and mental health, there exists a lack of information and research data within federal public health websites and articles utilizing their secondary datasets.

Methods: This study employs a systematic review of the existing ED literature, along with content analysis of available resources. This review aims to identify prevailing information gaps and assess the influence of changes in E survey questions. The study encompasses qualitative and quantitative data, examining the repercussions of the removal of ED questionnaires from the CDC's Youth Risk Behavior Survey (YRBS) since 2015 on researchers' capacity to monitor trends and patterns in ED behaviors.

Results: The study illuminates a deficiency in the available data from the Centers for Disease Control and Prevention (CDC) and explores the reasons behind this information gap. A timeline visualization tool was employed to depict this gap.

Discussion/Conclusion: This systematic review suggests a need for more comprehensive approaches to ED health to enable greater access to support, educational materials, and resources. The lack of current data from the CDC poses pressing concerns for ED researchers. Further investigation is required to gauge the extent of this existing information gap and to probe the possible rationales for this deficit. This study aims to advance knowledge about EDs, with a view to improving ED management and intervention strategies among the population.

A Correlative Study Between Maternal Healthcare Deserts and Infant Mortality Rates

Authors: Kamalika Kummathi, Lauren Vonhof, Matthew Richard, Frederick Kates,

Maternal healthcare deserts represent a disparity in access to healthcare between rural and urban areas. There are significant gaps in access to prenatal and postnatal care, leading to adverse health outcomes to both mothers and their infants. In addition, the lack of healthcare infrastructure, including the absence of primary obstetric care facilities and maternal health providers, is a prominent feature amongst all maternity deserts. Geographic factors, such as transportation barriers and distance to healthcare facilities, consistently emerge as barriers to care.

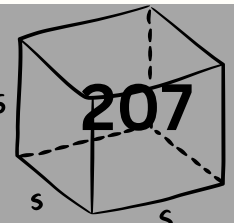
This study will shed light on how access to maternal healthcare will affect infant mortality by counties in Florida. The majority of studies on this topic have made generalizations about the US or comparisons between states, we will specifically focus on trends in Florida and make comparisons by county. We will use data from the CDC and the Maternity Care Deserts Report to base our findings

From our data review we have concluded which hotspots should truly be considered maternal care deserts with high infant mortality rates. After identifying these hotspots, we can then make recommendations, implement interventions and focus attention on improving access to maternal care in these areas. This allows for significant benefits, ultimately resulting in healthier mothers and infants and a more equitable healthcare system.

To address the challenges these "hotspots" face, potential strategies include telemedicine visits, educational initiatives, and government grants towards development of health infrastructure.

In conclusion, our study has shed light on the critical issue of maternal healthcare deserts and their impact on infant mortality rates in rural and underserved areas of Florida. We have highlighted the persistent disparities in access to maternal healthcare and the adverse health outcomes for both mothers and infants in these regions.

Public Health and Health Professions



An Examination of the Socioeconomic Factors Influencing the Incidence of Type 2 Diabetes Across Arizona-New Mexico State Lines

Authors: Grace E. Carreno, Brenda J. Lee, Kiley A. Vanness, and Frederick R. Kates

The rising prevalence of Type 2 Diabetes in individuals with low socioeconomic status has continued to grow in recent years and the dominant explanation for the issue of Type 2 Diabetes is due to low socioeconomic status. Beyond socioeconomic factors, food deserts, defined as low-income areas lacking adequate access to grocery stores and supermarkets, may also contribute to the increased incidence of Type 2 Diabetes. In utilizing data from the CDC, we were able to observe where the largest percentages of diabetes prevalence occurs throughout the U.S. and compare the data with the USDA Food Access Research Atlas, a food desert locator, to determine possible correlations. Identifying a “hotspot” for Type 2 Diabetes in the counties along the northern Arizona-New Mexico state line, we further explored additional factors including geography, population demographics, income, and policy that may be contributing to the high rate of the chronic disease focused in this particular area. Our findings indicate that low-income areas are more susceptible to food deserts which lead to a higher prevalence of Type 2 Diabetes within the area. The aforementioned factors may also play a role as these communities are rural, primarily low-income populations with high levels of food and water insecurity despite high agricultural product exports. Along with low socioeconomic status and food deserts, other risk factors for this issue include the following: being over the age of 45, having prediabetes, non-white ethnicity such as Latino or Asian American, and not being physically active. There are a multitude of things one can do to prevent Type 2 Diabetes, including: regular exercise, weight management, increased nutrition, oral medication, and injectable agents; however, as this is a huge issue for individuals in low-income areas, further research and intervention is necessary in food deserts, especially those with additional existing risk factors.

A Web Server for Integrating and Predicting Functional Variants by Massively Parallel Reporter Assay

Authors: Javlon Nizomov, Li Chen

Gaining a better understanding of the functional implications of single-nucleotide polymorphisms in the human genome can inspire significant advancements in healthcare applications such as precision medicine. Massively-parallel reporter assays provide an avenue for learning more about the functional impacts of different DNA sequences by measuring the effect of thousands of sequences at once. Here, we present MRPAVarDB, an online web server for searching existing SNP data linked to certain diseases and analyzing user-uploaded DNA data for functional prediction based on pre-trained machine learning models. Our server aims to integrate MPRA data across multiple studies and allow researchers to upload a variety of genomic file types, such as FASTA and BED, for predictive analysis. This can help accelerate the research process and allow for quicker identification of functionally relevant genetic variants, thereby serving as an important tool for researchers for identifying functionally relevant DNA variants.

Longitudinally tracking sleep using wearable devices – to examine its impact on balance and well-being – a case series study

Authors: Mahek Chandna, Hongwu Wang

Long-term sleep tracking using wearable technologies has not been extensively studied, specifically how different technology results compared to the Gold Standard of Sleep Diary.

This case study compares three popular wearable devices, the Fitbit Charge 5, Apple Watch Series 2 and the OURA ring, to the National Sleep Foundation Sleep Diary on longitudinally tracking sleep within 3 continuous months. The objective being to see which devices compares best with Sleep Diary. We are using a 2-week statistical analysis average to observe significant differences, specifically Time in Bed (TIB) results.

One undergraduate and one graduate student wear two of the devices daily and throughout their normal activity. From 09/17-10/17, our ANOVA test for sleep duration of Fitbit, OURA and the Sleep Diary come to a Pr(>F) of 0.0767 which is quite close to 0.05 yet quite different from our other ANOVA test between time in bed for Fitbit and OURA and the Sleep Diary – resulting in Pr(>F) as 0.949 which was close to 1. This serves as an intriguing variance, with one being aligned with both the devices and diary whereas the other opposes.

While the duration is still ongoing, we have been able to constantly create new patterns. One being modifying inconsistency with data in the first few months, whether due to syncing issues (not daily) or inconsistent wearing. Weekly assessments on functional mobility and well-being are collected using the Mini-BESTest and Mental Health Continuum Short Form, respectively. We also have a second objective aiming to compare the 3 devices (sleeping) amongst a monthly balance assessment, to see how functional mobility plays a role in longitudinal sleep. These findings will help us better understand how feasible/reliable wearable devices work for long-term sleep tracking and provide variance of response for mobility and well-being measures to conduct power analyses for future studies.

Food Insecurity and Availability: A Correlational Study of Rural and Urban Communities in Florida

Authors: Sarah McCartney, Charles Ellis

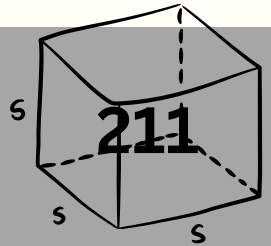
Background:
Although research has been conducted discussing the prevalence of food insecurity nationally, studies have yet to examine the difference between rural and urban counties in Florida. Florida's distinct and different areas allow for the correlational study between various groups that can be applied to the greater United States. The objective of this study was to examine rural-urban differences in food insecurity and availability among Florida counties.

Data for this project were obtained from Robert Wood Johnson (RWJ) County Rankings related to county level rates related to food insecurity and accessibility among individuals living in Florida. Key outcome variables were the percentage of food insecurity, percentage of limited access to healthy foods, and percentage of children eligible for free and reduced lunch. Comparisons were made between rural vs urban counties as defined by the Florida public health system using a correlational analysis.

Results:
State level data indicated that rural counties have more food insecurity than urban counties in Florida. These findings further indicate that the type of community in Florida affects one's access to healthy food and the likelihood of utilizing the free and reduced lunch program.

Conclusion:
The data highlights that rural counties have more food insecurity than urban counties in Florida. This study revealed that the type of community in Florida affects one's access to healthy food and a greater likelihood of utilizing the free and reduced lunch program. The difference in results between the two categories may be due to various factors, including grocery stores, average socio-economic status in the communities, and residential segregation.

Public Health and Health Professions

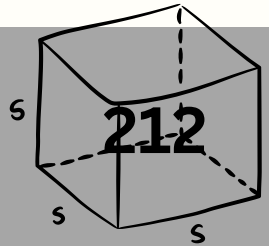


Improving Mental Health in Undergraduate College Students

Authors: Christine Innes, Ansley Williams, Alexa Roth

The state of college student's mental health has been a larger focus as of late, as the prevalence of mental health illness in college students has been on the rise. In recent years, colleges have been reporting an overall rise of mental health difficulties in college students by 85% from 2015 to 2017. By conducting a literature review of the subject, we identify possible stressors that can contribute to mental health issues as well as provide suggestions on how to combat them. The data and literature included in this review have been sourced from 18 peer-reviewed articles from established scientific journals. Through our review, we can conclude that mental health is a prominent public health crisis among undergraduate college students due to the academic, social, and financial stressors that college presents. Some ways to reduce the impact of the various stressors include expansion and development programs designed for lower-income students to address poverty and food insecurity, accessible support groups, and mentorship programs. Through the implementation of these programs and suggestions made, the hope is to see a reduction in reported mental health issues in college students as well as a rise in the management of existing mental health issues in the population.

Public Health and Health Professions



The Effects of Parental Language Input and Parental Knowledge of Child Development on Child Language Development

Authors: Kylie Fernandez, Susan Nittrouer

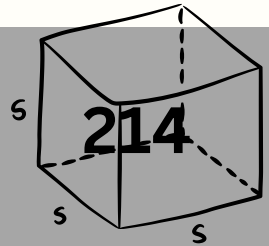
Past experiments have demonstrated that the amount and kind of parental language input affects language development, and poverty-related delays in language development have been attributed to poor parental language input. Concern has been raised, however, that parental language input may simply reflect broader parental competencies, largely related to how knowledgeable parents are about child development and how to support it optimally. This ongoing study addresses this possible confound by examining how parental language input is mediated by parental knowledge of child development. Twenty parent-child dyads across various SES will be tested over the course of this study using 5 measures. The parent and child will be recorded playing with Tinkertoys together and parental language behaviors will be scored to measure (1) parental language input. The child will complete two tasks measuring (2) vocabulary knowledge and (3) auditory comprehension of language. The parent will complete two surveys measuring (4) general knowledge of child development and (5) knowledge of best practices to use in parenting scenarios. Statistical analyses will involve: (1) computing zero-order correlation coefficients between each of parental language input and parental knowledge of child development on one hand and child language outcomes on the other; (2) computing partial correlation coefficients to assess the extent to which parental language input explains unique variability after controlling for parental knowledge of child development; and (3) comparing the ability of two different measures of parental knowledge of child development to explain variability in parental language input and child language outcomes..

Communication Issues Among Children Born During the COVID-19 Pandemic: A Scoping Review

Authors: Macy Monsour, Charles Ellis, PhD

The COVID-19 pandemic resulted in significant death, morbidity, and reduced quality of life for many US citizens. The focus of COVID-19 has primarily emphasized adult conditions as children were less likely to be negatively impacted by the disease. The literature has shown that even in the absence of having COVID-19 children born during the pandemic are displaying delays in cognitive, motor, and sensory development. The purpose of this project was to explore the literature related to communication delays (speech, language, cognitive) among children born and/or developing during the pandemic. Methods: a scoping review of the literature was completed to explore reports related to communication issues (speech, language, cognitive) among children born during the pandemic. Results: A significant number of studies have been published post-pandemic exploring communication issues among children born during the pandemic. Key observations include: Babies born during the pandemic exhibited less pre-speech behaviors (cooing, babbling, etc), less communicative behaviors and less word production. Preschool children exhibited reduced verbal language skills. Teachers also report that preschoolers demonstrated less social communication while communicating with peers. Conclusions – Children born or developing during the pandemic exhibit significant delays in speech, language and social communication when compared to counterparts who were not born during the pandemic. The underlying causes of such delays appear related to reduced social interaction with their families and the community due to fears of contracting COVID and strategies used to limit the spread of the virus. Future research must emphasize strategies to reduce the long-term effects of early developmental delays.

Public Health and Health Professions

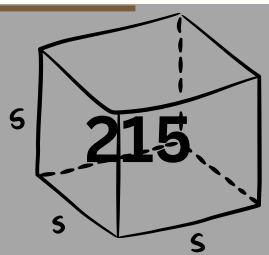


Assessing temporal association of asthma prevalence and hurricanes in Puerto Rico over a decade

Authors: Sofia Gonzalez, Rick Kates

Asthma is among the most prevalent respiratory conditions globally (WHO 2019). Environmentally linked airborne pollutants, including dust from the Sahara Desert and mold from hurricane-induced flooding, are believed to significantly influence its incidence. Puerto Rico exhibits the highest childhood asthma prevalence, making the link between air quality and asthma an escalating public health issue on the island. Maintaining good air quality is essential for optimal respiratory health. We sourced data from the CDC, spanning 10 years, on asthma incidence in Puerto Rico, and from NOAA on hurricane metrics (dates, wind speed, and pressure). Descriptive statistics were utilized to study asthma incidence and its potential correlation with hurricanes. A noticeable correlation was observed between asthma incidence and hurricane presence, with peak average wind speeds coinciding with the highest asthma prevalence in Puerto Rico. Conversely, between 2013 to 2016, the asthma rates for both the U.S. and Puerto Rico had declining asthma prevalence, during which there were no hurricanes affecting those areas during that time period. Hurricanes may increase asthma incidents owing to potential factors like mold growth in flooded zones, airborne allergens from upturned debris and dust, and challenges in healthcare and medication access post-storm. Additionally, the mental stress from hurricanes can trigger asthma symptoms, gas caused by the storm may introduce new allergens into the environment, increasing the risk for asthma exacerbations among vulnerable individuals.

Public Health and Health Professions

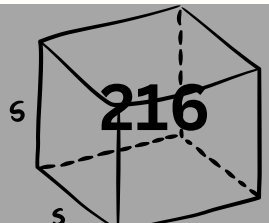


Assessing the Impact of Socio-Economic Status on Utilization of Dental Services during COVID-19 in North Central Florida

Authors: Ryan Jin, Benjamin Anderson

Due to COVID-19, there was a global reduction in healthcare utilization, which will impact health, cost, and equity. Dental care is an important part of overall health with studies showing poor oral health increases the risk of systemic conditions, such as coronary heart disease. Dental offices were considered high risk transmission routes of COVID-19, and in Florida were only open for emergency dental services from March 2020 until May 2020. Prior to the COVID-19 pandemic, socioeconomic status (SES) was shown to be associated with the utilization of dental services. Our study analyzed how COVID-19 may have impacted the utilization of dental services. We interviewed 36 participants at the ACORN clinic, a dental clinic with primarily low-income individuals. Through our questionnaire, we looked at perceptions related to barriers of dental services and compared to demographic variables, related to socioeconomic status. Through our study, we found that participants felt that cost of treatment, wait times for dental services, and transportation costs have increased as barriers following the COVID-19 pandemic.

Public Health and Health Professions



Does Phonological Memory Predict Sight Word Reading and Decoding?

Authors: Bailey Fawcett, Laurie Gauger

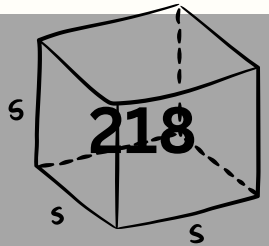
Phonological memory (PM) is thought to be involved in learning sight words and therefore is included in many reading assessment protocols. We compared the performance of young struggling readers between the ages of 7 – 12 years on two single word reading tasks of PM, memory for digits and nonword repetition, to their performance on sight word reading and decoding tasks. The Memory for Digits and Nonword Repetition subtests of the Comprehensive Test of Phonological Processing-2 were administered to measure PM. The Test of Word Reading Efficiency-2 was used to measure sight word reading and decoding. Scaled scores from all tests were used to complete Pearson correlation coefficients. Neither digit span nor nonword repetition were significantly related to sight word reading and decoding in a sample of 242 children. Regardless of the children's ages, neither PM task was related to either single word reading task indicating that age did not appear to be a factor. If PM affects the rate that individuals learn new sight words as researchers suggest, then it is unclear why we did not find any association between PM and single word reading skills. These results challenge the conventional understanding of the role of PM in reading acquisition for typically developing children and those with reading disorders, emphasizing the need for a reevaluation of current assessment methodologies. In addition, examination of the relationship between PM performance and children's responses to reading intervention may shed some light on PM's role in reading acquisition. Implications for our findings are presented.

Project B.L.A.C.K. Inclusiveness and Engagement with Cultural Diversity Among Black UF Students

Authors: Trish Parkinson, Molly Jacobs, PhD, Charles Ellis, PhD

Nationally, minoritized students, particularly Black students, attending predominately White universities (PWI) have reported challenges in the college experience that extend well beyond the academic process. Black students reported high levels of isolation, exclusion, and overall poor college experiences despite attempts to improve and integrate diversity, equity, inclusion, and access (DEIA) into the fabric of daily life. Black students at the University of Florida (UF) reported similar experiences despite UF being the flagship university in Florida and an acknowledged leader in DEI initiatives. This study examined Black students' perspectives of inclusiveness and engagement with cultural diversity. Methods: Data for this study were obtained from 163 undergraduate and graduate students enrolled at UF who completed the National Survey of Student Experience Inclusiveness and Engagement with Cultural Diversity Topical Module. Students were asked "How much does your institution emphasize the following?" Results: 38% of respondents reported UF had a commitment to diversity, 41% reported receiving resources needed for success in a multicultural world, 42% felt an overall sense of community among students, 41% were ensured that they were not stigmatized because of their identity, 33% believed there were antidiscrimination and harassment policies available, 31% believed allegations of discrimination or harassment were taken seriously, and 18% believed the University helped students develop the skills to confront discrimination and harassment. Conclusions: Despite nationwide changes to improve the experience of Black students at PWI, less than 50% of survey students reported the institution emphasized inclusiveness and engagement. These findings suggest greater emphasis must be placed on novel strategies to improve the Black student experience at UF.

Public Health and Health Professions



Examining the Relationship between the Social Determinants of Health and High Rates of Uncontrolled Asthma Afflicting Minority Children Residing in New York

Authors: Tyler Favier, Amba Ganesh, Viswa Naik, Pooja Sharma, Frederick Kates

Background: Uncontrolled asthma among minority youth represents a pressing public health challenge in New York, where the state witnessed the highest prevalence of uncontrolled asthma rates in the United States between 2018 and 2020, affecting 62.1% of children. Furthermore, it is evident that minority youth are disproportionately affected, reporting higher rates of uncontrolled asthma when compared to their white counterparts. This research project aims to investigate the social determinants of health that underlie this alarming asthma disparity among minority youth in New York. Methods: We leveraged data from the Centers for Disease Control and Prevention (CDC) about Uncontrolled Asthma in Children from 2018 to 2020. In addition to analyzing this quantitative analysis, we conducted a concise literature review encompassing relevant research articles to explore potential explanations and solutions for this health disparity. Results: This dataset reaffirmed the high prevalence of uncontrolled asthma in New York and underscored the national trend of elevated rates among minority youth groups. The literature review yielded various factors that may contribute to the increased rates of uncontrolled asthma in New York. Among these factors are air pollution, disparities in housing, and limited access to healthcare services. Discussion: These factors suggest a complex interplay of social determinants that warrant further investigation and intervention. One promising solution identified in this project is expanding community-based participatory research (CBPR). Our literature review revealed a successful CBPR study conducted in Michigan that improved asthma-related health in youth populations. This CBPR study could serve as a framework for future studies implemented in New York. Utilizing this approach could help identify and address specific barriers experienced by minority populations, thereby contributing to the development of targeted interventions to reduce asthma disparities in New York..

Reported Frequency Rates of Physical Distress and Mental Distress by Median Incomes of Florida Counties during the COVID-19 Pandemic

Authors: Hannah McCartney, Charles Ellis, Jr., Ph.D., CCC-SLP

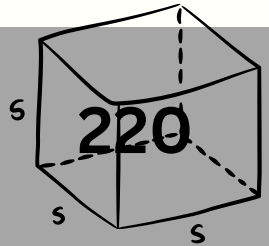
Background:
Studies indicate that financial strain negatively influences individual health outcomes and overall quality of life. Present or perceived concerns about financial security are reported to be connected to higher levels of psychological distress. Psychological distress is more often experienced by individuals from the lowest income backgrounds. The COVID-19 pandemic accelerated these conditions, as labor market responses such as substantial job loss occurred. The objective of this project was to examine physical and mental distress among Florida counties during the COVID-19 pandemic.

Data for this project were obtained from Robert Wood Johnson (RWJ) County Rankings related to county level rates of physical distress and mental distress. Linear regression models were used to evaluate the association between reported frequency of physical and mental distress and median household income among Florida counties.

Results:
A statistically significant strong negative correlation between the percentage frequency of physical and mental distress and the median household income among Floridians during the pandemic. More specifically, as the median income of a Florida county decreased, the reported frequency of physical and mental distress increased.

Conclusion:
This data reveals that there is a strong relationship between the average household income of Florida counties and the quality of life of its occupants using measure indicators for percentage frequency of physical distress and percentage frequency of mental distress. Both indicators reveal that as the average household income decreases, the quality of life decreased during the COVID-19 pandemic.

Public Health and Health Professions



Breaking language barriers: solving the shortage of interpreters in Hispanic agricultural communities.

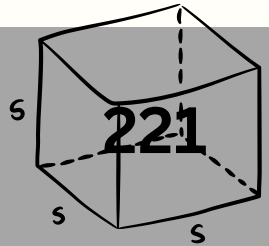
Authors: Rebekka Perinne, Alejandro Ramirez, Dr. Sharon DiFino

---

Over half of the agricultural workers in the United States are Hispanic immigrants (Isaacs 2020). They live and work in rural areas and often lack the time and resources to learn English. A major communication barrier is created between the Spanish-speaking workers and their English-speaking supervisors. Limited English Proficiency (LEP) farmers are left reliant on interpreters in healthcare settings (Clarridge 2008). In health-related emergencies, the shortage of interpreters poses a challenge for Spanish-speaking farmers seeking care for their injuries or other health problems in the first place or from receiving proper, timely care (Ramirez 2008). While the differences may not initially seem significant, a misunderstanding between a patient and a provider can create a costly delay in proper care (Nunez-Mendez 2022).

This research will investigate the linguistic and cultural differences in health communication between Mexican, Cuban, and Spaniard Spanish to address health disparities. The goal is to investigate the problem through a traditional literature review and to propose possible solutions for further directions.

Public Health and Health Professions



Generalization of inter-articulator timing control: evidence from tongue-jaw and lip-jaw kinematics using electromagnetic articulography

Authors: Kara Kent, Ana Rodriguez, Hannah Thomas, Rosalie Gendron, Matthew Masapollo, and Susan Nittrouer

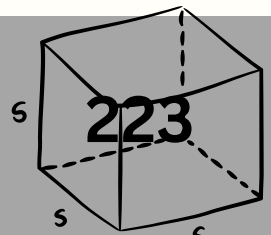
Recent research in speech production indicates that talkers rigidly control the relative timing of articulator movements across variation in production rate, syllable stress, and segmental makeup, and that this precision of inter-articulator timing control precisely specifies phonetic structure. To date, these timing relations have proven highly reliable for tongue-jaw kinematics. In the present study, we address the generality of these timing relations to lip-jaw kinematics. Eleven talkers recorded 240 /tV#Cat/ and 240 /bV#Cab/ utterances using electromagnetic articulography, with alternative V (/ɑ/-/ɛ/) and C (/t/-/d/), across changes in production rate (fast-normal) and stress (first syllable stressed-unstressed). To quantify inter-articulator temporal coordination, the timing of either tongue-tip or lower-lip raising onset for the intervocalic C, relative to the jaw opening-closing cycle for V, was obtained. Preliminary results (N=5) indicate that the same kinematic pattern occured in both types of utterances: any manipulation that shortened the jaw opening-closing cycle reduced the latency of either the tongue-tip or the lower-lip movement onset, relative to the onset of jaw opening. Furthermore, these timing relations were found to be differentiated by utterance type across both sets of supralaryngeal speech articulators, suggesting that timing relations between the tongue-tip and jaw may generalize to the lower-lip and jaw.

Prevalence of Stroke among Individuals with Communication and Swallowing Disorders by Income

Authors: Alanna Gmuer, Molly Jacobs, PhD, Charles Ellis, PhD

Communication and swallowing disorders frequently occur after chronic disease conditions such as stroke. Many individuals from low socioeconomic backgrounds are negatively impacted by lack of access to quality care to treat and manage these conditions. The impact of socioeconomic background on communication and swallowing disorders is poorly understood. Data for this project were obtained from the 2022 from the National Interview Survey (NHIS). NHIS collects information on a broad range of health topics including health status and health care access. Among the 27,651 respondents in the 2022 survey, 3,314 (12.2%) reported voice problems; 1,719 (6.2%) reported swallowing difficulties; 1,154 (4.8%) reported speech problems; and 613 (2.4%) reported language problems. The prevalence of stroke was assessed among respondents with voice, swallowing, speech, and language problems by income range. Income ranges were derived from reported income-to-poverty ratios (IPR) based on the sample distributions. Prevalence of stroke was compared between respondents with and without communication-related difficulties by income group. All analyses accounted for the geographic stratification of NHIS respondents and clustering at the demographic and household levels. All estimated were weighted to reflect a nationally representative population. Low-income individuals with communication and swallowing disorders after stroke experienced higher rates than those with higher incomes. These findings suggest that income mediates/moderates the outcomes of communication and swallowing disorders in individuals who experienced a stroke. Having low-income cane have a negative impact after stroke and in particular the recovery process. Lower income can limit access of care immediately after initial symptoms and over the longer term.

Public Health and Health Professions

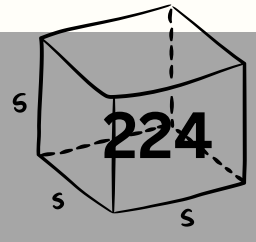


Understanding Code Switching in Heritage Speakers of Portuguese

Authors: Charlotte Maloney, Alejandro Ramirez, Dr. Sharon DiFino, PhD, CCC-SLP

The United States has the largest population of Brazilian immigrants compared to any other nation, and this number has been steadily rising over the past decade. (Guarino, 2023) Along with their food and culture, Brazilian immigrants have brought their language to North America, creating a population of young Portuguese Heritage Speakers (PHS). PHS are born to at least one Portuguese speaking caregiver, are bilingual, and receive the majority of their education in English. As with all heritage speakers, they are unique because they normally learn Portuguese as a first language, yet slowly transition to English as their dominant language overtime. This impacts their language use in a unique way that differs from bilingual or second-language acquisition populations. In particular, PHS unique understanding of both their native and dominant cultures and languages provides them with competency in both English and Portuguese. (Flores, 2015) While communicating in different environments, PHS commonly code switch, where “words from two languages are used within a single discourse” (Yow et al., 2017) Though research indicates code switching within populations of heritage speakers is informed by this proficiency of both languages, there is a gap in research regarding how and why Heritage Speakers code switch. (Flores, 2015) The purpose of this research poster is to examine the prevalence of code switching in PHS populations in the United States and under what circumstances it occurs. Further directions will include a survey for PHS on code switching tendencies.

Public Health and Health Professions

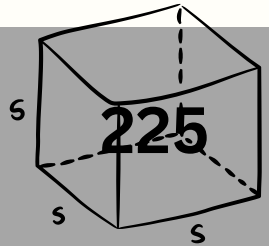


The Influence of Warning Label Language on Vaping/Smoking

Authors: Jonathan Brito, Laurynn McGee, Trish-Ann Parkinson

The use of smoking products has been a popular activity for a few centuries, and it continues to develop and maintain its prevalence in societies today. Different countries and cultures have different approaches to implementing forewarning language on the health risks for utilizing these products. Data withdrawn from The Behavioral Risk Factor Surveillance System (BRFSS) indicating alarming numbers that may show patterns of e-cigarette usage in different cultures, which may allude to differences in warning language use on e-cigarette packages and products. Initial observations prove that adults of Puerto Rican and Cuban descent are the leaders in electronic nicotine delivery system (ENDS) usage (AJMC, 2023). Factors such as warning label language can play a key role in the informed use of the product and negative health outcomes, including stroke, head and neck cancer, poor cardiovascular function, and cognitive decline. The purpose of this poster is to determine which demographic has the largest ENDS usage and analyze the impact of the warning language across cultures and its correlation to negative health outcomes.

Public Health and Health Professions



Project B.L.A.C.K.: Civic Engagement Among Black UF Students

Authors: Laurynn McGee, Molly Jacobs, PhD, Charles Ellis, PhD

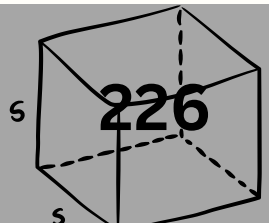
Background: Black students enrolled at predominately White universities (PWI) traditionally represented a small portion of the study body. As a result, Black students have felt isolated or excluded from the traditional educational experience. However, to date little effort has been given to understanding the college experience from the minoritized student perspective making it challenging to devise specific approaches are needed to ensure greater inclusion among Black students. The objective of this study was to examine Civic Engagement opportunities among Black UF students.

Methods: Data for this study were obtained from 163 graduate and undergraduate students currently enrolled at the University of Florida (UF) who completed the National Survey of Student Experience Civic Engagement Topical Module. Students were asked “How much does your institution emphasize the following?”

Results: 23% of respondents reported an emphasis on 1) discussing important social, economic, or political issues with others, 2) 28% organizing activities focused on important social, economic, or political issues, 3) 36% being an informed and active citizen, 4) 35% being involved in an organization or group focused on important social, economic, or political issues, 5) 58% voting in campus, local, state, or national elections, and 6) 52% encouraging free speech and expression.

Conclusions: A low percentage of UF Black students reported a focus on civic engagement. Increased civic engagement may be important to improving the Black student experience at UF.

Public Health and Health Professions



Mapping Working Memory Brain Circuits in Older Adults: Evidence from fMRI

Authors: Callie E. Alexiadis, Young Seon Shin, Yenisel Cruz-Almeida, & Stephen A. Coombes

Working memory (WM) refers to the ability to store and manipulate information over a short period of time. An increase in age leads to performance deficits in tasks that require WM. Studies utilizing the n-back task, a test used to assess WM, have found age-related changes in brain activation in old adults. The primary goal of this preliminary study is to determine whether we can implement n-back tasks during functional MRI (fMRI) and ultimately replicate previous findings in the literature that recognize behavioral performance and brain activation differences in 1-back and 2-back tasks. Seven older subjects (mean age – 71.9 years) each completed the n-back tasks during the fMRI. In line with previous studies, we found that accuracy was higher in the 1-back compared to the 2-back task. During both n-back tasks, activation was found across subjects bilaterally in the dorsolateral prefrontal cortex (DLPFC), insula, anterior cingulate cortex, and inferior parietal areas. Increased activation was found during the 2-back compared to the 1-back in the right DLPFC, the right intraparietal cortex, and the right anterior cingulate cortex. Subjects also had faster reaction times for 1-back. These findings support the evidence that aging causes a decline in accuracy and an increase in reaction time during performance on tasks requiring increased cognitive load, specifically the 2-back. Stronger BOLD signals during the 2-back tasks in brain areas associated with working memory suggest that higher loads require increased activation with advanced age.

Patient Perspectives on Brief Videos About Health Misinformation

Authors: Chrishann Walcott; Hannah A. Lavoie, MS; Megan A. McVay, PhD; Francesca Wilkins, MS; Danielle E. Jake-Schoffman, PhD

Given the high prevalence of overweight and obesity among US adults, there is a pressing need for scalable treatments that are low-cost and widely available. Building on the popularity and widespread use of online social communities for general social support and health information, behavioral interventions have begun to incorporate these online communities into weight loss programs. However, preliminary investigations have found there is a pervasiveness of weight-related misinformation in some communities, and research is currently lacking on how to effectively train people to identify and handle health misinformation. Thus, we aimed to develop educational materials to support individuals in navigating misinformation related to weight management online.

As a preliminary step, we developed three brief modules using evidence-based strategies to educate adults about health misinformation and how this might appear on social media. Feedback from target participants was then collected and data collection is ongoing. Eligible participants are 18-75 years old, have overweight or obesity (body mass index ≥25 kg/m2), and indicated an interest in learning strategies to help them manage their weight. Interviews will be conducted via Zoom and transcribed verbatim. The target sample is 5 to 10 adults, and recruitment will conclude once thematic saturation is achieved. Analysis of interview data will follow an emerging themes approach, in which the initial coding of transcripts will seek to reveal overarching themes regarding participants' impressions of the videos and the concept of health misinformation. Results will then be used to refine the video scripts. Final videos will be embedded into educational modules to support adults in handling misinformation during a future randomized weight-loss trial utilizing online social communities to be conducted by our team.

Ketamine Treatment for Depression and Anxiety: Preliminary Comparisons of Patients who are, versus not, Prescribed Complementary at-home Ketamine

Authors: Alexia Obrochta, Shahar Almog, Meredith S. Berry

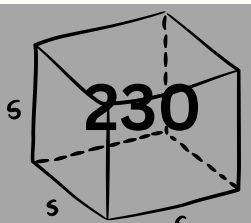
Rates of mental health disorders in the U.S. have risen after the COVID-19 pandemic, creating a mental health crisis. A similar compound to the commonly used anesthetic ketamine has emerged as a rapid antidepressant medication, becoming FDA-approved as an intranasal treatment (Spravato) for depression in 2019; however, off-label use via intravenous (IV) infusions or intramuscular (IM) injections have risen where hundreds of 'ketamine clinics' across the United States offer ketamine via periodic infusions or injections. In order to lengthen the intervals between the ketamine treatments, some patients are prescribed at-home oral compounded ketamine. The FDA recently issued a warning that compounded ketamine has not been ruled safe and effective, which raises concern. The aim of this study is to examine whether compounded at-home ketamine use has an additional benefit, by comparing the self-reported change in depression and anxiety among real-world long-term patients. The preliminary secondary data analysis from a larger ketamine survey, uses two scales; one to measure depression (PHQ-9) and one to measure anxiety (GAD-7) before and after ketamine treatment of patients who are prescribed complementary at-home ketamine in addition to treatment sessions versus patients who are not prescribed at-home ketamine. We included patients who were treated for mental health (with or without pain), and only included those whose main treatment included IV or IM ketamine (n=77). An independent sample t-test showed a significant difference in change scores for the PHQ-9 (p=.034) where patients using complementary at-home ketamine reported greater improvement. Exploratory analyses suggest that while current scores on assessments were not different, the group who were prescribed at-home ketamine oral compounded ketamine reported poorer mental health pre-ketamine. These results may indicate that complementary ketamine may be beneficial for some patients, or might have resulted in part from differences in pre-score measures and/or a bias in the retrospective nature of the assessment.

Utilizing Echocardiography to Evaluate the Effects of Exercise Preconditioning on Doxorubicin Cardiotoxicity

Authors:Ryan Krueger, Vivian Doerr, and Ashley J. Smuder

Doxorubicin (DOX) is a highly potent chemotherapeutic agent used to treat a variety of cancers including breast cancer and leukemia; however, DOX treatment often results in cardiomyopathy. DOX-induced cardiotoxicity primarily results from aberrant reactive oxygen species production, mitochondrial damage, and apoptosis, which limits its clinical application. Unfortunately, there are no definitive therapeutic approaches to prevent DOX-induced cardiotoxicity; however, endurance exercise training results in improved antioxidant capacity and mitochondrial biogenesis. Therefore, to determine if exercise preconditioning is sufficient to prevent DOX-induced cardiotoxicity, female Sprague-Dawley rats underwent two weeks of treadmill running (5 days/week, 60 min/day, 30 m/min, 0% grade). Twenty-four hours after the last bout of exercise, the animals were treated with DOX (20 mg/kg intraperitoneal) or saline. Forty-eight hours following treatment, echocardiography was performed to determine left ventricular (LV) function. Two-dimensional M-mode images were taken at the level of the mitral valve and used to measure fractional shortening (FS% = [(LV inner diameter during diastole (LVIDd) - LV inner diameter during systole (LVIDs))/LVIDd]*100%), posterior wall shortening velocity (PWSV = endocardial excursion time/distance), and wall thickness. In addition, doppler imaging was used to measure time intervals of mitral inflow and LV outflow to calculate myocardial performance index (MPI = (isovolumetric contraction time + isovolumetric relaxation time)/ejection time). Our results revealed that DOX treatment in sedentary rats significantly reduced FS% and PWSV, and significantly increased MPI compared to sedentary rats treated with saline. In contrast, there were no differences between DOX treated exercise trained rats and sedentary rats treated with saline. These findings demonstrate that exercise preconditioning is an effective intervention to prevent DOX-induced cardiac dysfunction.

Health and Human Performance

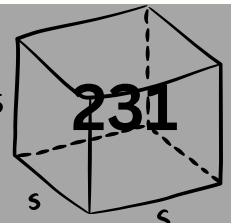


Echocardiogram Analysis of M-Mode and Doppler Imaging for DOX Treated Rats

Authors: David Zhang, Branden Nguyen, Ashley Smuder

Doxorubicin (DOX) is an effective chemotherapy agent used against a broad spectrum of cancers; however, its clinical application is limited by the risk of cardiotoxicity. High-resolution echocardiography is a non-invasive technique that is used clinically to monitor cardiac function in cancer patients. Importantly, it is also a key-dependent measurement used in preclinical studies focused on developing therapeutic countermeasures to combat DOX cardiotoxicity. Echocardiography uses ultrasound to view heart structures and their motion over time. Specifically, M-mode echocardiography is used to view changes in left ventricle size and contractility by measuring fractional shortening percentage (FS%) and posterior wall shortening velocity (PWSV). FS% quantifies the percent change in the left ventricular chamber size during systole compared to diastole, whereas PWSV evaluates the rate of cardiac sarcomere shortening from diastole to systole. Additionally, Doppler echocardiography utilizes a four-chamber view to evaluate blood flow through the mitral valve to measure the myocardial performance index (MPI). MPI encompasses both systolic and diastolic phases of the cardiac cycle and is calculated by summing the isovolumetric contraction time (IVCT) and isovolumetric relaxation time (IVRT) and dividing this sum by the ejection time (ET). In this pilot project, I evaluated M-mode and Doppler ultrasound images to determine the efficacy of ABCB8 overexpression in preventing cardiac dysfunction resulting from acute DOX exposure in rats (n=4/group). My analysis of M-mode and Doppler images from these rats showed no differences in any measured cardiac parameter between saline and DOX-treated rats overexpressing ABCB8. These results justify the need for a large-scale study to further understand the cardioprotective effects of ABCB8.

Health and Human Performance



Utilizing Echocardiography to Evaluate the Effects of Exercise Preconditioning on Doxorubicin Cardiotoxicity

Authors: Ryan Krueger, Vivian Doerr, and Ashley J. Smuder

Doxorubicin (DOX) is a highly potent chemotherapeutic agent used to treat a variety of cancers including breast cancer and leukemia; however, DOX treatment often results in cardiomyopathy. DOX-induced cardiotoxicity primarily results from aberrant reactive oxygen species production, mitochondrial damage, and apoptosis, which limits its clinical application. Unfortunately, there are no definitive therapeutic approaches to prevent DOX-induced cardiotoxicity; however, endurance exercise training results in improved antioxidant capacity and mitochondrial biogenesis. Therefore, to determine if exercise preconditioning is sufficient to prevent DOX-induced cardiotoxicity, female Sprague-Dawley rats underwent two weeks of treadmill running (5 days/week, 60 min/day, 30 m/min, 0% grade). Twenty-four hours after the last bout of exercise, the animals were treated with DOX (20 mg/kg intraperitoneal) or saline. Forty-eight hours following treatment, echocardiography was performed to determine left ventricular (LV) function. Two-dimensional M-mode images were taken at the level of the mitral valve and used to measure fractional shortening (FS% = [(LV inner diameter during diastole (LVIDd) - LV inner diameter during systole (LVIDs))/LVIDd]*100%), posterior wall shortening velocity (PWSV = endocardial excursion time/distance), and wall thickness. In addition, doppler imaging was used to measure time intervals of mitral inflow and LV outflow to calculate myocardial performance index (MPI = (isovolumetric contraction time + isovolumetric relaxation time)/ejection time). Our results revealed that DOX treatment in sedentary rats significantly reduced FS% and PWSV, and significantly increased MPI compared to sedentary rats treated with saline. In contrast, there were no differences between DOX treated exercise trained rats and sedentary rats treated with saline. These findings demonstrate that exercise preconditioning is an effective intervention to prevent DOX-induced cardiac dysfunction.

Health Access Research: Using a Machine Learning Model to Evaluate the Risk Factors associated with Fentanyl Overdoses in Florida

Authors: Sia Rajput, Hunor Vajda, Alaguvalliappan Thiagarajan, Abelardo D. Montalvo, Aubrey Townsend, Julio Rodriguez, Delores James

The opioid epidemic has become a national health challenge with a staggering 80,411 reported overdose deaths in 2021. Despite the excessive number of opioid deaths in Florida, the opioid reversal agent Narcan has been readily available as a lifesaving agent to restore respiratory depression. However, opioid overdose, specifically overdose on the highly potent opioid fentanyl, continues to be a burden due to illicit fentanyl abuse with many critical factors still unknown.

This interdisciplinary research project seeks to uncover the intricate relationships between provoking and palliative factors contributing to reported fentanyl overdoses across the state of Florida using machine learning models, random forests, and gradient boosting models to identify areas at high risk of fentanyl overdoses. Our cohort will consist of two groups: people who die from fentanyl overdose vs. people who survive.

We'll use linear and logistic regression coefficients to get a baseline of the importance of the predictors in determining fentanyl overdoses. After determining what specific factors are associated with high rates of fentanyl overdose deaths, we'll create a heatmap indicating what regions are at high risk as well as the features that could be improved to reduce the risk in particular regions.

Some key factors that we'll be analyzing are police presence, access to harm reduction sites, demographics, income levels, traffic and road accessibility, and the quality of healthcare services, specifically emergency medical services (EMS), emergency departments (ED), and intensive care unit (ICU) locations. We expect to find factors responsible for fentanyl overdose deaths across Florida and identify high risk areas to permit accessibility and alleviate factors associated with fentanyl overdoses to mitigate the opioid crisis. While our work is aimed at Florida, our work can serve as a potential generalizable model at the national level provided that reliable data is available.

The Seroprevalence of Babesiosis in Florida Shelter Dogs

Authors: Saachi Sharma, Sai Lata De, Alaina Keith, and Rhoel Dinglasan

Babesiosis is a tick-borne disease caused by the protozoal parasite named Babesia. Deer ticks are vectors for babesiosis- once infected by the parasite, anything they bite is prone to developing the condition. Transmission of Babesia gibsoni is particularly high in canine shelters due to the poor conditions and neglect. Dogs are often exposed to infected blood from others during dog fights. It is important to understand the pervasiveness of babesiosis in Florida shelter dogs because humans' proximity to canines could lead to growing human babesiosis cases.

The main objective of this project is to study the seroprevalence of babesiosis in shelter dogs. Identifying specific antibodies against the Babesia gibsoni antigen will indicate whether the host has an active infection or has had prior exposure. We will also be evaluating whether factors such as breed and site are associated with higher risk of exposure.

After conducting indirect ELISAs on samples from Miami-Dade, Hillsborough, Levy, Gilchrist, and Alachua County, we found a statistically significant difference between Hillsborough and Miami-Dade as well as Hillsborough and Levy. After looking at Ixodes scapularis distributions, there seems to be an association between tick endemic regions (North Florida) and increased risk of exposure. Additionally, we found that breed type is not a significant determinant of increased risk of exposure to babesiosis. This contradicts the previous notion that pit bull type breeds are more susceptible to infections. In the future, we hope to conduct PCR analysis on all samples to confirm host infection.

Planes on a Snake? The Evolution of Grasping Behaviour in Grapsoid Crabs

Authors: Robert Lasley Jr, Joseph B. Pfaller, Soma Elefánti, and Gustav Paulay

Epibiosis is a widespread phenomenon in the oceans. One of the most incredible epibiont communities form on the carapace of pelagic sea turtles. A wide range of sessile, sedentary and motile taxa has been reported to become epibionts of sea turtles. Among these the grapsid crabs of the genus Planes are particularly interesting. Usually inhabiting marine flotsam but found in large numbers in association with several sea turtle species, these crabs are known to change their behaviour when living on sea turtles. This suggests an association that has existed for a longer period during their natural history. A recent study found a large number of brachyuran megalopae epibiontic on the only exclusively pelagic sea snake Hydrophis platurus. They were only identified to belong to the family Grapsidae. Using COI and 16S genes we have identified them as Grapsus grapsus, Pachygrapsus socius, and Goniopsis pulchra. We then identified all thoracotremate crabs known from the area and found that only grapsoid crabs showed significant epibiosis on marine reptiles. Therefore, we suggest that this association – that eventually led to the complex epibiosis of Planes sp. on sea turtles – has only emerged in one lineage of the Thoracotremata.

Projected distributional shifts due to climate change for Rhexia (Melastomataceae

Authors: Jonathan Barz, Lyanna DeLeon, Karina Mendez, Michelle L. Gaynor, Makenzie E. Mabry, Pamela S. Soltis, & Douglas E. Soltis

The genus Rhexia (Melastomataceae), commonly known as the Meadow Beauty, is exclusively North American with a majority concentration of species in the southeastern part of the coastal plain in the United States. Rhexia plants are of poorly drained, acidic, often sandy soils and are common constituents of wet meadows, pine flat-woods, and roadside ditches. Most are early successional species that tend to inhabit areas that have been distributed by processes such as burning and clearing. Rhexia species are considered unique for having temperate distributions and are commonly found along roadsides and in open habitats in eastern North America, ranging from Nova Scotia to Florida and the West Indies to west and eastern Texas. To test how climate change will affect the habitat suitability of these species we developed ecological niche models (ENMs). We then use our ENMs to characterize the environmental niche of Rhexia species based on abiotic variables (e.g. precipitation, temperature, soil characteristics, elevation) and subsequently predict both the niche suitability of taxa and the major abiotic factors influencing their distributions. We projected our models to various climate scenarios to understand how the landscape of niche suitability changed over time. Using both current and future models we compare niche suitability between polyploid and diploid species in this genus. ENMs have become increasingly popular tools for predicting the geographic ranges of species and have been important for conservation, for predicting changes in distribution from past or future climatic events, and for investigating patterns of speciation and niche divergence. This project aims to estimate potential geographical shifts in a suitable climate and geographical areas at risk of invasion under possible climate change scenarios for eleven Rhexia species.

Understanding the Taxonomy of Neotropical Andean Butterfly Species

Authors: Ava Mingrone, Keith Willmott

Neotropical Andean butterflies are one of the most diverse and species-rich groups on Earth. The focal species for this study is Malaveria alcinoe and relatives including M. ballofi, M. nebulosa, M. rodriguezi, M. bottoi, and M. mimas. Malaveria are satyrine butterflies inhabiting middle-elevation montane forests in the Neotropics. The relationships between satyrine butterflies have been difficult to determine due to their morphological homogeneity. Understanding the species limits within the Malaveria alcinoe species complex will allow improved knowledge of the taxonomy and distribution of the complex. I curated the M. alcinoe complex in the Florida Museum of Natural History's McGuire Center Collection according to location and sex of the butterflies. Photographs were then taken of both sides of each butterfly specimen and data recorded in a Microsoft Access database. These images are being used in a morphometric study of butterfly wing patterns. To compare genitalic characters of male butterflies, I dissected them and drew the genitalia using a stereomicroscope at 50X magnification. I plan to continue research by obtaining DNA sequences. Combined new knowledge of morphological, molecular, and wing pattern variation and distribution will allow revision of the taxonomy of the M. alcinoe species complex.

Clarifying the Ecuadorian Pedaliodes asconia/pollonia Species Group

Authors: Bloch, Aidan and Willmott, Keith

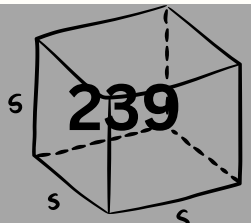
Pedaliodes (Nymphalidae, Satyrinae) is a diverse genus of Andean brush-footed butterflies whose taxa can be difficult to distinguish. As such, the relationships between the various Pedaliodes, as well as their exact definitions, ranges, and distributions, are often poorly understood. As part of the CUR Emerging Scholars Program, I have been working to clarify these characteristics within the poorly-understood Ecuadorian Pedaliodes pollonia/asconia species complex using mtDNA analysis techniques.

In addition to pre-existing specimens from the Florida Museum of Natural History's McGuire Center collections, I have gathered samples through fieldwork throughout Ecuador in summer 2023. By analyzing mtDNA data from these specimens, I attempt to clarify the number of distinct species within the Pedaliodes pollonia/asconia complex, as well as their ranges and identifying characteristics. The preliminary results of this analysis support a multi-species group with clear differences in distribution and distinct biogeographical trends.

Automation of Petrographic Thin-Section Analysis

Authors: Griffin Pitts, Nicolas Gauthier

Geologists use a process called petrographic thin-section analysis to study rock and mineral samples. The process involves observing thinly sliced mineral samples under cross-polarized light within a microscope, identifying various features such as mineral composition, texture, and structure. The analysis process can be time-consuming and requires significant expertise, as geologists must manually identify minerals features within the slide in a microscopic scale. This manual analysis process can be inefficient and subject to human error, especially when dealing with large volumes of petrographic data. Geologists may spend hours analyzing a single slide, and even then, the results may not be consistent or reproducible. Therefore, there is a need for a more efficient and reliable method for analyzing and segmenting petrographic slides. These challenges present an opportunity for an automated process to cut down on the time required, to increase total task efficiency. Considering this, our project aims to introduce a model proficient in image-based pattern recognition, designed to segment and classify the distinct mineral features present in the petrographic data from the Florida Museum of Natural History. With initial tests leveraging a pretrained machine learning model based in U-Net structure, we achieved a mean IoU value of 0.967, showing success within the ability of our model to segment the petrographic data. The further development of such a tool could significantly improve petrographic analysis, allowing geologists to process larger volumes of data and make more informed decisions about the minerals they are studying.



Connecting Researchers to Sample

Authors: Vishnu Prasad, Harlan Phillips, Sigrid Reinsch

The NASA NBISC biorepository at Ames Research Center is a critical resource housing non-human samples collected from spaceflight missions and ground studies, primarily consisting of specimens from rats, mice, and select microbes. Its primary objective is to systematically receive, document, preserve, and facilitate access to these samples for the global scientific community, promoting international collaboration.

Researchers can request access through a user-friendly online request form. This study addresses two core research objectives: streamlining the sample lifecycle processes and strategizing for managing an influx of 50,000 samples. The methods employed include dissecting biological protocols to individualize scripts, metadata input into an Excel sheet, transformation into a Laboratory Information Management System (SLIMS) template, and a script for data assignment. Improved organizational measures in the freezers and error-checking in the Anaconda terminal enhance the process.

Automation and data organization are essential, as they free up time for promotion and increase the accessibility of samples. The Biospecimen Sharing Program benefits from streamlined data ingestion, and this project's feasibility aids broader research initiatives.

As of Fall 2023, plans include transferring sample data to public repositories, expanding the reach of the digitized mouse sample collection, advancing space biology research, astronaut health insights, radiobiology, and potential applications in cancer treatment. This study underscores the significance of making these samples available to the scientific community to promote collaboration.

Nipple Areolar Malposition vs. Ideal Position After Nipple Sparing Mastectomy Reconstruction

Authors: Alessa Mikaela Mendoza, Alex Hochwald, MS, Zhou Li, MS, Sahar Borna, MD, Antonio Forte, MD PhD, Brian Rinker, MD, Sarvam TerKonda, MD, James Jakub, MD, Sarah McLaughlin, MD, Olivia Ho, MD MMSc MPH FRCSC FACS

PURPOSE:

Malposition of the nipple areolar complex (NAC) is a non-optimal complication of nipple-sparing mastectomy (NSM) reconstruction, NSM that preserves the NAC and surrounding skin and results in both a more naturally appearing reconstructed breast and improved patient quality-of-life. NAC malposition may undermine these major reconstructive benefits, but there are various aspects of surgical technique that may potentially affect the NAC positioning: use of acellular dermal matrix (ADM), reconstruction type (direct-to-implant vs tissue expander), implant or tissue expander plane of placement, and mastectomy incision location.

METHODS:

To better understand NAC malposition and these potential surgical factors, measurements and data were recorded for 88 NSM reconstruction patients between January 2020 and May 2023. Statistical analyses comparing actual and ideal measurements were completed and demonstrated that, while patients' measurements strayed from the ideal at both pre-operative and post-operative timepoints, most patients had worsened malposition post-operatively compared to pre-operatively. Analyses of the surgical variables was performed using mixed effect regression models.

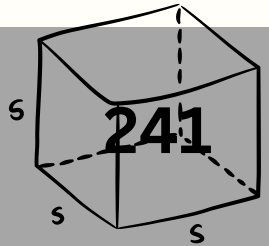
RESULTS:

Findings were significant for ADM usage ($p=0.003$ and $p<0.001$) and direct-to-implant reconstruction type ($p=0.058$ and $p=0.029$), being associated with NAC malpositioning along the vertical axis. Subpectoral placement of tissue expanders or implants ($p=0.012$ and $p=0.011$) and breast-splitting mastectomy incision type ($p=0.003$) were found to result in increased malposition.

CONCLUSION:

These findings demonstrate how certain NSM reconstruction surgical techniques may influence NAC positioning by highlighting which variables may have a higher risk of NAC malpositioning. These factors should be carefully considered with surgeons' operative planning and with patient counseling regarding reconstructive options.

Mayo Clinic Florida
Plastic and
Reconstructive Surgery

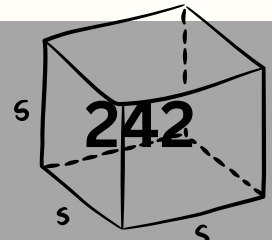


Examining impacts of AMF treatments on the drought-stress response of 8 apple rootstock-scion combinations

Authors: Jieli Wegerif, Kenneth Buck, Yue Pan, Jason P. Londo

The domesticated apple (Malus x domestica) is the fourth most produced fruit in the world. However, irregular precipitation events and rising temperatures are threatening the survival of apple trees around the globe. Water stress in apples induces oxidative stress, reduces photosynthesis, and hampers fruit development. Research has shown that introducing beneficial arbuscular mycorrhizal fungi (AMF) to the roots of apple trees can bolster their resilience to heat and drought. These symbiotic pairings are often highly specialized, and the exact relationship between AMF type and apple rootstock-scion (RS-S) genetics is largely unknown. This study sought to evaluate the drought responses of eight unique graft combinations under 4 AMF treatments. A LI-600 Porometer/Fluorometer was used to measure stomatal conductance and photosynthetic efficiency of trees under well-watered and water-stressed conditions on a bi-weekly basis. Statistical analysis indicated scion cultivar, not AMF treatment, had the greatest impact on a tree's stress response, and that each RS-S combination had a signature curve for carbon assimilation. This research suggests that more investigations should be done on how rootstock and scion genetics interplay to impact climate resilience in apples.

Cornell University School of Integrated Plant Sciences

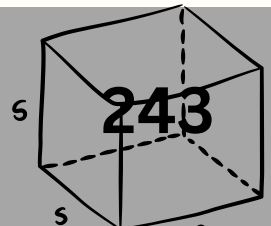


Impact of Sea Surface Microlayer Glass Plate Drip Time on Organic Matter Composition

Authors: Kira Zautcke, Felix Agblemanyo, Andrew Wozniak

The quantity and composition of organic surfactants at the sea surface microlayer (SML), located at the air-sea interface, change the properties of the SML and influence air-sea exchanges of gasses and aerosols, which are relevant when constructing climate models. A new ship-based method of glass plate SML sampling (NEW-ML) uses larger glass plates that make collecting higher sample volumes more efficient. However, the NEW-ML method requires 30-60 seconds prior to sampling, which is outside of the typical recommended 10-20 seconds. To allow for comparison between samples obtained via the traditional and NEW-ML method, this study aimed to quantify the relationship between drip time and organic matter quantities and composition. Three glass plate samplers were used to simultaneously sample estuarine waters in Lewes, DE, USA on four different occasions over a one month period. For three sampling events, each glass plate was assigned a drip time of 10, 45, or 60 s. The fourth sampling event served as a control, and all plates dripped for 10 s. Filtered samples were analyzed for optical (absorbance and excitation emission matrix spectroscopies) and dissolved organic carbon (DOC) measurements. Consistent with expectations, drip time was found to result in a significant, predictable decrease in SML thickness. There was no statistically significant DOC concentration increase with drip time. Variations in chromophoric dissolved organic matter and fluorescent dissolved organic matter indices were nonlinear and showed no clear relationships with drip time. Considerable variation was observed for the BIX and FI indices during the control sampling event, when all glass plates sampled with the same drip time, suggesting potential biases due to the glass plates themselves or to the sampling teams. Future work is needed to improve on this study design to gain an understanding of potential biases using the NEW-ML compared to the traditional glass plate method.

University of Delaware
Marine Sciences



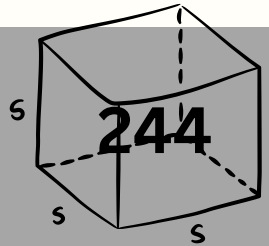
Fat Graft Tumescent Solution Base Product Development Activities

Authors: Camille Ianno, Cheryl Rosenberger, Purna Kasha, Catherine Pachuk

---

Fat grafting after procedures such as liposuction are increasing in frequency in the cosmetic and reconstructive surgery world; however, fat grafting is limited clinically by problems with fat retention post-grafting. MAR-FG-001, a tumescent solution base, addresses this issue by protecting adipose tissue from ischemic injury. Preliminary studies have shown that, compared to standard tumescent solutions, MAR-FG-001 improves the viability and functionality of human adipocytes, both mature and preadipocytes, following liposuction and ischemic storage. This also allows the preadipocytes to further differentiate after storage. A tumescent solution is used by being injected into the subcutaneous tissue and infiltrating the target fat tissue to be removed. A tumescent solution is also used to deliver local anesthetic but is also the medium into which adipose tissue is aspirated (Uttamani et al., 2020). As such, tumescent solutions are also typically used to store and process adipocytes following liposuction in preparation for fat grafting procedures. However, standard tumescent solutions do not contain any components to protect these living cells from ischemic injury.

Marizyme Inc., Summer 2023 Internship



Emergency Laparotomy on Extra-Corporeal Membrane Oxygenation: A Retrospective, Observational Study

Authors: Rhoda Tawk, Anek Jena MD, Allison Perez MD, Devang Sanghavi MD, Anirban Bhattacharyya MD, Pablo Franco MD, John Bohman MD, Pramod Guru MD, Sanjay Chaudhary MD

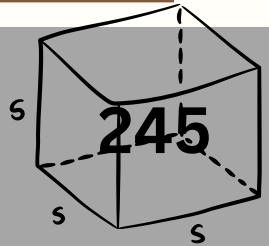
INTRODUCTION: Patients on extracorporeal membrane oxygenation (ECMO) are critically ill with increased risk of intra-abdominal complications necessitating emergency laparotomy (EL). There is paucity of data regarding the outcomes in patients undergo EL while receiving ECMO support.

METHODS: Patients who received ECMO support between January 2018 and June 2023 were identified. A retrospective chart review was conducted for the following datapoints: SOFA score within 24 hours of ICU admission, ECMO duration, ICU length of stay, type of surgery, duration on mechanical ventilation, length of hospitalization, and mortality. Initial SOFA score, mortality, and pre and post-surgical complications were calculated and correlated with length of ICU stay and mortality.

RESULTS: Forty patients (18.2%, 220 total) who underwent EL while on ECMO were included. While 30 % were on venovenous (VV) ECMO, 70 % had venoarterial (VA) ECMO during EL. Bowel ischemia was the most common pathology (50%) followed by intra-abdominal hemorrhage (28%). The mortality rate was 77.5%. The incidence of re-exploratory laparotomy was 82.5 % and acute kidney injury occurred in 59.4%. The mean duration of survivor ICU stay was 61.1 and the average duration on ECMO was 24.44 days. The length of ICU stay and ECMO support for non-survivors were 84.1 and 42.70 days respectively. The period of invasive mechanical ventilation was 21.5 days for survivors and 33.6 days for non-survivors. The maximum SOFA score was 4.75 ± 2.50 in survivors and 8.9 ± 3.70 in non-survivors ($p<0.05$).

CONCLUSIONS: Patients on ECMO frequently require EL with the VAECMO group at highest risk. Bowel ischemia and intra-abdominal bleed representing the most common pathologies necessitating surgical intervention. Non-survivors following EL were more critically ill at admission and had a longer duration of ECMO support, ICU stay, and mechanical ventilation.

Critical Care, Mayo Clinic Jacksonville



The Role of Microglial LRP1 in the Pathogenesis of Alzheimer's Disease

Authors: Allison Wetmore, Jada Owens, Monica Castanedes Casey, Virginia R Phillips, Yixing Chen, Wenhui Qiao, Na Zhao

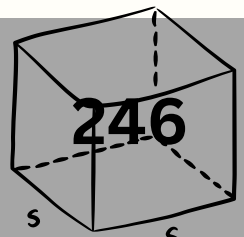
Alzheimer's Disease (AD) is the most common form of elderly dementia, characterized by the accumulation of amyloid-β (Aβ) and tau pathologies with subsequent microglial reactivity. The polymorphism of apolipoprotein E (APOE) gene is the strongest genetic risk determinant of late-onset AD, with various allelic combinations conferring differences in probability, severity, and age of onset. Low-density lipoprotein receptor-related protein 1 (LRP1) is a major APOE receptor and is expressed in several different brain cell types. Previous studies have explored the roles of LRP1 in vascular cells, neurons, and astrocytes. However, little is known on how microglial-LRP1 contributes to microglial functions and AD pathogenesis.

To dissect roles of microglial LRP1 in the presence of Aβ, we crossed P2ry12-CreER mice with Lrp1 floxed mice and 5xFAD mice to obtain inducible, conditional, LRP1 knockout, amyloid mouse models. Tamoxifen was administered to mice at 1.5 months of age to induce microglial Lrp1 deletion in adult mice, avoiding potential developmental disturbance. After harvesting all the mice at 6.5 months of age, we utilized the brain tissues for immunostaining and biochemical assays to investigate the effects of the mKO on amyloid burden, glial responses, and neuronal toxicity.

We observed no significant changes of the amyloid load, fibrillar plaque densities, and plaque sizes upon microglial Lrp1 deletion. There are no significant differences in the microgliosis, astrogliosis, phagosome protein levels, and myelin status between the mKO group and control group. However, we observed a significant reduction of presynaptic marker protein, vesicular glutamate transporter 1 (VGLUT1) in the mKO group compared to the Ctrl group even though there are no significant changes of neuronal numbers denoted by the NEUN staining.

Despite that LRP1 plays critical roles in other cell types (neurons, astrocytes, and vascular cells) regulating Aβ clearance, our findings suggest limited roles of microglial-LRP1 in amyloid pathologies..

Department of Neuroscience at Mayo Clinic

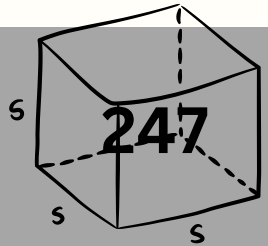


Molecular Dynamic Simulations of Perfluoroalkyl Substances Self-Assembly on Graphene Sbustrates

Authors:Morgan Gunter, Bradley Lamb, Boran Ma

Polyfluoroalkyl substances (PFAS) are a growing cause for concern due to their resistance to degradation, environmental accumulation, and correlation with negative health effects, such as infertility and cancer. Development of effective filtration technologies for the sequestration and removal of PFAS from water is paramount in reducing human exposure. However, PFAS adsorption mechanisms are not well-understood and act as a barrier in the design of effective sorbents for adsorption-based removal techniques. In this study, atomistic molecular dynamics simulations were employed to elucidate the adsorption and self-assembly behavior of perfluorooctanesulfonic acid (PFOS), a well-characterized PFAS species, when introduced to a graphene substrate in an aqueous environment. Systems containing varying concentrations of PFOS were investigated to determine the influence of concentration on aggregation. Aggregation of PFOS in solution and on graphene was observed in all systems, as this behavior reduced the interactions between water and the hydrophobic PFOS. At low concentrations, PFOS exhibited a preference for self-assembly into monolayers of alternating staggered and anti-parallel arrangements flush against substrate. This geometry was energetically favorable, as it minimized repulsion between the electron-dense head groups of PFOS. As concentration increased, aggregates grew in size and adopted multilayer and ellipsoidal geometries, with head-groups positioned along the aggregate interface. This shift in behavior was entropically driven: fewer configurations of monolayers were possible compared to multilayer aggregates as the number of PFOS molecules increased. The impact of concentration on PFOS self-assembly on substrates revealed by this study offers insights into optimizing adsorption-based filtration of PFAS for environmental remediation applications.

USM School of Polymer Science and Engineering

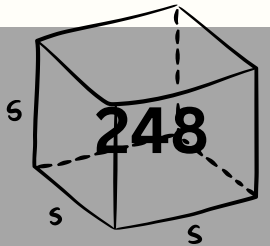


Identifying Social Environmental Stressors that Increase Risk for Preeclampsia in Black and Hispanic Birthing People

Authors: Gene Pozas, Dr. Brittney Francis

Preeclampsia is a serious maternal complication that can affect mothers of all races and ethnicities. However, Black and Hispanic birthing people are disproportionately affected by preeclampsia and its related outcomes. There is a growing body of research showing that social environmental stressors and social determinants of health play a significant role in the increased risk of preeclampsia. The aim of our study was to examine the current literature on the relationship between social environmental stressors and preeclampsia, with a particular focus on noise pollution and food deserts as these factors are more prevalent in our target communities. We conducted a literature review to examine the documented relationships between social environmental stressors and preeclampsia among Black and Hispanic birthing people in the U.S. Preliminary results show a lack of noise pollution data collection in the U.S. and that populations living in food deserts are disproportionately affected by higher rates of preeclampsia. Future studies should push to gather extensive data on noise pollution levels in the affected neighborhoods and create evidence-based policies to reduce rates of preeclampsia in these groups.

Harvard T.H. Chan School of Public Health

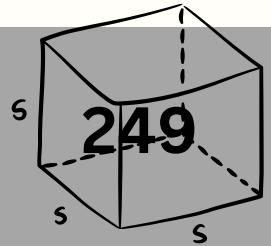


Exploring First Responder Experiences with Opioid Overdose Calls

Authors: Riley Curie, Kimberly Menendez, Kathleen Mooreh

The opioid crisis is an increasing public health concern that affects communities at large. High rates of use across multiple countries suggest a global problem. In 2022, the State of Florida's Emergency Medical Services responded to 40,544 opioid overdose calls. First responders, such as paramedics and law enforcement officers (LEOs), often respond in tandem to these calls. The purpose of this study was to explore the challenges first responders face when responding in tandem to opioid overdose calls. Past research has identified problems with a blending of roles between LEOs and paramedics, specifically with the administration of naloxone. In-depth semi-structured interviews were conducted with 14 first responders (paramedics n= 8, LEOs n = 6) in the Tampa Bay Florida area. Data were analyzed using applied thematic analysis techniques. Themes included the following: a) challenges in response time differences, b) conflicting response protocols, and c) potential solutions. Paramedics expressed frustration with LEO use of naloxone specifically with the amount administered and lack of communication. LEOs struggle with arriving on the scene first and having limited skills to take care of patients. This supports previous literature and raises questions about the best ways to address this problem. Potential solutions include appointing an LEO to respond with paramedics and enhanced training for LEOs regarding naloxone. A limitation of this study is that it may not be generalizable to other townships or municipalities. Future research should include 911 dispatcher perspectives to understand how opioid overdose calls are assigned to first responders as well as the feasibility and acceptability of proposed solutions..

University of South Florida
College of Behavioral and Community Sciences



A QuantiFERON Gold Rush of Determinate Results in Fully Recovered COVID-19 Patients

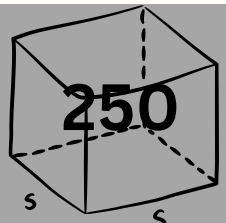
Authors: Michael Morodomi, Melissa P. Cortes, M.D.

Tuberculosis (TB) is a contagious airborne disease caused by Mycobacterium tuberculosis and leads to latent TB infection or (active) TB disease. The strength of a patient's immune system determines the state of TB infection; stronger immune systems can limit the spread of infection, resulting in latent infection. TB can be assessed before initiation of immunosuppressive therapy in patients with active severe COVID-19 infection with the use of a QuantiFERON – TB Gold test (QFT-Plus). This test utilizes M. tuberculosis antigens to assess the response of the patient's immune system by measuring interferon-gamma (IFN-γ). If infected with M. tuberculosis, the immune system will release IFN-γ upon contact with antigens.

COVID-19 impedes antigen presentation by downregulating Major Histocompatibility Complex (MHC) associated molecules, inhibiting the T-cell mediated immune response. In patient cases of COVID-19, the amount of T-cells was lower compared to healthy patients, triggering lower levels of IFN-γ. With disrupted T-cell activity, the QFT-Plus test's ability to precisely measure the immune system's response to M. tuberculosis antigens is hampered. Accordingly, our previous study demonstrated a higher incidence of indeterminate QFT-Plus results among patients with active COVID-19 infection.

This study aims to compare QFT-Plus results collected during severe active COVID-19 infection to results following full recovery. COVID-19 admission data was extracted between October 13, 2020, and September 20, 2021, from Mayo Clinic, Florida. Our findings indicate a lower frequency of indeterminate results post-COVID-19 recovery. This outcome is supported by COVID-19's immune deregulatory qualities and ability to manipulate the activity of T-cell mediated immune response.

Mayo Clinic Florida



Summer Undergraduate International Research Program

e-Portfolios

Emma Hanley

Mahir Rahman

Jacob Roman

Han Kim

Rayyan Merchant

SUIRP