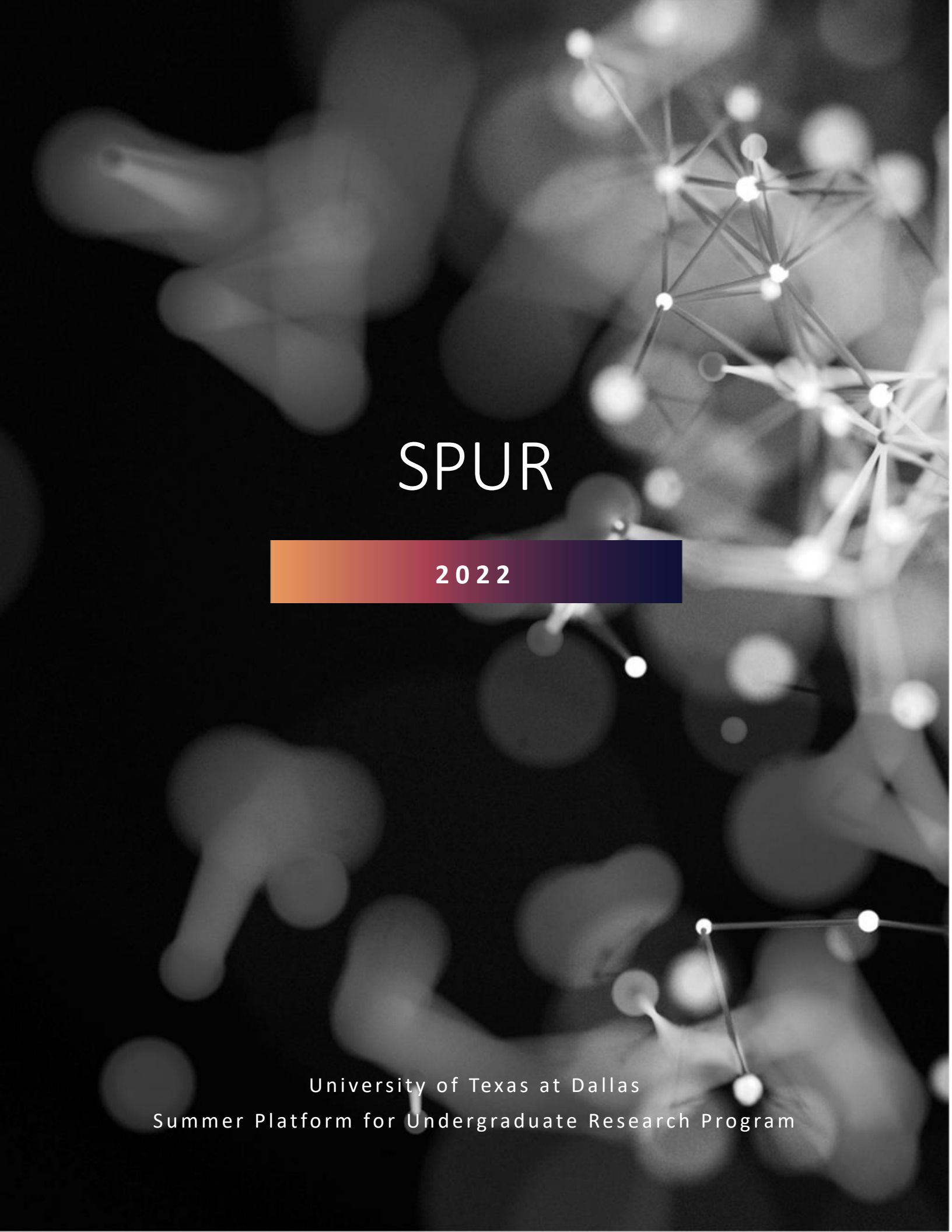
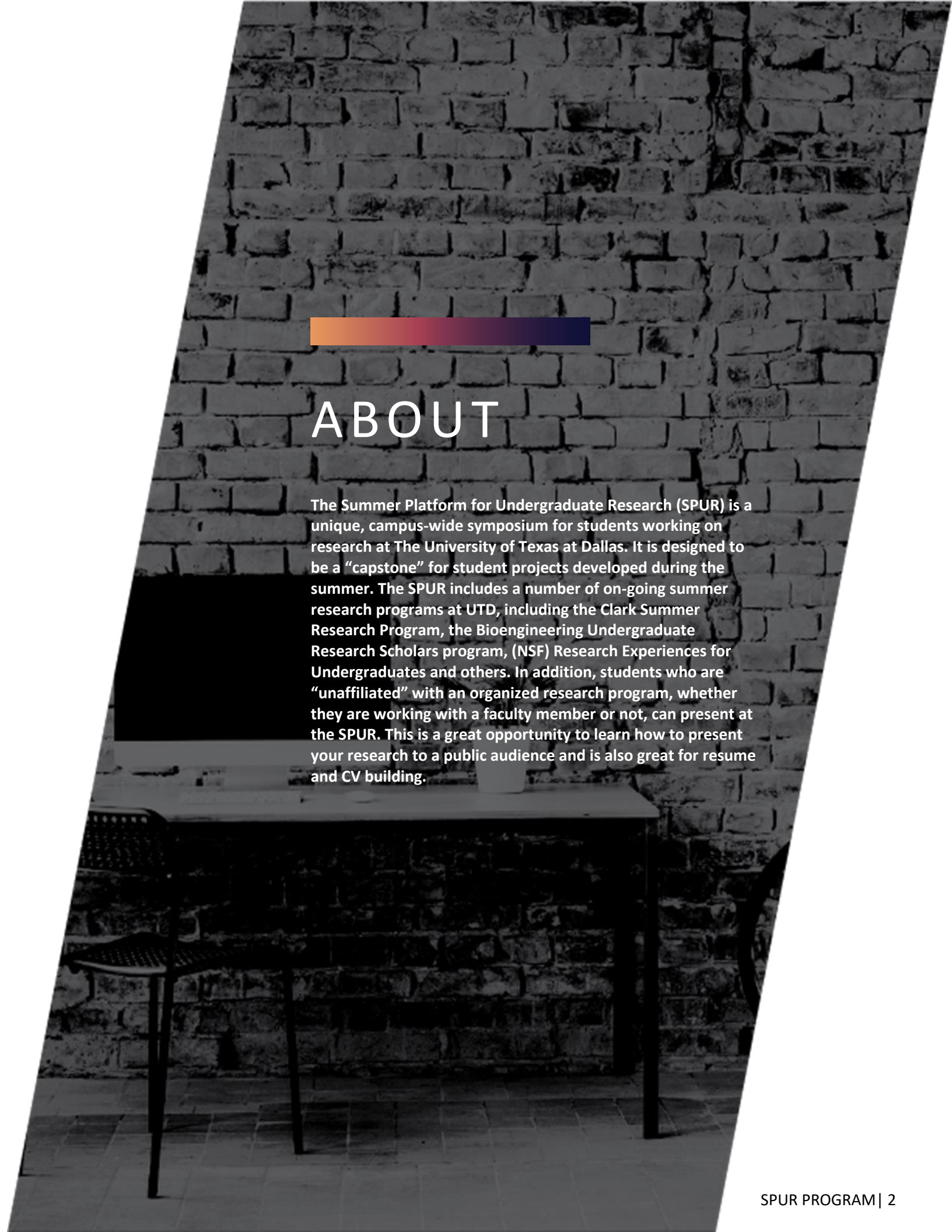


SPUR

2022

University of Texas at Dallas

Summer Platform for Undergraduate Research Program



ABOUT

The Summer Platform for Undergraduate Research (SPUR) is a unique, campus-wide symposium for students working on research at The University of Texas at Dallas. It is designed to be a "capstone" for student projects developed during the summer. The SPUR includes a number of on-going summer research programs at UTD, including the Clark Summer Research Program, the Bioengineering Undergraduate Research Scholars program, (NSF) Research Experiences for Undergraduates and others. In addition, students who are "unaffiliated" with an organized research program, whether they are working with a faculty member or not, can present at the SPUR. This is a great opportunity to learn how to present your research to a public audience and is also great for resume and CV building.

Thank you to our Sponsors:

Office of the Provost
Naveen Jindal School of Management
Office of Undergraduate Education
School of Behavioral and Brain Sciences
Office of Research and Innovation
Department of Computer Science
Center for Advanced Pain Studies
NSF REU Site: Cultural Responsive Research in Developmental Science

Organized by:
The Hobson Wildenthal Honors College

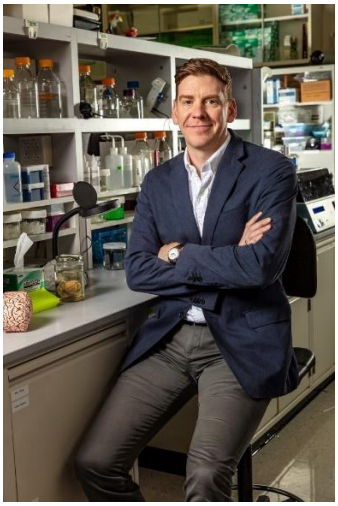
SCHEDULE

Edith O'Donnell Lecture Hall, *ATC 1.102*

11:30 – 11:40 am Welcome
11:40 – 12:15 pm Keynote Speaker
Dr. Benedict Kolber
12:15 – 12:45 pm Oral Presentations
Grace Moore
Miguel Barcellano
Shruti Bindingnavile

Move to Davidson-Gundy Alumni Center

1:15 – 2:30 pm Poster Session 1 (even numbers)
2:30 – 3:45 pm Poster Session 2 (odd numbers)


Dr. Benedict Kolber

Keynote and Oral Presentations

KEYNOTE
Dr. Benedict Kolber

Dr. Kolber is an associate professor in neuroscience and faculty in the center for advanced pain studies. Kolber is passionate about training the next generation of diverse, responsible, and skeptical scientists by actively engaging trainees at all levels (undergraduate, graduate, and post-graduate) in questions related to chronic pain and psychiatric comorbidities. He received his B.S. degree from the University of Dayton in Biology and Psychology. It was at the University of Dayton and Wright State University in Dayton Ohio that Dr. Kolber first became involved in undergraduate research when he was named an undergraduate research fellow funded by the American Physiological Society.

STUDENT PRESENTERS
GRACE MOORE
MIGUEL BARCELLANO
SHRUTI BINDINGNAVILE

Grace Moore is a senior neuroscience major. Moore will present: Prdm12 knockout model of a painless mouse reveals properties of nociceptors across development

Miguel Barcellano is a sophomore biomedical engineer major. Barcellano will present: Making Connections with Physiological Data and Healthy Sleep.

Shruti Bindingnavile is a senior data science major. Bindingnavile will present: Effectiveness of Domestic Travel Restrictions in reducing the spread of COVID-19

ABSTRACTS

(1)

Biomimetic Vesicles as a Vehicle for Photosensitizers in Near-Infrared Photodynamic Cancer Therapy

Kevin Fritz, Chanda Bhandari, Girgis Obaid

Department of Bioengineering, The University of Texas at Dallas

Nanomedicines allow for the encapsulation of traditionally toxic or non-bioavailable therapeutic agents in a more stable shell, increasing circulation times in vivo. Biomimetic vesicles are nanoparticles derived from cell membranes that allow for more specific cellular uptake. This is specificity is a result of homotypic binding, or the binding of membrane proteins between similar cell lines. We are interested in measuring how vesicle specificity impacts uptake in the context of photodynamic cancer therapy, where a photosensitizer may be delivered specifically to cancer cells to allow for enhanced therapeutic precision or improved imaging resolution. By enhancing the precision of photosensitizer delivery, healthy cell death and subsequent tissue damage may be reduced while increasing treatment efficacy. Previous studies in our lab have demonstrated selective uptake of synthetic nanoparticles in tumors due to changes in tissue microenvironment, but specific uptake of biomimetic vesicles had not been examined. To investigate these claims, AT84 and ID8 cells – two murine cancer cell lines – were exposed to AT84-derived vesicles tagged with fluorescent markers. After a variable incubation period, cell fluorescence may be measured with flow cytometry and cellular uptake assays, allowing for the uptake of biomimetic vesicles to be quantified. Our results found similar uptake levels through 24 hours between both cell lines, with significant specific affinity found after 48 hours of exposure. This suggests that initial uptake is ruled by non-specific interactions, after which homotypic binding becomes prevalent.

(2)

Developing Ultrasound Guided Approaches to Guiding Immune Cells to Solid Tumors

Roshni Gandhi, Hossein Razmi Bagtash, Mohammadaref Ghaderi, Shashank R. Sirsi, Caroline N. Jones

The University of Texas at Dallas

Neuroblastoma is a type of cancer found in children and infants where the solid tumor is most commonly found in the adrenal glands. Currently, immunotherapy is a widely used treatment option for neuroblastoma due to its many benefits of utilizing the body's own immune system to fight disease. However, a major limitation of immunotherapy is the poor penetration of circulating leukocytes into solid tumors. Ultrasound contrast agents, or microbubbles, are gas filled spheres that are known to react in an ultrasound field by moving in the direction of a propagating ultrasound wave due to "primary radiation forces". DBCO-Azide click chemistry reactions can be used to create clusters of microbubbles and cells, which can be displaced in flow to promote ultrasound vascular adhesion and uptake to the tumor region. The same click chemistry reaction can be used by displacing microbubbles to the vasculature and attaching positively charged cells, promoting uptake to the tumor region. The impact of microbubbles, ultrasound application, and positively charged polymer on immune cell migration can be determined through a series of live/dead assays, migration experiments using microfluidic devices, and in vitro vessel mimicks. Initial studies have shown that increasing ultrasound intensity from 0 W/cm2 to 2 W/cm2 does not have an impact on cell migration patterns, as they preferred to migrate towards fMLP rather than Leukotriene B4.

(3)

Acquisition of Whole Slide Images in Hyperspectral Domain

Ofelia Gomez, Minh Ha Tran, Baowei Fei

Department of Bioengineering, The University of Texas at Dallas

Hyperspectral imaging has shown to be a successful, non-invasive imaging tool widely used in the medical field. This is especially due to its ability to give morphological and spectral feature information. Deep learning techniques have been used in previous studies for thyroid cancer detection in whole histologic slides. The standard input for these models is H&E-stained slides captured by a traditional RGB camera. However, hyperspectral inputs have shown better improvements in cancer classification compared to RGB inputs. This project implemented a recent customized hyperspectral imaging system for the acquisition of whole slide HS images of tissue from patients diagnosed with thyroid carcinoma. This system also included an optical microscope, a compact hyperspectral camera, and a high-precision motorized stage that synchronized stage movement with image acquisition. They were obtained at an objective of 10x and a raster size of 2000x2000x84. These images were captured with the purpose of being used as training input data in a transformer network for cancer classification and to compare its performance to that of RGB inputs in the classifier. A total of 7 tumor and 9 normal images were acquired from histological samples, resulting in 29,696 tumor and 35,226 normal tissue patches generated.

(4)

Real-time Fluorescent Sensors for Detecting EMT Status

Madalynn Green, Leonidas Bleris

Department of Bioengineering, The University of Texas at Dallas

Epithelial to Mesenchymal Transition (EMT) is a biological process where epithelial cells depolarize, lose cell-to-cell adhesion, change morphology, and acquire migratory capabilities. For cancer cells, EMT can also confer chemoresistance and tumor-initiating properties. Thus, EMT allows primary tumor cells to enter a metastatic cascade and form secondary tumors leading to cancer progression and reoccurrence. The current gold standard for determining the EMT status of in vitro cells is through population-based end-point assays such as RT-qPCR and western blot. However, EMT may be more accurately quantified through fluorescence-based assays, which allow for tracking EMT status of individual cells in real-time. Thus, we generated a plasmid with the endogenous E-cadherin (CDH1) promoter driving YFP expression, and then stably integrated it into A549 cells. CDH1 is a gene consistently down-regulated during EMT, thus the decrease in CDH1 promoter activity and subsequent decrease in YFP signal indicates that the cells have transitioned to a more mesenchymal state. Similarly, we also designed a Vimentin promoter-RFP integration plasmid where the activation of the Vimentin promoter during EMT increases the RFP output. Using fluorescent imaging and flow cytometry, this dual sensor system can analyze both the gene expression and spatiotemporal data of each cell and provide more insight into the mechanisms of EMT.

(5)

The effects of increasing backpack load carriage on lower extremities and abdominal region

Ashley Guzman[1], Angeloh Stout[1], Ke'Vaughn Waldon[1], Gu Eon Kang[1,2]

[1]Department of Bioengineering, The University of Texas at Dallas, [2]Department of Plastic Surgery, The University of Texas Southwestern Medical Center

While load carriage has been studied in military personnel and adolescents, there is a scarcity of literature on college aged students that focus on the effects of variable load carriage on the muscle activity of the lower extremities and abdominal region. We investigated how increasing the weight of a backpack affects the muscle

activities of the bicep femoris (BF), vastus lateralis (VL), gastrocnemius (GL), tibialis anterior (TA), and rectus abdominis (RA). The hypothesis was if increasing load carriage on the back correlates to an increase in muscle activity. We used a 3D motion capture technology (VICON, Richardson, Texas) and wireless surface electromyography (sEMG; Delsys, Richardson, Texas). sEMG data from one subject (age=24, male) was collected for 3 walking trials with an increasing load via backpack (0, 2.27,4.53,6.08 and 9.07 kg) after a calibration process. Dynamic trial sEMG data was averaged across each gait cycle and normalized against the MVC to analyze for MVC% and utilized ANOVA statistics via excel for data analysis. Muscle activity in the BF and TA decreased respectively by 26.49% and 3.50%. While muscle activity in the RA, GL, and VL increased respectively by 50.05%, 5.54% and 7.11%. In conclusion the hypothesis is supported by results from the rectus abdominis, but future study should consider the lower portion of the rectus abdominis to analyze to further understand the differing activating regions. Additionally, a bigger population would be necessary prior to making conclusive interpretations.

(6)

Decorin Inhibits Corneal Fibroblast Differentiation to Reduce Scar-Forming Phenotype in Vitro

Hudson Hicks, Nathaniel Tjahjono, Divya Subramanian, David Schmidtke

[1] Department of Bioengineering, The University of Texas at Dallas, [2]Department of Surgery, The University of Texas Southwestern Medical Center

Decorin is a small, leucine-rich proteoglycan found in the corneal stroma that has been shown to bind to type I collagen fibrils. Decorin is involved in a broad range of biological processes, playing a role in wound healing through its ability to modulate a wide variety of growth factors and cell receptors. In the cornea, fibroblast differentiation into myofibroblasts, indicated by positive α-smooth muscle actin (α-SMA) expression, contributes to corneal opacification, a leading cause of blindness. Furthermore, transforming growth factor-β (TGF-β) has been shown to significantly increase the amount of α-SMA expression in cells. Both soluble and collagen-bound decorin can inhibit TGF-β, resulting in reduced myofibroblast differentiation and fibrotic scar formation. The purpose of this study was to analyze the effects of decorin and TGF-β on cellular morphology and α-SMA expression. To fabricate the collagen fibrils, type I collagen was polymerized on polydimethylsiloxane (PDMS) coated glass coverslips and subsequently treated with a decorin surface coating. When corneal keratocyte cells were seeded in the presence of TGF-β on substrates coated with decorin, α-SMA expression was observed to decrease compared to the control. This result demonstrates the ability of decorin as a collagen fibril surface coating to inhibit TGFB and reduce myofibroblast differentiation. Future studies will involve the use of aligned collagen fibrils created with microfluidic techniques to observe how topographical cues of the native stroma further affect the inhibition of TGFB by decorin.

(7)

Regional Biomechanical Characterization of Human Colonic Tissues

Nicole Huning, Adil Khan, Jacopo Ferruzzi

Department of Bioengineering, The University of Texas at Dallas

Colorectal cancer (CRC) remains one of the most common causes of cancer-related deaths worldwide. Over the past decades, there has been a decline in the incidence of average-onset colorectal cancer (AO-CRC, 65 years of age and older) accompanied by a steady increase in the incidence of early-onset colorectal cancer (EO-CRC, under 50 years of age). Among other risk factors, fibrosis and extracellular matrix stiffening are common hallmarks of CRC as well as of other inflammatory bowel diseases such as Crohn's disease (CD) and ulcerative colitis (UC). To better understand and predict disease progression, there is a pressing need to develop realistic in vitro models that recapitulate the biomechanical properties of human colonic tissues. In this study, we seek to characterize colonic tissue biomechanics using standardized measurements. For each patient undergoing surgical resection due to either AO-CRC, EO-CRC, CD, or UC, we investigated both proximal (normal) and distal (diseased) colonic specimens. Each specimen was prepared using a tissue slicer

and a biopsy punch to the final cylindrical shape of 3mm in diameter and 2mm in height. Cylindrical samples were placed in a bath containing 1X PBS at 37°C, imaged using a digital camera, and subjected to local indentation followed by global unconfined compression testing to explore, respectively, the mesoscale and macroscale biomechanical properties of colonic tissues. Despite a large inter-patient variability, we report biomechanical properties of proximal and distal tissues. These methods will be used to develop synthetic hydrogels to recapitulate the biomechanical signatures of healthy and diseased colonic tissues.

(8)

Visualizing the Topology of Single DNA Molecules with a Visible-light Microscope

Jenna Krueger[1], Zhixiang Lei[1], Ryan Compton[1], Riccardo Ziraldo[1], Andreas Hanke[2], Stephen D. Levene[1,3,4]

[1]Department of Bioengineering, The University of Texas at Dallas, [2]Department of Physics and Astronomy, The University of Texas, Rio Grande Valley, [3]Department of Biological Sciences, The University of Texas at Dallas, [4]Department of Physics, The University of Texas at Dallas

DNA topology (supercoiling, knotting and catenation) plays a vital role in biological regulation via “action at a distance” and modulating essential processes such as transcription, DNA replication, genetic recombination, and DNA repair. To dissect the mechanisms of these complex processes, single-molecule approaches offer major advantages over bulk (ensemble) techniques because topological changes occur in discrete steps that cannot easily be resolved using ensemble methods in solution. There currently exist no “force-free” methods for investigating changes in the topology of single DNA molecules.
The aim of the project is to develop a rigorous method for investigating dynamic changes in DNA topology. We will use a method previously developed to investigate conformations of single DNA molecules, tethered-fluorophore motion (TFM), to characterize the topology of single, covalently closed, circular DNA molecules. We hypothesize that this method can quantitatively measure transition rates of two fundamental pathways that regulate DNA topology. Specifically, we will quantitate transition rates of supercoil relaxation and unknotting of a three-crossing knot by human topoisomerase IIα. TFM imaging is based on quantitative imaging of a fluorescent-dye molecule that is covalently attached to a specific base within covalently closed DNA. Previous results from the lab suggest that the new imaging method will be successful and should advance our knowledge of the dynamics of enzyme-mediated changes in topologically closed DNAs.

(9)

Evaluation of Insertion Speeds that Facilitate Intracortical Ultramicroelectrode Array Implantation

Shreya Tirumala Kumara, Rahul Radhakrishna, Ana Hernandez Reynoso, Joseph J. Pancrazio, Stuart F. Cogan

Department of Bioengineering, The University of Texas at Dallas

Intracortical microelectrode arrays (MEAs) are implantable devices that can record neuronal electrical activity and are used to control brain-machine interfaces. However, after implantation into the cortex, MEAs trigger a foreign body response (FBR), limiting the ability of the device to record over time. It has been shown that MEAs with smaller cross-sectional areas are capable of largely evading the FBR. However, it is more challenging to insert such smaller devices because of their relatively higher flexibility, which may lead to buckling before penetrating the cortical surface of the brain. Here, we evaluated the insertion mechanics of traditional MEAs (thickness by width: 123 by 33 μm) and a novel, ultra-thin MEA made of amorphous silicon carbide (a-SiC), (thickness by width: 50 by 10 μm). The goal of this experiment was to characterize insertion dynamics and choose an insertion speed that facilitates cortical penetration with these devices. We measured axial insertion, maximum forces, and dimpling depth during insertion into a rodent brain mimic (0.8% agarose gel phantom) at four different speeds (0.05 mm/s, 0.1 mm/s, 0.5 mm/s, and 1.0 mm/s). Each trial consisted of mounting an MEA to a load cell and recording insertion force as the array is driven perpendicularly into the agarose phantom. A two-way ANOVA for each measured variable was calculated to determine statistical

significance. Results showed that the speeds requiring the least force for penetration were 0.05 and 0.1 mm/s (p < 0.01), suggesting that speeds lower than 0.1 mm/s may facilitate insertion of these novel ultra-thin devices.

(10)

Varying the parameters of VNS to improve the efficiency of plasticity within the motor cortex

Joseph Montefalcon[1], Connor Neifert[1], Juliet Addo[1], Tanya Danaphongse[2], Stephanie Abe[2], Vikram Ezhil[2], Michael Kilgard[3], Seth Hays[1]

[1] Department of Bioengineering, Erik Jonsson School of Engineering and Computer Science, The University of Texas at Dallas, [2] The University of Texas at Dallas, [3] The School of Behavioral and Brain Sciences, The University of Texas at Dallas

Many neurological injuries impair the function of the motor cortex. It is widely recognized that therapies that can increase plasticity after injury represent potential approaches to improve recovery of function. Vagus nerve stimulation (VNS) paired with rehabilitation has emerged as one such promising strategy. Previous studies demonstrate that pairing VNS with specific rehabilitation training increases motor cortex plasticity and consequently improves recovery after injury. As such, identifying VNS paradigms that yield greater plasticity may lead to greater recovery. In previous studies, the frequency of stimulations as well as bursts of stimulations influence the magnitude of plasticity. This study aims to systematically characterize the effect of these temporal parameters on VNS-dependent plasticity in the motor cortex.
Female rats were trained to perform a simple behavioral task during which VNS was paired with jaw muscle activation during chewing. Each group received VNS with a prespecified set of parameters, including 20 Hz, 30 Hz, 45 Hz, in bursts of 4 pulses every 500 ms (Burst VNS) and slower, and steady pulses over a span of 2000 ms (Long VNS). After 5 days of training paired with VNS, intracortical microstimulation (ICMS) was conducted to analyze cortical movements representations. The results of this study will help establish the optimal stimulation parameters for VNS. These optimal parametrizations of VNS will help maximize the therapeutic effectiveness for patients with neurological injuries.

(11)

Effects of HMGB1 on Ti dental implant bone remodeling and osseointegration in ovariectomized rat model.

Jimena Mora[1], Claudia Cristina Biguetti [2], Alexandra Arteaga[1], Bhuvana Lakkasettar Chandrashekar [1], Danieli C Rodrigues[1]

[1] Department of Bioengineering, The University of Texas at Dallas, [2] School of Podiatric Medicine, The University of Texas Rio Grande Valley

Prevalence of osteoporosis is linked to a decrease in estrogen hormones after menopause in women, which induces accelerated bone loss. The microarchitectural deterioration of the bone tissue often leads to a decrease in proliferation of osteoprogenitors that cause an imbalance in bone remodeling mechanisms. High Mobility Group Box 1 (HMGB1) is a DNA binding protein secreted by macrophages during the acute inflammatory response that indirectly regulates cytokine secretion for growth activity as well as the promotion of osteogenic differentiation of mesenchymal stem cells. The goal of this study is to explore the surface performance of this protein in ovariectomized(ovx) rats. We are implementing an injection model of HMGB1 during surgical implantation to evaluate how this protein could enable receptor binding that induces the inflammatory response and healing, improving the osseointegration in accelerated bone loss conditions. Further, in our experimental approach, we use histopathological analyses as well as microCT and immunohistochemistry to quantify bone remodeling and to observe the quality of bone tissue between groups treated or non-treated with HMGB1 at different time points. Future studies of different compromised conditions will allow us to learn more about the role of HMGB1 in the overall healing processes, especially when applied to underlying conditions that are linked to impaired osseointegration of tissues onto biomaterials.

(12)

Investigation of the influence of topography and growth factors on HTK cell wound closure

Stephanie Morgan[1,3], Divya Subramanian[2], Nathaniel Tjahjono[2], David W Schmidtke[2]

[1]Department of Biomedical Engineering, Pratt School of Engineering, Duke University, [2]Department of Bioengineering, The University of Texas at Dallas

The cornea is the trinal transparent anterior most region of the eye. The corneal stroma makes up 90% of the cornea and is made up of orthogonally stacked aligned collagen lamellae, which is interspersed with keratocytes. Following corneal injury, these keratocytes become activated and facilitate the wound healing process. Corneal wound healing is governed by cues such as topography (aligned collagen fibrils) and soluble cues (eg. growth factors) in the corneal microenvironment. Previous work has shown that exposure to platelet-derived growth factor (PDGF) caused keratocytes to align and migrate into a wound along the aligned fibrils. My project aims to assess the influence of topography and soluble growth factors like PDGF in isolation and combination using a Freeze Injury model. To determine the effect of the absence of topography on wound closure, I will use collagen monomers/fibronectin. Previously characterized human corneal keratocytes (HTKs) will be cultured on substrates for 24 hours prior to the creation of a freeze injury. To create a Freeze Injury a rod dipped in liquid nitrogen will be held flush against the underside of the substrate and media supplemented with or without (control) PDGF will be added. HTKs will be allowed to migrate into the wound for 48 hours. HTKs will be fixed and fluorescently labeled for F-actin and Nuclei, and the wound size will be measured. Preliminary results indicate that both topography and growth factors are important cues that facilitate wound closure. In future experiments, we will determine the effects of other growth factors.

(13)

CRISPR-Cas13d based method for RNA imaging in live cells.

Paula Phan, Zikun Zhou, Elijah Harbut, Leonidas Bleris

Department of Bioengineering, The University of Texas at Dallas

CRISPR-Cas13 is a powerful tool known to target RNA in cells. Catalytically inactive Cas13d (dCas13d) proteins are capable of innocuously labeling RNA in live cells. Based on previous studies, researchers have utilized dCas13 and the MS2-MCP technique to image cells by modifying messenger RNAs (mRNAs) with MS2 insertions that bind to a fluorescently tagged MCP. However, dCas13 is unable to amplify fluorescent signal at a specific target site and the MCP modified mRNA often requires extensive time to prepare. Thus, we propose a new method that incorporates dCas13d into MS2-MCP methods by targeting single guide RNAs (sgRNAs) than mRNAs to produce a stronger fluorescent signal. To test this method, the plasmids were transfected into HCT116 cells with MUC-4 RNA-targeting sgRNAs. Using fluorescent microscopy, a strong fluorescent signal should be localized in the nucleus, proving that MUC-4 RNA was targeted. Further applications of this experiment can provide the possibility to image non-coding RNAs such as tRNAs, snRNAs, and miRNAs and provide a deeper understanding on the cellular mechanisms of RNA.

(14)

Microfluidic Device to Quantify Neutrophil Migratory Decision-Making in Septic Patients

May Phoo[1], Hossein Razmi Bagtash[2], Caroline N Jones[2]

[1] Department of Biomedical Engineering, The University of Michigan, [2] Department of Bioengineering, The University of Texas at Dallas

Neutrophils are the most abundant type of white blood cells recruited to the site of inflammation during infection. They are coordinated by intermediary chemoattractants and the more dominant chemoattractants

known as the end-target chemoattractants. This migration of neutrophils is disrupted during sepsis. Sepsis occurs when the body has an overreaction to infection causing organ disfunction and often death. Current diagnostic methods measure broad clinical parameters nonspecific to sepsis. Therefore, we designed a microfluidic device to quantify neutrophil migratory decisions in septic patients and examine the expression level of six molecular targets significant to the migratory mechanism. We retrieved the neutrophils that migrated towards each chemoattractant and neutrophils that did not migrate. This was done so that we can measure different types of markers produced by different subpopulations of activated neutrophils towards different signals. Retrieved neutrophils were used for RNA isolation, cDNA synthesis, and finally droplet digital PCR (ddPCR) for measuring the expression level of markers. We optimized the retrieval process using gel loading pipette tips (GLPT) and/or syringe pump with media and/or RNA extraction buffer. Our first hypothesis was confirmed since in healthy subjects, neutrophils showed preferential 34.84% migration towards fMLP (end-target) over 28.83% of LTB4 (intermediary); in septic patients, this migration pattern was disrupted. Understanding the mechanism of dysfunctional neutrophil migration can result in tuning the response towards bacterial clearance and resolution of inflammation. Our second hypothesis was also confirmed as the neutrophils were successfully retrieved from the microchips via GLPT using media so that ddPCR can be performed.

(15)

Investigating the role of ECM stiffness during nephron differentiation in the embryonic kidney

Tasha Rustandi[1], Michael Morales[2], Somdutta Chakraborty[1], Thomas Carroll[2], Victor Varner[1]

[1]Department of Bioengineering, The University of Texas at Dallas,[2]Departments of Internal Medicine (Nephrology) and Molecular Biology, The University of Texas Southwestern Medical Center

The kidney is a highly complex organ that is responsible for eliminating waste and maintaining the homeostasis of fluids in the body. Nephrons are the functional units of the kidney, and each is patterned along the cortical-medullary axis with specific domains fulfilling specific physiological roles. During development, nephrons originate from a population of progenitor cells residing in the nephrogenic zone, but it is not well understood how a nephron is developmentally patterned. Recent work, however, has shown that regional differences in stiffness are present within the embryonic kidney. Changes in stiffness can influence the differentiation of stem cells in culture, but it is unclear if stiffness gradients within the embryonic kidney influence nephron patterning. Here, we used a polyacrylamide (PA) gel system to determine if changes in substratum stiffness influence the differentiation of nephrogenic zone cells (NZCs) isolated from embryonic mouse kidneys. The NZCs were cultured on soft (1 kPa) or stiff (10 kPa) PA substrata that had been functionalized with either vitronectin or collagen V. The cultured cells were then fixed and stained for markers of nephron differentiation, as well as YAP and phospho-YAP immunofluorescence. In addition, we also performed mechanical testing of new preparations of PA to create substrata that more closely match the measured mechanical properties of embryonic kidneys. These data highlight the importance of biophysical cues during embryonic kidney development and suggest that patterns of ECM stiffness may influence nephron differentiation.

(16)

Natural Color Visualization of Hyperspectral Histology Images using Deep Learning

Jeremy Sherey, Ling Ma, Baowei Fei

Department of Bioengineering, The University of Texas at Dallas

Hyperspectral images (HSI) could be a better alternative to RGBs in terms of computer-aided histopathological analysis due to their abundance of spectral information; however, the images cannot be easily displayed without modification. Additionally, visualization of RGB histology images is the most prominent method of diagnosis that pathologists use today. This project aims to synthesize natural color RGBs from hyperspectral histology images through deep learning. High-quality hyperspectral images of hematoxylin and eosin (H&E)-stained histology

slides were acquired using an automated hyperspectral microscopic imaging system. RGB images of the corresponding regions were cropped from the whole-slide digital histology images and registered to the matching hyperspectral images. A five-layer convolutional neural network (CNN) was trained using the co-registered HSI and RGB image patches to synthesize RGBs with natural color. Also, the classification of tumor and normal tissue was implemented using a pre-trained network with the real and synthetic RGBs, respectively, in order to validate the effectiveness of the synthetic RGB. As a result, the average mean square error (MSE) between the synthetic and real RGBs was 0.00351 in the testing group, and the classification had a better AUC and accuracy using the synthetic than using the real RGBs. With the proposed method, pathologists will have access to the high information density of a hyperspectral image and the quality visualization of an RGB with less time to acquire both modalities. These findings enable HSI to replace RGB cameras in pathology and make HSI a viable tool for histopathological diagnosis.

(17)

Polarized Hyperspectral Imaging (PHSI) for ex-vivo and in-vivo Tissue Assessment

Akhila Srinivas, Ling Ma, Baowei Fei

Department of Bioengineering, The University of Texas at Dallas

Linearly and circularly polarized light interactions with biological tissues can reveal integral information regarding tissue structure, while spectral characteristics are closely related to tissue composition. An integration of both modalities in a compact system could better assist tissue assessment. This project aims to develop a polarized hyperspectral imaging (PHSI) system that fulfills both linearly and circularly polarized hyperspectral imaging for *in vivo* and *ex vivo* applications. The system is comprised of a white LED source, two polarizers, two liquid crystal variable retarders, and a hyperspectral camera that operates within the visible spectrum. The system was calibrated and detects full Stokes polarimetry. For analysis of tissue differentiation, fresh *ex vivo* mouse tissue specimens from various organs (liver, spleen, muscle, salivary gland) were imaged. Three measurements, named degree of polarization (DOP), degree of linear polarization (DOLP), and degree of circular polarization (DOCP), were calculated and their respective spectra were generated. A support vector machine (SVM) was trained with the spectra, and it was determined that DOP better differentiates tissue with an achieved accuracy of 86-99%. Additionally, DOCP identified the liver and the spleen, whereas DOLP identified the muscle and the salivary gland. For oxygen saturation measurement, an *in vivo* human finger with and without a blood occlusion was imaged. Preliminary results demonstrated that DOCP results in a greater distinction of oxygen saturation states. These results indicate our system is a feasible modality in distinguishing between optical properties of tissues and shows immense potential in disclosing disease-related information for diverse medical applications.

(18)

Investigating the Release Rate of Doxorubicin in PLA Microcapsules due to Lipid Microbubble Oscillations

Om Vadodaria, Ghazal Rastegar, Shashank R. Sirsi

Department of Bioengineering, The University of Texas at Dallas

Polymeric microcapsules and lipid microbubbles are known to have a notable contribution in the drug delivery field. Both particles have rigid shells, in which the composition of them can be altered. While polymeric microcapsules have an aqueous core, microbubbles differ by possessing a gas core. In addition, both particles can be hit with different intensities of ultrasound waves. Microcapsules are loaded with doxorubicin (DOX) and are hit with these waves. As a result, the polymeric shell destabilizes and releases the DOX into the surroundings. Lipid microbubbles can go into two different states depending on the intensity of the ultrasound waves: stable and inertial cavitation states, which release energy to the surroundings due to oscillation or collapse of the microbubble. This energy has the potential of also breaking open the microcapsules and increasing the release rate of doxorubicin to the surroundings. As a result, DOX loaded PLA microcapsules are mixed with different concentrations of DSPC and DSPE-PEG lipid-coated microbubbles and are hit with the highest ultrasound

intensity of the sonoporator. The destabilization of the polymeric microcapsules and the DOX release rate are investigated due to the energy released by the microbubbles

(19)

Characterization of Engineered Cell Lines Harboring Distinct NAB2-STAT6 Fusions Found in Solitary Fibrous Tumors

Sydney Zacher, John Nguyen, Leonidas Bleris, Heather Hayenga

Department of Bioengineering, The University of Texas at Dallas

Hemangiopericytoma (HPC) also referred to as solitary fibrous tumors (SFTs), depending on the location of first occurrence, is a rare mesenchymal tumor found anywhere in the body. This rare cancer affects 0.06 people per 100,000 each year and has an average life expectancy of 6-13 years and is nonhereditary resulting from environmental factors that induce a genetic mutation. This disease is driven by a fusion mutation between the NAB2 and STAT6 genes located on chromosome 12. The fusion can occur between any of the seven NAB2 exons and twenty-two STAT6 exons. We have utilized Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) technology to generate cell lines harboring a distinct NAB2-STAT6 fusion. Our hypothesis is that the NAB2-STAT6 fusion is the sole driver in oncogenic phenotypes. These phenotypes include, nuclear localization of the fusion protein in both tissue and cell cultures, increased proliferation rates, and overexpression of the Insulin-like Growth Factor 2 (IGF2) gene. We performed a series of cell characterization experiments including immunocytochemistry (ICC), immunohistochemistry (IHC), quantitative polymerase chain reaction (qPCR), proliferation and wound healing assays. These were performed in both cell cultures and xenograft animal models to probe whether a distinct NAB2-STAT6 fusion is the sole driver mutation leading to the formation of SFTs. We have observed STAT6 nuclear localization, increase in proliferation rates, and upregulation of IGF2 gene in our engineered NAB2-STAT6 fusion cell lines as compared to their parent cells. The use of CRISPR to generate disease models of genetic origins creates opportunities for developing therapeutics.

(20)

Transfection Efficiency of Different Reagents in Breast Cancer T47D and MCF7 cell lines

Ayaan Ahmed[1], Siva Siripurapu[2], Allison Haskell[2], Leonidas Bleris[2]

[1] School of Behavioral and Brain Sciences, The University of Texas at Dallas,[2] Bioengineering Department, The University of Texas at Dallas

Breast cancer is the most common cancer for women worldwide. Specific treatments for breast cancer are contingent on the presence of certains receptor such as Human growth (HR), progesterone, and human epidermal growth factor receptor two (HER2). This research will focus on the HR-positive and HER2-negative variety of breast cancer cells by utilizing MCF7 and T47D cell lines. The broader goal of this research project is to be able to edit the genome of the MCF7 and T47D cell lines in the lab to recreate the exact mutations observed in patients and test the effectiveness of cyclin dependent kinase 4 (CDK4) inhibitor drugs on these cells in a controlled laboratory environment. Though MCF7 and T47D cells have been successfully transfected by numerous researchers, it has been documented by both our lab and other researchers of the difficulty involved in transfection with certain reagents and protocols. Therefore a viable transfection reagent must be determined before proceeding with the genome editing. We tested T47D and MCF7 cells using various transfection reagents with the fluorescent reporter mKate2. To analyze the efficiency and viability of the transfection reagents we performed flow cytometry and the fluorescence microscopy.

(21)

Quantifying cells in the central amygdala containing PKC Delta, Somatostatin, and CGRP

Iniya Anandan, Veronica Hong, Heather Allen, Uma Chatterjee, Benedict Kolber

Department of Neuroscience, Center for Advanced Pain Studies, The University of Texas at Dallas

A brain region called the amygdala, specifically the central nucleus of the amygdala (CeA), plays an important role in processing neuropathic pain. With this crucial information in mind, our lab has been working to create an 3D agent-based computational model that will be used to simulate the virtual brain to understand pain-induced behavior. To create a fully functioning pain model of the CeA, we need to first understand the presence of the different cell type specific markers expressed within the CeA. As a part of this project, we used RNAScope to quantify protein kinase C-delta (PKC-delta) and somatostatin (SOM) mRNA in three dimensions. Cells expressing these markers have been shown to modulate pain, which makes these markers a major part of the model. A grid was overlaid on the stained and imaged brain slices to accurately identify the exact number of cells with PKC-delta or SOM and their location in the brain based on the “Allen Reference Atlas”. The wet lab experiments led to quantified results that showed prominent clusters of PKC-delta and SOM all throughout the CeA. To provide an anatomical reference for these cell type specific markers, we also probed the mouse brain for the calcitonin gene-related peptide (CGRP), which is concentrated in the CeC sub-nucleus. In the future, additional samples can be quantified and compared to build a more accurate representation of the cell type specific markers within the CeA, as well as establish a reliable reference model.

(22)

PTSD, Stroke, and Spinal Cord Injury Rehabilitation through Vagus Nerve Stimulation

Sumedhasri Annabathini, Amy Porter, Robert Rennaker

Bioengineering and Sciences Neuroengineering Research Laboratory, TxBDC

Neuroplasticity is the brain’s ability to adjust its connections itself based on experiences. Without this ability, it would be hard for us to learn new information or recover from brain injuries. Plasticity is critically involved in all forms of learning including recovery of function after injury. Events that excite the brain cause the rush of adrenaline causing the vagus nerve to activate. When the vagus nerve is activated, it releases chemicals in the brain which enhances learning. Electrically activating the vagus nerve has been shown to enhance learning and recovery following a brain injury. In the Neuroengineering Lab, the vagus nerve is stimulated to help a patient recover from their brain injury much faster compared to a regular recovery process. We believe that with this process, future rehabilitation processes regarding brain injuries could be much faster and more efficient. However, it is very important that all the steps in this process are done accurately. Once a participant fits all the inclusion criteria, they will go through a set of doctor visits to record their progress. The first two visits are to see where the participants' starting point is. For the third visit, the chip is inserted into the vagus nerve. The visits following the surgery are all focused on tracking the progress of the participants' rehabilitation. After the detailed analysis of the data, it was seen that the patients who underwent the experiment had all shown improvement in their process.

(23)

Biomimetic Mineralization of Nicotine-Qβ packaged with CpG to Increase Immunogenicity of Vaccine

Induja Asthigiri, Noora M. Al-Kharji, Jeremiah J. Gassensmith

Department of Chemistry and Biochemistry, The University of Texas at Dallas

Virus-Like Particles (VLPs) are widely used as models for vaccines against infections, therapeutic treatment of chronic diseases, and to combat drug addictions. A vaccine against nicotine addiction (NicQβ) was developed in 2005 by covalently bonding nicotine haptens to bacteriophage Qβ, well-studied VLP that is non-infectious to humans. Phase I clinical trials showed promising results as NicQβ produced nicotine-specific antibodies in human beings. However, NicQβ failed to induce sufficient antibody titers in Phase II trials, as there was no significant difference in abstinence from those vaccinated compared to placebo subjects. This study intends to improve on the previous attempt of developing a nicotine vaccine using NicQβ by enhancing the formulation with CpG and encapsulating the whole system in ZIF-8. The single-stranded DNA oligomer, Class B CpG, is an adjuvant added to vaccine formulations to enhance immune response by increasing the body's B-cell function and uptake. In case of NicQβ, CpG can be encapsulated inside the Qβ capsid to increase the vaccine's protective immunity. This packaging assists to protect the CpG from nuclease degradation. Simply injected into the body, Qβ-CpG does not produce enough antibody titers due to its reduced circulation time, since the system is prone to thermal degradation. In efforts to increase NicQβ's immunogenicity and circulation time, NicQβ-CpG is encapsulated into Zeolitic Imidazolate Frameworks (ZIF-8), a zinc-based metal-organic framework, which has been shown to increase antibody titers due to its prolonged release of the antigen. ZIF provides thermal stability to the vaccine formulation, in addition to resisting stresses of transportation.

(24)

Synthesis and characterization of delafossite type materials (ABO_2)

Julian Barrientez, Nikhil Dhale, Bing Lv

Department of Physics, The University of Texas at Dallas

Oxides are known normally for acting as very poor electric conductors until the discovery of superconductivity above liquid nitrogen temperature in the Cu-based oxides (known as cuprates) has completely changed the landscape of this perspective. Metal oxides, with the delafossite crystal structure and composition ABO_2, are another class of fascinating layered materials exhibiting strongly anisotropic atomic and electronic structures. The crystal structure consists of alternating layers of monovalent A-site cations and edge-sharing BO_6 octahedra. Many of these delafossite compounds are *p*-type semiconducting oxides, where Pt- and Pd-based delafossite compounds exhibit highly metallic transport behavior comparable with that of copper and gold. The magnetic properties and band gaps of these compounds could be affected by the B-site trivalent metal ions and associated chemical doping, where superconductivity has been predicted to occur in some of these delafossite through chemical doping. Here, we will present synthesis and characterization of two class of delafossites: one conducting $PtCoO_2$, and another pure phase and Mg-doped $CuAlO_2$ to search for superconductivity. The detailed synthesis and their characterization using X-Ray Diffraction (XRD), Scanning Electron Microscope Energy Dispersive X-ray Analysis (SEM-EDX), and low temperature transport measurements with Physical Properties Measurement System (PPMS) will be presented.

(25)

Intravital and Interactive Study of Cardiac Contraction

David Bonilla[1], Xinyuan Zhang[1], Yichen Ding[1,2]

[1] Department of Bioengineering, Erik Jonsson School of Engineering and Computer Science, The University of Texas at Dallas, [2]Hamon Center for Regenerative Science and Medicine, The University of Texas Southwestern Medical Center

As a vertebrate model organism, zebrafish offer a unique potential for *in vivo* study of myocardial infarction and repair. Light-sheet microscopy allows us to investigate the remodeling process of the myocardium following injury in zebrafish embryos, but quantitative analysis of 3-dimensional (3D) local cardiac contraction remains a challenge. In this context, we sought to use our in-house light-sheet microscope to capture the complete cardiac cycle of a zebrafish embryo and reconstruct it in a 4D (3D + time) digital model for analysis of cardiac contractile function. To assess 3D local contractility across the entire heart, we further introduced virtual reality (VR) for an in-depth analysis. Our 3D heart models for each timepoint were constructed through the active contour algorithm and image registration techniques for accurate segmentation of the heart and computation of the cardiac displacement. We then imported the models into Unity for the development of user-directed navigation and manipulation with more interaction in the VR mode. Through the interactive analysis offered in VR, we were able to view the cardiac motion from unconstrained perspectives and measure the ventricular volume. This method enables us to quantify the local contractility in an interactive manner, advancing the understanding of cardiac development and repair in live vertebrate models.

(26)

Potential Drug Screening on SET 7/9 with a Continuous Coupled Fluorescence Assay

Rosalyn Brysch, Teri Douglas, Robert Fick, Gracie Hamilton, Jung-Mo Ahn, Allison Stelling

Department of Chemistry and Biochemistry, The University of Texas at Dallas

In the past few decades, dysregulation of the SET domain lysine methyltransferases has been found to be important in certain cancers. Since discovering this, there has been a push to create drugs that target methyltransferases in an attempt to prevent this dysregulation. However, there are many SET domain methyltransferases and the differences between them are often subtle, making it difficult to target just one. This is problematic considering how important proper methyltransferase function is to cell health. While all SET domain methyltransferases act on lysine, they are still highly selective and different ones will only act on specific lysine residues in certain positions. It remains a challenge to use this recognition in drug design, as synthetic compounds lack the specificity of the biomolecules these methyltransferases naturally bind to. One methyltransferase in particular, SET7/9, acts as an excellent model enzyme for the SET domain methyltransferases. Here, we use a continuous coupled fluorescence assay to screen peptide mimicking (peptidomimetic) compounds using ThioGlo, a dye which fluoresces from enzyme activity. The purpose of this screening is to find inhibitors for SET 7/9. Better enzyme inhibitors will show less fluorescence and therefore flag the peptidomimetic compound as a potential cancer drug.

(27)

Dimensional profiling of sweat dispersion across a wearable biosensor

Eva Burgos, Cornelia Greyling, Shalini Prasad

Department of Bioengineering, The University of Texas at Dallas

Sweat-based biosensing is an up-and-coming field in the healthcare industry. Sweat-based sensing unveils novel noninvasive methods of indicating and monitoring target biomarkers. There are two different types of sweat glands found in humans, eccrine and apocrine. The purpose of eccrine sweat glands, a form of passive

sweat, is to help maintain homeostasis and stabilize body temperature, apocrine sweat glands secrete in response to emotional stimuli. The sweat-based sensor was created with two-electrode sensors and a porous membrane attached in order to assess the sweat rates in specific areas of the human body. The designed sweat-based biosensor functioned off of the passive sweat of the patients. In order to investigate this theoretically, there first needs to be the development of a basic mathematical equation that relates to the dynamics of sweat being absorbed by the sensor. As well as establishing a rate between the volume of sweat excreted in relation to outside humidity. Along with the development of adapting the sensor to target consumer form and fit. To begin, the experiment will first be simulated through COMSOL Multiphysics ® in order to validate the results with the on-bench experiment. The on-bench analysis will be done through colorimetric analysis of the fluid flow of synthetic sweat on the porous membrane. The results will be used as a bench study in order to provide foundational information for future studies. Therefore, the results of this study will help to verify the functionality of biosensor design.

(28)

Reviewing the Electrical Properties of Poly(3-hexylthiophene) for Use in Organic Electronics

Srikar Chamarthi, Branston Mefferd, Ziyuan Ma, Michael Biewer, Mihaela Stefan

Department of Chemistry and Biochemistry

Conjugated polymers contain an alternation of single and double bonds which confers them desirable electronic properties for semiconductor applications. Owing to its intrinsic flexibility, high solubility, facile tunability, and low cost of production compared to the conventional inorganic materials, poly(3-hexylthiophene) (P3HT) became the staple in this industry sector. It has found applications as the active layer in devices such as organic solar cells (OSCs), organic field-effect transistors (OFETs), and displays. For this project, allyl capped P3HT was chosen and characterized. Fourier-Transformed Infrared Spectroscopy (FT-IR) and Nuclear Magnetic Resonance (NMR) were used to confirm the chemical structure and identify functional groups of the polymer. Using solid state UV-Visible Spectrophotometry (UV-Vis), the electrical properties, such as band gap, were investigated. Furthermore, the conductivity of both the iodine doped and undoped allyl-capped P3HT was analyzed using a 4-probe station. The results show that doping P3HT dramatically increased the conductivity as compared to the undoped one. Further investigation will be done to measure the mechanical properties of the polymers and compare these properties to those of other organic polymers for comparison.

(29)

Analysis of Sex-Dependent Differences in Fibroblast Morphology after Activation via TLR-4

Cheri K. Chan, Melissa E. Lenert, Michael D. Burton

Neuroimmunology and Behavior Research Group, Department of Neuroscience, School of Behavioral and Brain Sciences, Center for Advanced Pain Studies, The University of Texas at Dallas

Aim and significance: Understanding the role that specific cell-types have in the development and recovery of pain states is crucial in creating therapeutics to approach chronic pain. Treatments have focused on immune cells as targets, ignoring sex-specific differences that they exhibit in inflammatory pain. Research at the NIB Lab finds that fibroblasts, wound-healing stromal cells that create extracellular matrix, have an important, but not well-defined, role in the body that could overcome sex-specific treatment in inflammation and pain. Toll-like receptor 4 (TLR4) is a protein that responds to lipopolysaccharide (LPS) on gram-negative bacteria. This study looks at how the morphology of fibroblasts activated by LPS via TLR4 impacts their role in inflammatory pain.

Methods: We used male and female mice that were either wild type (WT), had TLR4 restricted to only fibroblasts (FSP1cre-TLR4$^{LoxTB/TB}$), or were TLR4 whole-body knockouts (TLR4$^{LoxTB/TB}$). These mice were injected with LPS (intraplantar) or vehicle. Fibroblasts from paw skin (4 hours post injection) were analyzed using Imaris for changes in cell shape and volume.

Results: Our imaging results showed that after LPS injection, the fibroblasts of male and female mice significantly decreased and increased (respectively) in volume, which could indicate a sex-specific functional difference in response to injury. Furthermore, the fibroblasts of both sexes were less elongated after LPS injection, possibly marking a change in immune function. In behavioral assays, $TLR4^{LoxTB/TB}$ mice had no pain response following LPS injection, as compared to a significantly lower withdrawal threshold (larger pain response) seen in WT mice and FSP1cre-$TLR4^{LoxTB/TB}$ mice.

(30)

PyGNN: AI-Based Python Decompiler with Graph Neural Network

Logan Cheng, Josh Wiedemeier, Kunal Mukherjee, Kangkook Jee

Erik Jonsson School of Engineering and Computer Science, The University of Texas at Dallas

The growth in Python malware coupled with increased demand to reverse engineer malware has placed decompilation at the forefront of software security. However, Python's rapid update cycle causes more complex control flow structures, inducing greater difficulty in decompilation. So far, maintenance overhead remains an issue without an adequately robust solution that popular Python decompilers can implement.

We propose PyGNN, an AI-based Python decompilation system that combats challenges encountered during the decompilation process with 3 neural networks that work jointly to decompile Python code. The Segmentation model employs a BERT language model to divide the bytecode instructions into statement-level chunks. The Translation model then translates a statement-level chunk of the segmented byte code into a corresponding line of source code. Finally, the Control Flow Reconstruction model identifies control flow blocks in the bytecode to correctly format the translation output with a graph neural network which is fed data from the control dependence graph. While current decompilers suffer from labor-intensive maintenance, the implementation of an AI-based solution allows for retraining of the model on new compiler versions. Additionally, a constantly evolving dataset from PyPI and GitHub enables the model to learn new language features. Overall, PyGNN aims to replace existing Python decompilation programs, simplify decompiler maintenance, and provide the groundwork for potential generalization to other dynamic languages.

(31)

Optimizing sensor locations for non-invasive brain-computer interfaces (BCIs) using geometric algorithms

Anand Cheruvu, Ka Yaw Teo, Ovidiu Daescu

Department of Computer Science, The University of Texas at Dallas

Brain-computer interfaces (BCIs) detect and use electrical brain signals to interact with output devices such as computers and robots. BCIs can also be used to stimulate the brain via electrodes to treat neurological disorders. However, to accurately stimulate the brain or translate brain signals into output commands we need to be able to determine where the electrical signals are being transmitted from. Our objective is to devise a computational method to determine the optimal sensor placement for identifying the neural ensembles electrical signals are relayed from. We begin by formulating the problem in two dimensions. Consider a workspace W consisting of an open half-plane bounded by a line L. Workspace W represents the brain, whereas L denotes the surface of the skull and the set of viable locations for sensor placement. Neural ensembles are represented by a set P of points within W. Our goal is to determine a set S of points (sensor locations) on L such that any subset of P can be uniquely identified based on the sum of the reciprocals of their distances to S. This can be seen as a new generalization -- with geometric constraints -- of the problem of constructing a subset-sum-distinct set, which is defined as a set of numbers of which no two subsets have the same sum. Besides its relevance to planning sensor placement for BCIs, our work could be of theoretical interest in computational geometry as well as to other applications such as multi-channel signaling in wireless communication.

(32)

Testing the Rewarding Properties of Right Vagus Nerve Stimulation

Myna Chintapalli, Keziah H. Joy, Ching-Tzu Tseng, Catherine A. Thorn

Department of Neuroscience, The University of Texas at Dallas

Left cervical vagus nerve stimulation (l-VNS) is an FDA-approved treatment for several neurological disorders such as epilepsy and stroke and is thought to induce neuroplasticity. However, there are differences in connectivity between the right and left vagus nerves and the dopaminergic midbrain. This study investigates whether right cervical vagus nerve stimulation (r-VNS) drives dopamine-dependent reinforcement of lever-pressing behavior in rats. Rats were implanted with a cuff electrode around their right vagus nerve and underwent self-administration trials where lever pressing was reinforced by r-VNS. This self-administration period was followed by an extinction period, where no stimulation was provided for a lever press, then by a cue-only reinstatement period. Based on prior work, we hypothesized that rats would readily self-administer r-VNS, indicating that r-VNS has rewarding properties. During the self-administration period, the rats pressed the lever at high rates, consistent with our hypothesis and previous research. However, during the extinction period, the rats continued to lever press at high rates, suggesting that there may have been other factors that influenced the rats' behavior. As we did not fully replicate prior findings, more work is needed to develop a repeatable r-VNS self-administration protocol. If r-VNS can reliably drive dopaminergic signaling, it could provide a novel treatment strategy for neurological diseases in which midbrain function is impaired.

(33)

Acinetobacter baumannii Mutations Lead to Tetracycline Minocycline Resistance, Threatening the Lifetime of Antibiotic Treatments

Deepa Chivukula, Suman Tiwari, Nicholas Dillon

Natural Science & Engineering Research Lab, The University of Texas at Dallas

Acinetobacter baumannii infections have a high mortality rate (55%) due to its propensity for being resistant to commonly used antibiotics. Accordingly, *A. baumannii* has been classified by the WHO as a critical priority bacterial pathogen in the fight against the evolution of antibiotic resistance. Tetracycline minocycline has been one of the most effective treatment options for multi-drug resistant *A. baumannii* infections. However, minocycline resistant *A. baumannii* strains have begun to be detected in the clinic, potentially threatening the long-term utility of the drug. We are seeking to understand how minocycline resistance develops to prolong and enhance minocycline's treatment efficacy. Using systems biology approaches, 30 clinical mutations have been predicted to be associated with minocycline resistance. Utilizing a transposon library each mutation is being analyzed for its role in aiding minocycline resistant strains. We anticipate that mutations could evolve to enhance bacterial fitness, virulence, or resistance. Through defining the mechanisms that *A. baumannii* uses to develop minocycline resistance we hope to be able to create, bacteria resistance can be slowed, allowing antibiotics to successfully kill bacteria and remain a dependable treatment for various bacterial infections. It is imperative to understand how resistance to antibiotics develops as they are the singular most effective treatment for bacterial infections.

(34)

Pinpointing the source of colistin resistance in *A. baumannii*

Reagan Crow, Muneer Yaqub, Nicholas Dillon

Department of Biological Sciences, The University of Texas at Dallas

Acinetobacter baumannii are a gram-negative rod-shaped bacteria known for being an opportunistic nosocomial pathogen with a mortality rate of up to 70%. *A. baumannii* infections are increasingly difficult to treat owing to their high propensity for evolving resistance to commonly used antibiotics. Accordingly, *A.*

baumannii has been identified by the World Health Organization as a critical priority pathogen in the fight against antibiotic resistance. Colistin, otherwise known as polymyxin E, is an antibiotic reserved as a last line of defense for treating multi-drug resistant *A. baumannii*. Unfortunately, we are beginning to detect strains of *A. baumannii* that are also resistant to colistin. We currently do not understand how *A. baumannii* evolves colistin resistance. so effective treatments can be developed. Through utilizing bioinformatics and machine learning approaches, we have identified 31 single-gene mutations associated with colistin resistant *A. baumannii* clinical strains. We are currently analyzing the function of each of the 31 mutations in *A. baumannii* utilizing a constructed *A. baumanii* transposon library. To accomplish this, we are evaluating each strain's ability to thrive in different concentrations of colistin by conducting minimum inhibitory concentration tests. This work seeks to identify the mutations that reduce *A. baumannii*'s susceptibility to colistin as a first step to improve the treatment of this dangerous pathogen in the clinic.

(35)

Effects of Single Nucleotide Polymorphisms (SNPs) on the Behavior of DNA Mismatch Repair Protein, MSH3

Priya Darbha, G. Andrés Cisneros

Department of Chemistry and Biochemistry, The University of Texas at Dallas

Most information contained in our DNA guides complex biological processes that serve to sustain life and thus must be communicated to progeny cells effectively. In humans, the MSH3 gene, which encodes a DNA mismatch repair protein, is one such way that the body ensures that information is propagated correctly. The resulting protein functions by forming the MutSβ heterodimer to correct improperly paired bases, base insertions, and deletions. However, some single nucleotide polymorphisms (SNPs), which are localized mutations in DNA, can lead to the assembly of flawed and potentially dangerous proteins. As a result, ensuring the proper functioning of such DNA repair mechanisms is essential to prevent the accumulation of mutated proteins, some of which may foster the development of cancers and other diseases. For example, previous research from our lab uncovered a link between rs184967 (a missense SNP in the MSH3 gene) and lung cancer. To explore this further, we have performed molecular dynamics (MD) simulations to examine the impact of the Q949R and Q949L SNPs, arising from the aforementioned rs184967 variant, on the MSH3 gene. We predict that the mutations will result in possible structural and dynamical differences with respect to the wild-type MSH3 protein. By inspecting these discrepancies, it may be possible to identify a link between the specific SNP and a potential difference in the function of the protein, which can spark further study into the effects of such varied behavior on its interactions within the human body.

(36)

Predicting Respiratory Episodes Using a Machine Learning Model

Anshuman Das, Glenn Swartzfager, Lakshman Tamil

Department of Electrical & Computer Engineering, The University of Texas at Dallas

Many people find themselves limited by a variety of respiratory conditions that can worsen depending upon weather conditions. Factors such as temperature, humidity, and particulate presence in the air can all contribute towards increased severity of respiratory conditions. Our goal was to develop a mobile app to advise people with said conditions the chances of a respiratory attack in a particular place. We used a machine learning model that was available to us that predicts the onset of a respiratory attack given the weather condition. We incorporated this model into a mobile application that uses an open-source weather API to generate real-time weather data when provided with a zip code. The application was built using the Kotlin programming language. The data from the weather API when used as an input for the machine learning model, it classifies the situation either as normal or a respiratory attack. The result was a smartphone app that allows users to input a zip code and receive advice on whether it is safe for them to travel to a specified location.

(37)

The Bugs in Bug Detectors: An Empirical Investigation of Issues in Static Analysis Tools

Joshua Das, Dakota Soles, Austin Mordahl, Shiyi Wei

Department of Computer Science, The University of Texas at Dallas

Software debugging is a challenging task as programs and their bugs become increasingly complex. Many tools known as “static analyzers” are created to detect bugs, but these tools have bugs of their own. Such bugs can cause the tool to say a dysfunctional program functions correctly, a problematic conclusion with harmful effects. Trying to locate and resolve bugs is crucial as we want static analysis implementations to more correctly identify bugs in software. In this research, we aim to better understand how and why bugs come into existence in such tools. We analyze bugs in 3 popular static analysis tools, FlowDroid, SOOT, and WALA, by looking through bug reports in their respective repositories. Each bug is categorized based on how it was detected, either via a crash or an unexpected result. The latter takes precedence because it is more dangerous for a user to be unaware of incorrect results rather than produce a crash. We further distinguish these bugs based on their root cause. Root causes are defined as a misunderstanding of the underlying analysis algorithm, a misunderstanding of the target language, or an unsound optimization. We identify root causes by reading the original bug report, as well as trying to understand the associated fix. We find that bugs are typically edge cases caused by incorrect assumptions about the language. This leads to the conclusion that there need to be better methodologies for creating and evaluating static analysis tools to ensure that a user is not misinformed by their results.

(38)

Pediatric Head Shape Delineation for Detection of Craniosynostosis

Payson Eberz, Ka Yaw Teo, Ovidiu Daescu

Department of Computer Science, The University of Texas at Dallas

Craniosynostosis is a condition in about 1 in 2,500 newborns where bones in their skull fuse together too early. As the brain grows, it has nowhere to expand to, leading to pressure buildup that can result in blindness, seizures, or brain damage. Diagnosing craniosynostosis early is crucial to properly treating the condition, but the current methods can be unreliable or expensive. Using a digital image of the top of the newborn’s head to diagnose would address both issues. This has been tried in the past using machine learning, but the lack of a large and annotated dataset led to poor accuracy for test images. This study attempts to alleviate that issue by extracting the shape of the newborn’s head as a preprocessing step. With the shape already extracted, both classification and annotation would become easier. We are currently pursuing an image segmentation method that exploits geometric properties and color of the image to delineate the contour of the head. More specifically, we use curve fitting along color intensity profiles to identify edges in the image. With proper application of convexity and curvature, the contour can be identified from the edges. Our current work has shown promise in approximating the shape, and with further research we believe the program could be tuned to identify the shape accurately.

(39)

Role of Hepatocyte Fatty Acid Synthase in the development of Alcohol-associated Fatty Liver Disease

Manahil Firdaus, Keyur Patadia, Lin Jia

Department of Biological Sciences

Alcohol-associated liver disease (AALD), characterized by accumulation of excess fat (triglycerides) in the liver due to overconsumption of alcohol, has become a serious health problem worldwide. Increasing evidence

suggests that the automatic metabolic formation of fat, or endogenous lipogenesis, plays an important role in the development of AALD. Fatty acid synthase (FASN) is the rate-limiting enzyme in lipogenesis that is responsible for synthesizing long chain saturated fatty acids (key components of triglyceride) from acetyl-CoA and malonyl-CoA. Therefore, we hypothesize that hepatocyte FASN deficiency protects mice from AALD. After multiple generations of breeding, we produced mice with the FASN gene between Lox-P sites in the DNA ($FASN^{Fl/Fl}$). By crossing $FASN^{Fl/Fl}$ mice with mice expressing Albumin-Cre, we produced mice lacking the FASN gene in the liver ($FASN^{\Delta Hep}$). Both $FASN^{\Delta Hep}$ and $FASN^{Fl/Fl}$ mice were subjected to either a non-alcohol control or an alcohol binge prior to collecting blood and liver tissue. Surprisingly, we found that $FASN^{\Delta Hep}$ mice showed higher plasma ALT levels, indicating enhanced liver damage. However, similarly elevated hepatic triglyceride contents were observed in both genotypes after alcohol binge. These interesting findings will lead us to investigate whether fatty acid oxidation (FAO) is reduced in alcohol-fed $FASN^{\Delta Hep}$ mice since the increased malonyl-CoA content inhibits FAO and contributes to hepatic fat accumulation. In addition, liver fatty acid content, which is critical in the development of liver injury, will be examined.

(40)

Disordered Tails contribute to Histone Thermal Stability

Sameeha Gazi, Oladimeji S. Olaluwoye and Sheena D'Arcy

Department of Chemistry and Biochemistry, The University of Texas at Dallas

Histone tails are the N- and C-terminal regions of core histones H2A-H2B and H3-H4. These tails are involved in a variety of chromatin functions, including regulating DNA accessibility and nucleosome dynamics. The tails are highly basic, vary in length, and contribute to nucleosome stability. The effect of the tails on the stability of the H2A-H2B dimer and H3-H4 tetramer, however, is yet to be studied in detail. Here, we measure the thermal melting temperature of histones both with and without their N-terminal tails at various salt concentrations. We monitor the fluorescence of SYPRO Orange dye in the presence of histones as the temperature is increased. Fluorescence increases when the histones unfold and expose hydrophobic residues that bind SYPRO Orange. Given the role the N-terminal tails have in regulating the accessibility of the nucleosome and DNA, we expect that the stability of histone complexes lacking their N-terminal tails will be impacted. Furthermore, because high salt concentration is used to refold histones, we also expect that increasing the salt concentrations will increase stability and therefore the melting temperature. These findings will provide important information on how histone N-terminal tails, as well as salt, contribute to the stability of histone complexes.

(41)

alaA Expression in Various Carbon Sources

Christina Gu, Jacob Hogins, Lawrence Reitzer

Department of Biological Sciences

The pyruvate transaminase, *alaA,* plays a large role in the synthesis of the amino acid alanine, an essential molecule in peptidoglycan assembly that helps bacteria maintain the structure of their cell wall. An understanding of the alanine synthesis pathway in bacteria, therefore, is crucial to comprehending the physiology of bacteria. By using restriction enzymes BamHI and AatII to digest a PCR product of our parental genome, we were able to perform a gel purification to isolate the *alaA* promoter. The isolated target sequence was inserted into a recipient plasmid and then transformed into W3110 and alanine transaminase mutants. We examined the role of *alaA* in the alanine biosynthesis pathway by comparing fluorescence curves and growth between various mutants of *E. coli* (all of which are derivatives of K-12 W3110) in several carbon sources. In glucose, alanine stimulated *alaA* expression but in glycerol, both alanine and pyruvate repressed *alaA* expression. Highest levels of expression were shown when cells were grown in glucose with alanine, which was initially surprising as alanine had previously been identified as a repressor of *alaA*. However, we propose that the higher levels of pyruvate generated by glucose in comparison to glycerol explain the seeming discrepancy. Our *alaA* expression studies revealed that the presence of alanine in higher pyruvate generating carbon sources allows for activation of *alaA*, while also highlighting pyruvate's role in the cell's ability to sense alanine.

(42)

Multiplying Matrices with the Power of Multithreading

Mariyam Zaki, Aaryan Gupta

Erik Johnson School of Engineering and Computer Science, The University of Texas at Dallas

The expansion of tech over the past years has helped us in our daily lives. We are able to conduct different tasks in less time because of these advancements. It is all thanks to multithreading. Multithreading is the process where a program can concurrently execute many tasks all under one program. In Short words, Multithreading is just like how we multitask in our everyday tasks. Some real-life examples would be playing video games, Booking tickets, or even something as simple as typing. They all have different processes happening all at once. In this project, we tried multiplying matrices using multithreading. This was using one project with multiple threads working together. The end goal was for the user inputted result to execute with no errors.

(43)

Connecting Phenotypical Outcomes of Antibiotic Resistance with Computational Models of Sequence Evolution

Abraar Haider[1], Adam Davis[1], Sophia Alvarez[1], Faruck Morcos[1,2,3]

[1]Department of Biological Sciences, The University of Texas at Dallas, [2]Center for Systems Biology, The University of Texas at Dallas, [3]Department of Bioengineering, The University of Texas at Dallas

Computational models can be implemented along with experimental techniques to investigate evolutionary changes in protein sequences and structures. We have previously introduced a new model called Sequence Evolution with Epistatic Contributions (SEEC). SEEC predicts the epistatic connections within the evolutionary history of protein sequences through direct coupling analysis (DCA) and a series of calculations using a Hamiltonian quantity derived from the DCA formulation. In addition to utilizing sequencing data to generate predictions for amino acid evolution, we designed a bacterial culture growth plate to observe mutations directly. We inoculated Escherichia coli with gradually increasing amounts of carbenicillin to test the effectiveness of a β-Lactamase plasmid and induce mutations. The β-Lactamase plasmid implanted in our wild-type E. coli severs the β-lactam ring present in the carbenicillin, therefore, allowing bacterial growth. A cuvette growth assay for each inoculated E. Coli picked from the various antibiotic concentrations gives a comparison between their rates of growth. We hypothesize a relationship between increased growth of E. coli bacteria from higher antibiotic concentrations to mutations that lead to increased antibiotic resistance. Through sequencing of bacterial cultures from the cuvette assays, genetic sequences can be juxtaposed with the predictions from SEEC to compare or optimize its predictive capabilities. Future work includes the exploration of protein evolution by creating multiple coexisting lineages within our plate model. Our results will help us understand how proteins evolve to acquire mutations that lead to adaptation to persistent environmental pressures and might lead to constructing better models of protein evolution.

(44)

ConfliBERT – A Multilingual Pretrained Language Model for Political Conflict and Violence

Nathan Garrett Hilburn, Amogha Pokkulandra, Vikas Thoutam, Latifur Khan

Erik Jonsson School of Engineering and Computer Science, The University of Texas at Dallas

Properly analyzing political conflict has been a constant obstruction for political research because of its constantly evolving nature. The specialized text along with metadata (event coding) needed to accurately examine political violence has been the largest contributing factor to this hindrance. Focusing on the resolution of this issue, a pre-trained language model made specifically for the analysis of these texts was created,

named ConfliBERT. However, this language model was limited in terms of its global utility because it was developed only with an English text-corpus, impeding its ability to analyze domain-specific text in other languages which differ in grammar, culture, and other aspects that are lost in simple translation. ConfliBERT 2.0, a similarly pretrained domain-specific language processing model, addresses this issue by generalizing to a multilingual text space. We first gathered news media sources native to non-English speaking countries. For our research, we focused primarily on Spanish. Specifically, we crawled online news sites, and we were able to compile over 1 gigabyte of raw text that was compiled as training data. We then repurposed the English regular expressions of keywords from the first iteration of ConfliBERT. This filtered out text irrelevant to the scope of ConfliBERT. As we continue to grow the text-corpus size, ConfliBERT 2.0 will be a significant step in the direction of a universal political analysis tool.

(45)

Making Alternative Designs Competitive: The Design and Modeling of Vertical Axis Wind Turbines

Renny Hoang, Hossain Sanower, Todd Griffith

Department of Mechanical Engineering, The University of Texas at Dallas

With increasing demand and need for renewable energy alternatives to fossil fuels, the traditional horizontal axis wind turbine (HAWT) is not an all-encompassing solution to the ever-increasing need for more renewable energy. Alternative designs for wind turbines have seen renewed interest from researchers. Vertical axis wind turbines (VAWTs), have numerous differences from HAWTs that make them better suited to particular scenarios: smaller form factors allow VAWTs to be placed in residential areas, a lower center of gravity allows for better floating offshore applications, etc. While HAWTs are more efficient overall, research in VAWTs has nearly bridged the gap in efficiency between the two. Developments in airfoil design, VAWT modeling, and control mechanisms have allowed researchers to better predict and fine-tune the performance of a VAWT. Modeling the performance of VAWTs has become more accessible with the use of MATLAB to leverage pre-existing models. As these models continue to improve and their use increases, VAWTs will provide a valuable supply of renewable energy currently untapped by traditional HAWT designs. This research study is focused on adjusting our use of the CACTUS model to more accurately predict the optimal behavior of differing turbine and airfoil designs. More specifically, by changing/iterating on our operational strategy using past research utilizing the CACTUS model.

(46)

Exploring Binding Between EC12 and the Insecticidal Bt Cry1Ab D3

Syed Abbad Hoda, Jiahe Zhi, Stefanie D. Boyd, Duane D. Winkler

Department of Biological Sciences, The University of Texas at Dallas

Naturally occurring bacteria may possess insecticidal properties. One such microorganism, the soil bacterium *Bacillus thuringiensis* (Bt), fatally targets the *Manduca Sexta*, commonly known as tobacco hornworms. This mechanism occurs due to the Cry1Ab toxin, produced by Bacillus thuringiensis, that binds to the Bt-R1 receptor located in the midgut of the hornworms. When Cry toxins bind to Bt-R1, it activates a signal cascade triggering apoptosis (death). Past analysis shows that the EC12 domain is the smallest toxin binding site (TBS) of the Bt-R1. Prior research on Cry1Ab's toxin family, Cry, has indicated strong evidence for the Cry protein's Domain III (D3) region in binding and insecticidal activity.

Given that Cry proteins share high topological similarities, we can apply these findings to our current research goal: to find the smallest binding fragment in the Cry1Ab toxin that binds to the EC12 receptor by focusing on D3. Following the establishment of a recombinant wild-type Cry1Ab D3 through Gibson assembly, it was amplified and expressed, with subsequent large-scale expression and protein purification. Finally, a nickel pulldown assay between D3 and EC12 occurred to determine a binding ability between the two. Then, we

mutated D3 into F493W D3 to contain a tryptophan amino acid for easier image analysis and repeated the process.

This research is applicable in the world of agriculture and health. Determining the smallest binding domain in Cry1Ab would be significant in helping us understand Cry toxin action on a deeper level and harness our findings for future applications.

(47)

Regulation of YAP by Ceramide in Liver Fibrosis

Allison Huang, Hasmitha Kaminen, Subhajit Maity, Jyoti R. Misra

Department of Biological Sciences, The University of Texas at Dallas

The Hippo signaling pathway plays a critical role in tissue development and homeostasis. This pathway is commonly deregulated in cancer and tissue fibrosis. The Hippo signaling pathway consists of a kinase cascade, in which MST1/2 phosphorylates and activates LATS1/2, which in turn phosphorylates the transcriptional coactivators YAP/TAZ. Phosphorylated YAP/TAZ is sequestered in the cytoplasm, where it is ubiquitinated and degraded. Unphosphorylated TAZ translocates into the nucleus, where it associates with TEAD1-4 transcription factors to regulate target gene expression. In hepatic fibrosis, the hepatic stellate cells are converted into myofibroblasts, which produce excessive amounts of extracellular matrix components. Increased YAP activity is critical for the conversion of the stellate cells into myofibroblasts. Interestingly, the myofibroblasts show increased expression of acid ceramidase, which is supposed to cause a decrease in ceramide levels. Therefore, we tested how ceramide regulates YAP localization. We treated HEP3B cells with different concentrations of ceramide and stained them for YAP/TAZ. Normally, YAP localizes to the nucleus. We observed that higher levels of ceramide completely prevent YAP nuclear localization. Future studies will reveal the molecular mechanism by which ceramide exerts this effect on YAP.

(48)

Proving versatility in game testing using reinforcement learning

Abhay Iyer, Kaelen Raible, Harsh Paswan, Zihe Song

School of Engineering & Computer Science, The University of Texas at Dallas

As the complexity of games increases with every release, the concern for game quality has also increased, which makes regression testing become an important part of game testing. Compared with general software, the complexity and diversity of games make it difficult to apply the existing automated testing techniques, so current games rely more on manual testing and semi-automatic testing (e.g., script testing). Prior research has proven that virtual agents powered by reinforcement learning can be trained to play this game and those agents can be used in tests to determine the existence of any inconsistencies that might harm the overall quality of the game. However, as the game updates and the environment changes, it is uncertain whether reinforcement learning agents can remain stable across regression tests. In this paper, our objective is to detect whether the reinforcement learning agent could maintain performance in various environments without prior knowledge. We improved a Unity AI Shooting Game and continually morphed the testing environment to introduce new environments. With this testing process extended to a randomized environment generator capable of producing up to 2^{22} different arenas, we could compare the agent's relative skills and efficiency from the static training environments to the new testing environments. Per the findings, the Shooter Agent could adapt to the dynamic environment and produced results that displayed high versatility because it worked with similar efficiency in both original and entirely new environments.

(49)

Eye-Blink Conditioning to Evaluate Age Associated Learning and Memory Impairment

Shreya Jagan, Nuhaa Mohammed, RM West, LT Thompson

Aging & Memory Research Laboratory, The University of Texas at Dallas

Eye-blink conditioning (EBC) is a classical conditioning model of learning and memory, involving a conditioned (binaural tone) and unconditioned (corneal air-puff) stimulus, which aims to evaluate neural structures and functions associated with aging. Within this procedure, 60 paired trials of a tone and air-puff elicit eye-blink responses, which are then averaged and used to assess the rates of conditioned learning across age groups. This study explores the effectiveness of EBC in evaluating age-associated learning and memory impairment. We hypothesize that eye-blink conditioning tests evaluate the effects of aging on time-related learning and memory. Subjects ranged from 30-50 years of age, with educational levels above or equivalent to a high school diploma. Subjects also reported average alcohol/nicotine consumption. Several subjects were taking other medications as well. In addition, MMSE scores for cognitive status were also collected. To understand interactions between these variables, we will conduct a two-way analysis of variance (ANOVA), testing one continuous dependent variable and two or more categorical independent variables. The P value will test for significance in the strength between multiple variables. We expect to find impairments in EBC performance with increasing age, and plan to analyze other categorical variables (e.g., sex, educational attainment) on age-related impairments in EBC. Ultimately, this assay may serve as a cost-effective evaluation of age-related learning and memory declines at a potential clinical level.

(50)

Synthesis of 3D Expressive Body Motion from Speech Audio Input

Rishik Kanchanapally, Luke Liu, Jennifer Zhang, Hamza Daruger, Xiaohu Guo

Department of Computer Science, The University of Texas at Dallas

Talking avatars that can communicate through speech, body motion, and facial expression can be utilized in various applications: guiding users through requesting a refund on a website, teaching children in an interactive manner, and creating playable human-like avatars in video games. Previous research has made progress in synthesizing talking avatars by using neural networks to generate plausible body motions from speech. However, current research models represent body motion using 2D keypoints. An alternative that uses 3D models allows for more realistic visualization of body motion because of its kinetic constraints that help prevent issues such as overlapping body parts and variance in bone length. For the 3D model, we use a modified version of SMPL-X, an expressive body capture model that uses an image and 2D keypoints to compute a model. After testing SMPL-X with short clips, we discovered that it took unseen 2D keypoints into account while generating the pose, which resulted in deformed body models. To counter this, we are modifying the SMPLify-x program to ignore any unseen keypoints. On the speech to body motion synthesis side, we are using FreeMo, a freeform motion generation model that maps audio to body motion using 2D keypoints. Before completely modifying FreeMo into using 3D models for body motion, we are experimenting with our own dataset to train the neural network to infer body motions. Our research is not complete, but we anticipate that speech to body motion synthesis using 3D models will yield better visualization of motion when applied.

(51)

Orphan transmembrane protein *h*TMEM52B's role in human Copper(I) metabolism

Preston Khetsavanh, Mitchell Pope, Gabriele Meloni

Department of Chemistry & Biochemistry, The University of Texas at Dallas

Although present in small quantities, transition metals are trace elements vital to organisms from all kingdoms of life. They are essential for a variety of cellular functions, serving roles as enzyme cofactors (e.g. SuperOxide Dismutase I), as signaling ions (e.g. Cu(I) in neurons), and as integral structural units in metalloproteins. Copper – a trace transition metal – catalyzes a variety of biochemical reactions due to its unique redox properties. In parallel, its distinct redox activity necessitates strict regulation of free copper to prevent oxidative damage and dysregulation. Despite Cu(I)'s both essential and potentially damaging role, the details of its metabolism remain still to be completely understood. *h*TMEM52B, an uncharacterized orphan transmembrane protein, has been hypothesized to be involved in human Cu(I) metabolism due to its enriched content of traditionally Cu(I) coordinating amino acids (e.g. cysteine & methionine). Our project sought to demystify *h*TMEM52B through exploring its role in human Cu(I) metabolism. Using a previously developed recombinant E. coli based expression system, *h*TMEM52B was successfully expressed and purified for subsequent biochemical characterization. UV-Vis spectroscopy was used to probe the Cu(I) binding character of *h*TMEM52B through ligand-metal charge transfer (LMCT) analysis which characterizes Cu(I) binding to sulfur containing amino acids. Lastly, *h*TMEM52B's affinity for Cu(I) was characterized by competition reactions with spectrophotometric Cu(I) binding probes of known affinity. These experiments unambiguously show that *h*TMEM52B is a novel Cu(I) binding transmembrane protein, shedding light on another piece of human Cu(I) metabolism.

(52)

Photoimmunotherapy- image guided surgery of head and neck tumors using hyperspectral imaging

Tyler Kim, Nimit Shah, Girgis Obaid

Department of Bioengineering, The University of Texas at Dallas

Photoimmunotherapy uses an antibody-photosensitizer conjugate, which when irradiated with near-infrared light, can lead to the photo destruction of head and neck cancers by generating reactive molecular species. The main aim of the study is to use a photoimmunoconjugate (PIC) i.e. cetuximab tagged benzoporphyrin derivative (BPD) for photoimmunotherapy and use hyperspectral imaging (HSI), an optical imaging technique that can acquire two-dimensional images and construct three-dimensional figures for image guided surgery. The first objective is to synthesize the PIC and then characterize it using UV-Visible spectroscopy. The second aim is to perform in-vitro experiments to see the efficacy of photoimmunotherapy in producing reactive molecular species using FaDu cells, derived from human head and neck cancers. The in vitro experiments also involve using a flow cytometer to compare the PIC signals of 3 groups of cells; a control, cells treated with PIC, and a negative control. The experiments have shown a significant increase in signal in cells treated with PIC when compared to the control group. The in vivo experiments include implanting the FaDu tumors into J:NU immunocompromised mice. Once the tumors have grown to 5-8 mm in diameter, PIC will be injected intravenously into the mice. The accumulation of the PIC in the mice will be analyzed via fluorescence imaging (PEARL instrument), at various time points. To activate the PIC, the tumor will be irradiated with 690 nm light. After treatment the tumor and other organs of the mice will be harvested and analyzed using hyperspectral imaging.

(53)

Mapping metabolic sensors in the mammary gland

Abhiram Kodali, Sharon Kwende, Purna Joshi

Department of Biological Sciences, The University of Texas at Dallas

Overweight and obesity rates continue to rise globally and over 40% of the United States population is obese. In addition to several health problems related to metabolic dysfunction, obesity is linked to increased risk and adverse prognosis in several cancers including breast cancer. The underlying biology of how excess fat contributes to cancer risk and progression is an area of active investigation. Although research has studied the role of hormones such as estrogen, insulin, and adipokines in obesity-related breast cancer, specific cell types in breast tissue that are affected by obesity and involved in breast cancer are not well defined. To bridge this gap in knowledge, we sought to probe metabolic-sensing cells in the mammary gland that are likely stimulated in obesity. Specifically, we investigated the distribution of cell types in the mammary gland that express Leptin (Lep-R), Insulin (IR), and IGF receptors (IGF-1R) that sense metabolic signals known to be elevated in obesity. Using immunofluorescent staining and imaging on mouse mammary tissue sections, cell-type specific expression and localization of metabolic-sensors with epithelial and adipocyte progenitor markers were analyzed. As we previously found, $PDGFRa^{+}$ adipocyte progenitors, known to differentiate into adipocytes, were confined to the mammary stroma adjacent to mammary epithelial ducts. Notably, we observed specific expression patterns for Lep-R, IR and IGF-1R on epithelial cells as well as stromal cells including $PDGFRa^{+}$ cells. Future studies will focus on investigating changes in metabolic-sensing cells in obese breast cancer models to unravel their contribution to obesity-driven breast tumorigenesis.

(54)

Measuring the Optoelectronic Properties of a Pyrroloisoindole-ethynyl-bithiophene

Allen Liang, Branston Mefferd, Ziyuan Ma, Mihaela Stefan

Department of Chemistry and Biochemistry, The University of Texas at Dallas

When compared to inorganic semiconductors, organic semiconductors offer a plethora of different advantages including flexibility, weight, and potential cost-effectiveness. These advantages allow for applications in the growing fields of organic field effect transistors (OFETs), organic light-emitting diodes (OLEDs), organic solar cells, and more. The concept of semiconducting organic polymers stems from conjugation, the alternation of single and double or triple bonds, which allows delocalized electrons to flow both intramolecularly and intermolecularly, allowing for charge transport and conductivity. Polypyrroles and polythiophenes, specifically, are two of the most common organic semiconducting polymers. The provided materials were poly(3-hexylthiophene) (P3HT) and a polymer of pyrroloisoindole-ethynyl-bithiophene. First, Fourier-Transformed Infrared Spectroscopy (FT-IR) and Nuclear Magnetic Resonance Spectroscopy (NMR) were used to confirm the chemical structure of the polymers. Furthermore, UV-Visible Spectrophotometry (UV-Vis) was employed to investigate the optical properties, while Gel Permeation Chromatography (GPC) revealed the molecular weight and polydispersity index of the materials. Lastly, the conductivity was measured using a four-point probe for both the undoped and iodine vapor-doped polymers. The resistance results showed a lack of conductivity, in contrast to the neat P3HT which showed a value of 3-4 kΩ under these specific conditions.

(55)

#*Body Positivity*: A content analysis of YouTube fatosphere videos

Chisom Mbah, Shayla Holub

Department of Psychology, The University of Texas at Dallas

Social media use has been associated with unhealthy eating habits, self-image issues, and weight bias. Fat stigma is pervasive, especially on social media. The Body Positivity movement was created in an attempt to lessen these biases and idealization of thinness; body positivity encourages acceptance of all bodies, regardless of size. The current project is a content analysis of body-positive content found on YouTube. We anticipated that most videos would positively showcase larger body types (size 6-to-9 on a figure array scale). We also expected messages related to fat acceptance and rejection of fat stigmatization. We selected 25 videos on YouTube using the search term “body positivity” to compile into a playlist. We filtered all videos under four minutes based on those most viewed within the last year. Coders then analyzed the content by socio-demographic, body size attributes, fat acceptance, fat shaming, and the type of body positivity conveyed. In contrast to our expectations, most videos included main characters with thin body sizes (only 5 of the 25 were sizes 6 to 9 on the figure array). We also found that when fatter bodies appeared, they were usually the object of ridicule or fetishized. Last, most of the videos did not focus on fat acceptance but highlighted other aspects of body positivity (24% thin acceptance, 24% curvy acceptance, 12% fat acceptance, 8% body acceptance, 8% skin conditions, 8% skin conditions, and 8% disability). We will further explore the implications of these results and what it means for the #body positivity movement.

(56)

Mental Health In Texas Community Colleges

Lucy Metheny, Denise Williams, Heidi Kane

Department of Psychology, The University of Texas at Dallas

Student mental health and well-being is critical to overall academic success in higher education. The goal of this qualitative study is to assess how community colleges in Texas approach supporting the mental health needs of students, particularly underrepresented students such as low-income students, students of color, and LGBTQ+ students. To support this study, we are conducting a literature review to synthesize the literature regarding interventions and programs to promote and protect student mental health in education to better understand the findings from the qualitative study. The review consists of theories, frameworks, and philosophies of change, an overview of current prevention efforts, and contextual factors that contribute to the success or setbacks with delivering mental health care in an academic environment. By deepening our understanding of the needs and knowing the challenges community colleges face in supporting student mental health, this study will allow us to make recommendations on ways to promote mental health among college students in Texas. Findings from the literature review will be reported and discussed.

(57)

Solving the structure of TEAD1 using MD simulations

Vijval Nataraja, Kira Mills, Hedieh Torabifard

Department of Chemistry and Biochemistry, The University of Texas at Dallas

The TEAD (TEA Domain Transcription Factor) family of proteins can be found in all eukaryotes, prokaryotes, and single-celled organisms, and play a key role in the Hippo signaling pathway, which promotes apoptosis and cell proliferation in order to control organ size and suppress tumors. TEAD proteins are characterized by having a DNA-binding domain at the N-terminus and a protein-binding domain at the C-terminus. TEAD proteins are unable to induce transcription without the respective transcriptional co-activators, the yes-associated protein 1 (YAP) and transcriptional coactivator with PDZ-binding motif (TAZ). Previous research

has been performed to create inhibitors that disrupt interactions of TEAD, which could be used in antineoplastic drugs to treat malignant mesothelioma, ovarian cancer, and cholangiocarcinoma where the YAP1/TAZ-TEAD complex is usually hyper-activated or over-expressed. Currently, researched inhibitors bind to the protein-binding domain and function by outcompeting YAP/TAZ for the same binding pocket. In order to better understand TEAD and improve research into more efficient inhibitors, we set out to model an unsolved region in TEAD1 (Residues 143-214). Utilizing the full structure of a TEAD protein, researchers would be able to develop new inhibitors that target the aforementioned middle region, which would hopefully increase the effectiveness of tumor inhibition. To this end, we performed AlphaFold and molecular dynamics (MD) simulations which provided new insight into the structure of TEAD1, which is expressed in tissues throughout the human body, including in the muscle, heart, and lungs. The AlphaFold model predicted the DNA-binding and protein-binding regions as being similar to previous experimentally determined structures, however, was unable to provide a clear structure for the unsolved region. The subsequent MD simulations; however, have shown promising results with the variable region folding into a more defined structure.

(58)

Development of reward-related behavioral responses in male and female rats

Sasha Oak, Millie Rincon-Cortes

Department of Neuroscience, School of Behavioral and Brain Sciences, The University of Texas at Dallas

Reward-related deficits are present in multiple psychiatric disorders. However, little is known about the development of reward-related responses, including how these may differ in rats of both sexes. This background knowledge would be useful for understanding how these processes may be affected in rodent models relevant to psychiatric disorders. To this end, we tested reward-related responses in developing male and female rats using sucrose consumption, palatable food intake and social play tests at two time-points (prepubertal, adolescence). In the sucrose test, rats are presented with a choice of either a water or a sucrose solution and the amount of these solutions consumed is calculated. In the palatable food intake test, the amount of M&Ms consumed (as determined by changes in weight) during a specific amount of time are measured. In the social play test, observed play behaviors (e.g., pouncing, boxing/wrestling, pinning) are scored in a pair of rats. Previous results in rats suggest that adult females exhibit a pronounced preference for sweet-tasting liquids and food and express more social play behaviors during prepuberty and adolescence. Based on these findings, we hypothesized that female rats would exhibit stronger reward-related behavioral responses in all tests. Our preliminary results show no difference between prepubertal male and female rats in the sucrose, palatable food intake and social play tests. However, these data were obtained using a small number of rats (n=4, pilot study) to determine optimal parameters for future cohorts. Data collection for prepubertal and adolescent cohorts is currently in progress.

(59)

Expression of a novel elongated variant of Aquaporin 4 water channel in the mouse retina

Edwin Philip, Darshan Sapkota

Biological Sciences, School of Natural Sciences and Mathematics, The University of Texas at Dallas

Aquaporin 4 (AQP4) is the most prominent water channel protein within the central nervous system, primarily expressed in astrocytes. It is previously known that the stop codon readthrough of the AQP4 transcript produces a C-terminally elongated variant of the protein (AQP4X) which is exclusively perivascular, and AQP4X has been shown to promote Amyloid β clearance, serving as a protector against Alzheimer's disease. Due to AQP4X's role as a protector in the brain, it can be speculated that the altered protein holds a similar role in the context of the eyes. Here we asked if AQP4X is expressed in the retina and optic nerve, and if so if it is expressed in a specific cell type: Müller glial cells. Using immunofluorescence staining of mice tissue samples, we imaged and identified the expression pattern of AQP4X in the retina and optic nerve. Based on

our data, AQP4X is exclusively perivascular in the retina and optic nerve, and a partial overlap of AQP4X and the Müller glial cell marker suggests that AQP4X is expressed within Müller glial cells in the retina and optic nerve. A better understanding of the mechanisms involved in interactions between AQP4X and Müller glial cells will be helpful in the research of degenerative retinal diseases, many of which directly affect Müller glial cells in both the retina and optic nerve.

(60)

Replicating naturally occurring synthesis of gold encapsulated wrinkled mesoporous silica

Vyshnavi Poruri, A. K. M. Nur Alam Siddiki, Kenneth J. Balkus, Jr.

Department of Chemistry and Biochemistry, The University of Texas at Dallas

Wrinkled mesoporous silica (WMS), which has a flower or dendritic-like morphology, is a porous form of silica The unique structure of WMS has been exploited in many applications, including drug delivery, energy storage, and catalysis. Recently, both WMS and gold nanoparticles encapsulated in WMS (Au@WMS) have been found to occur naturally in Marcellus shale. In this research, WMS and Au@WMS were synthesized and compared to natural silica composites. WMS was synthesized by using surfactant template method. To recreate the Au@WMS, gold nanoparticles were added during the synthesis. The resulting particles were characterized by Transmission electron microscopy (TEM), scanning electron microscopy (SEM), X-ray diffractometers, UV-Visible spectroscopy, and fluorescence spectroscopy. The TEM images confirm the fibrous, conical-shaped outer pores and the presence of gold nanoparticles at the core of wrinkled mesoporous silica. Likewise, the SEM images confirm the mesoporous and dendritic-like structure of its outer surface. Recreating these materials in the lab provides insight into their formation in nature and their potential applications. The biocompatibility and fibrous morphology of WMS coupled with the properties of gold nanoparticles, such as their optical properties and ability to produce heat, make the encapsulation of gold nanomaterials into the WMS potentially valuable for a range of biomedical applications.

(61)

The effects of optogenetic silencing of the locus coeruleus on vagus nerve stimulation-induced enhancement of extinction of conditioned fear in rats

Pranathi Prasanna, Debora Calderon, Christa McIntyre

Department of Neuroscience, The University of Texas at Dallas

Vagus nerve stimulation (VNS) is undergoing clinical trials as a supplement to exposure therapy for post-traumatic stress disorder (PTSD) patients. Elevated emotional arousal results in difficulties extinguishing conditioned fear (CF) of trauma. Paired with a conditioned tone, VNS increases memory consolidation and neural plasticity. Norepinephrine enhances memory consolidation and elevates emotional arousal. This study examines whether VNS-enhanced extinction of CF in rats is mediated by the Locus Coeruleus (LC). A Cre-dependent viral construct expressing the inhibitory opsin ArchT3.0 was infused into the LC of tyrosine hydroxylase-Cre transgenic rats. 4 weeks later, rats were implanted with optic fibers above the LC and a VNS cuff around the vagus nerve. Rats were administered auditory fear conditioning for two days, receiving a 9kHz tone (CF) paired with a footshock. The 3rd day, rats were given a CF response test. Extinction training occurred on the 4th day. During the CF tone, rats received laser light through the optic fibers to activate ArchT during either VNS or sham treatments. Rats were given another CF response test the next day, and a fear recovery test two weeks later. VNS enhanced extinction of CF, compared to sham stimulation, but LC inhibition blocked the enhancement, indicating that inhibition of the LC impairs the efficacy of VNS. Norepinephrine thus likely has a significant role in aiding VNS functionality. Findings from this study can help PTSD patients by better refining VNS treatments through a more nuanced understanding of how VNS works.

(62)

Supercapacitor Cells with Activated Carbon Nanofiber Electrodes for Capacitive Deionization

Venkata Harshitha Pulagam, Erling Beck, Syed Fahad Bin Haque, Masoumeh Tajik Asl, John P. Ferraris

Department of Chemistry and Biochemistry, The University of Texas at Dallas

Attaining fresh, sustainable water is becoming an increasingly major global crisis from both an environmental and humanitarian standpoint. Because of its sustainability and feasibility, capacitive deionization (CDI) has emerged as a promising technique to desalinate water. Supercapacitors are electrochemical energy storage devices that operate by electrostatically adsorbing ions to high surface area electrodes. Such a configuration can be utilized to rapidly characterize electrode materials and their subsequent modifications to assess their suitability for CDI applications. The cell consists of a sodium chloride electrolyte sandwiched between oppositely charged high surface area carbon electrodes. Microporous carbon nanofiber electrodes were obtained by carbonizing precursor fiber mats synthesized from electrospinning polymer blends. Cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) were employed to measure the cell's performance.

(63)

Analysis of brain region specific microglia in the context of alcohol-induced depression

Aditya Purugulla, Shevon Alexander, Michael D. Burton

Department of Neuroscience, The University of Texas at Dallas

Depression is a complex psychiatric disorder involving dysfunction of various neuroimmune cell types in the brain. Previously, our lab has shown sex-specific differences in alcohol-induced pain sensitization. We observed that short-term alcohol consumption facilitated mechanical allodynia in female mice but not male mice. In addition to this, signs of depression were observed in only female mice as well. Microglia, the resident immune cells of the central nervous system (CNS), play a key role in the neuroinflammatory response associated with depression. Preliminary studies indicate activation of microglia in limbic brain regions is involved in the development of depression. Regions of interest include the prefrontal cortex (PFC), anterior cingulate cortex (ACC), hippocampus, and the amygdala. Our focus is to identify preclinical depressive-like behaviors using the forced swim test (FST) and form an initial understanding of which brain regions are responsible for the observed sex–specific depression. We will use image analysis software to analyze microglia morphology. We expect to see an "activated morphology" in microglia in the PFC, ACC, and the hippocampus of alcohol exposed female mice compared to males. This "activated morphology" will be evident through enlarged somas and reduced process lengths. This study highlights the often-neglected effects of low-dose, short-term alcohol exposure and provides incentive for a deeper understanding of its clinical relevance. Future directions for this study include a more thorough analysis of microglia morphology to obtain a more conclusive understanding of the specific brain regions responsible for the sex-specific depression.

(64)

A cross species analysis of the neuroanatomical organization of the mouse, pig, and human dorsal root ganglia

Hasun A. Qavi, Shanjida N. Mim, Stephanie I. Shiers, Theodore J. Price

The University of Texas at Dallas

A large majority of preclinical research in the field of chronic pain relies on the testing of lab animals like mice or rats. However, the translation of pain therapeutics derived from mice or rat studies into humans is often inadequate due to molecular differences in the sensory neurons of the dorsal root ganglia (DRG). These neurons relay nociceptive information to the brain leading to pain, but little is known about the anatomical organization of these cells in the DRG between species. To answer this question, we

stained mouse, pig, and human DRGs with hematoxylin and eosin to visualize neurons and other cells in the DRG and assessed neuronal density, neuronal size, non-neuronal density, and ganglia-to-animal size ratio. We hypothesized that the density of neurons is relative to animal size, but the distribution of neuronal subtypes and non-neuronal cells is drastically different between species. These experiments will be the first to probe the gross neuroanatomy of the DRG in the mouse, pig and human and will provide insight into how the DRG is cellularly organized for future preclinical studies related to species homology.

(65)

Vagus Nerve Stimulation as a Potential Adjunctive Therapy for Improving Auditory Behavior in a Rat Model of Autism

Arjun Raghuram[1], Brendan Williams[1,2], Yuko Tamaoki[1,2], Crystal Engineer[1,2]

[1] *Department of Neuroscience, The University of Texas at Dallas*
[2] *Texas Biomedical Device Center, The University of Texas at Dallas*

Patients with autism spectrum disorder (ASD) typically experience disordered speech processing and difficulty with communication. Such difficulties can only be partially overcome with speech therapy, justifying the need for a more effective treatment to improve sound processing. Vagus nerve stimulation (VNS) drives event-specific plasticity and could pose as an adjunctive therapy to improve the efficacy of traditional speech therapy. Auditory processing deficits, like those seen in individuals with ASD, can be modeled in rodents using prenatal exposure to valproic acid (VPA). VPA-exposed rodents exhibit impaired speech sound discrimination ability. Our study evaluates the hypothesis that sound-paired VNS improves discrimination in an auditory behavioral task. Rats were exposed to either VPA (n=6) or saline (n=4) on embryonic day 12.5. Upon aging to three months old, rats began behavioral training where they learned to nose-poke in response to the target word “Dad” at 60 dB. After training, rats underwent VNS cuff and headcap surgery. Following recovery, rats underwent a speech discrimination task where they discriminated between the target word and five nontarget words differing by consonant. During the task, VPA-exposed rats (n=3; VPA+VNS) received VNS paired with successful nose-pokes. Utilizing a two-sample t-test, it was determined that VPA rats consistently outperformed the two other groups ($p<0.01$). The results of the current study are contrary to what was hypothesized. It is possible that VPA-exposed rodents do not have auditory processing difficulties when speech sounds are presented in silence, but future research would be needed to understand the implications of VPA-exposure on auditory processing.

(66)

NMDA Receptor Signaling Induces Protein Synthesis in a Subset Neurons and Nociceptor Axons in the Spinal Cord

Isha Ravuri, Lauren F. Cook, Molly E. Mitchell, Theodore J. Price

Center for Advanced Pain Studies, Department of Neuroscience, The School of Behavioral and Brain Sciences, The University of Texas at Dallas

Chronic pain is an often-devastating condition with current therapies remaining largely inadequate. The most debilitating symptoms are hypersensitivity and pain that persist well after the initial injury has healed. Both pathological and healthy nociceptive sensitization are forms of long-term plasticity requiring activity-dependent protein synthesis. NMDA receptors are critical drivers of these processes that malfunction in chronic pain. These receptors induce the synthesis of proteins that modify neuronal structure and function to initiate and support long-term nociceptive circuit excitability. Therefore, we aimed to characterize the overall neuronal protein synthesis response to NMDA receptor activation across spinal circuits. We used Fluorescent Noncanonical Amino Acid Tagging or FUNCAT to detect increases in newly synthesized proteins within spinal neurons during NMDA receptor activation. We treated living spinal cord slices with vehicle, 50uM NMDA, or 100uM NMDA for 60 minutes to gauge this response across neurons. Here, we demonstrate that NMDA receptor signaling largely engages protein synthesis in neurons within laminae I-II circuits. Increased FUNCAT signal in these synaptic fields indicates that many of these proteins play important roles in synaptic function. This suggests that NMDA receptor signaling induces protein synthesis in spinal neurons and their processes that primarily receive

inputs from nociceptive C-fibers. This signaling also induced protein synthesis in nociceptor axons innervating the spinal cord. Axonal translation in these fibers may critically contribute to long-term nociceptive circuit excitability and maladaptive plasticity. Overall, our findings are consistent with nociceptor and spinal circuit-specific roles for NMDA receptor-driven protein synthesis in the development of chronic pain.

(67)

Metal-Organic Polyhedra Using Hexaphenylbenzene Derivatives

Isabella Roske, Milinda Senarathna, Ronald Smaldone, Christina Thompson

Department of Chemistry and Biochemistry, The University of Texas at Dallas

Metal-Organic Polyhedra (MOPs) are three-dimensional inorganic-organic hybrid structures constructed from organic linkers and metal ions. Applications for MOPs vary from gas storage and drug delivery to nonlinear optics and data storage; utilizations barely scratching the surface of MOPs' unique inorganic-organic hybrid structure. With the intent of developing a MOP using a hexaphenylbenzene-based isophthalic acid derivative and copper ions, we first synthesized tetraphenylcyclopentadienone. This was then reacted with dimethyl 5-(phenylethyl)isophthalate through a Diels Alder reaction to give a protected form of the desired hexaphenylbenzene product. A final saponification using sodium hydroxide provided our desired product in XX overall yield. Crystallization trials between the tetraphenyl dicarboxylic acid and a copper salt (*e.g*., copper acetate, copper nitrate) are now proceeding. Presently, six trials are underway, and one trial resulted in a microcrystalline copper (II) containing precipitate which was unsuitable for single crystal X-ray analysis. Research will be continued to expand knowledge, application, and creation of MOPs. Due to pending results of crystallization trials, time will tell whether our process works, therefore further trials may be in order. Once the ligands are confirmed, further synthesis and crystallization trials may be established to prove that a MOP structure can be formed from hexaphenylbenzene derivatives and metal ions.

(68)

The Role of ATP-Sensitive Potassium Channels in Preclinical Stress-Induced Migraine Models

Aiswarya Saravanan[1,2], Hao-Ruei Mei[1,2], Gregory Dussor[1,2]

[1]Department of Neuroscience, The University of Texas at Dallas, [2]Center for Advanced Pain Studies, The University of Texas at Dallas

Migraine affects over one billion people worldwide and is one of the most disabling diseases. Symptoms include throbbing pain, photophobia, phonophobia, and nausea, among others. However, little is known about its causes. Previous studies have shown that the opening of K_{ATP} channels has been linked to headache symptoms. We explored this relationship by using levcromakalim and glibenclamide. Levcromakalim acts on K_{ATP} channels and helps relax the vascular muscle. Glibenclamide, a K_{ATP} channel blocker, is a common medication for Type 2 diabetes. We used pre-clinical migraine models that are established in our lab. In these experiments, mice responses were evaluated using Grimace and Von Frey tests. Migraine-like behaviors were induced in the mice through restraint stress for two hours a day for three consecutive days. On the first day post-stress, we performed grimace and von Frey tests to measure their responses. Afterward, we injected them with 30mg/kg glibenclamide and then tested them one hour and three hours after injection. We tested them at multiple time points and did sodium nitroprusside (SNP) injections on day 14. When mice were given glibenclamide before SNP injections, they had higher facial withdrawal thresholds than the vehicle before SNP, which suggests the glibenclamide inhibited the SNP-induced responses. With levcromakalim, animals showed lower facial withdrawal thresholds similar to SNP responses. Higher withdrawal thresholds with glibenclamide treatment indicate the mice were less hypersensitive, showing us that opening K_{ATP} channels influence the development of this behavioral response. This supports the hypothesis that K_{ATP} channels contribute to migraine.

(69)

Brain Masking: Using White Matter Tracts to Understand School-Age Autistic Children

Hamshitha Sasidhar, Meghan R. Swanson

Department of Psychology, The University of Texas at Dallas

Brain masking of Diffusion Magnetic Resonance Imaging (dMRI) isolates the grey and white matter of the brain from surrounding tissue using three-dimensional slicing techniques. Editing brain masks is the initial step in atlas-based diffusion tensor imaging (DTI) tractography. For the current project, we are using ITK-SNAP, a program that uses automatically generated preliminary brain masks from dMRI images. The automated brain mask is then manually segmented in axial, sagittal, and coronal views by inserting missing brain matter and removing unnecessary surrounding tissue. The scan data being processed in this project is from the Infant Brain Imaging Study (IBIS) school-age time point. Participants with and without autism spectrum disorder (ASD) and Down syndrome (DS) are studied. Some of the school-aged participants, aged from 7 to 11 years, are at high likelihood for autism (characterized by having an older sibling with ASD). The MRI scans were collected at one of the four IBIS clinical sites in the United States. Although past research has analyzed neuroimaging data from high-likelihood infants under 24 months of age, IBIS is the first to have longitudinal DTI data starting from infancy and extending into school age. The purpose of this project is to process data that will be used to determine if aberrant white matter development seen during infancy is also present in school age autistic children.

(70)

Scalable Synchronization Techniques for Multicore Systems

Sarvesh Sathish, Neeraj Mittal

Advanced Networking and Dependable Systems Laboratory, The University of Texas at Dallas

With an alarming increase in computing resources, Moore's law states that the number of transistors on a single-core chip will double every two years which supersedes the rate at which CPU cooling techniques can keep up with. Recent advancements suggest an alternative to migrate to multi-core processing units to efficiently use computing services simultaneously and to harness the entire computing power of the machine. With every core having their unique shared memory model, concurrent programs are difficult to write as each thread needs to share data through an interconnected memory model. Failure to effectively distribute cache within CPU resistors lead to a phenomenon known as a "Race Condition". To eliminate race conditions, efficient Mutual Exclusion (ME) algorithms are implemented through locks. A Peterson Lock is used when two concurrent processes attempt to enter the critical section of a given process. Through this work, this poster proposes to apply the concept of a Peterson Lock to a 'n' node binary tree. The tree consists of 'n' Peterson locks on $\log_2(n)$ levels to allow threads to synchronize their actions to effectively distribute data through interlinked memory systems. With this tournament-based data structure, each thread must acquire a lock in each of their respective levels until they reach the root node of the given binary tree. While a Peterson lock is used amongst only two threads, this algorithm is a more advanced variation where it can access any 'n' threads and each thread must only access $\log_2(n)$ locks to enter the critical condition.

(71)

Automated Feature-Aware Benchmark Generation for Static Analysis

Emma Schaumann, Austin Mordahl, Shiyi Wei

Department of Computer Science, The University of Texas at Dallas

Static analysis tools can be useful for finding bugs and security issues in software. However, testing and evaluation of static analyzers can be difficult due to a lack of suitable benchmarks for these tools. Our review of previous literature relating to static analysis revealed that many existing benchmarks used to evaluate static analyzers do not include ground truths, are specific to certain programs, or lack real-world applicability. This can cause evaluation to be inaccurate or ineffective for comparing tools, which could lead to incorrect conclusions about tool effectiveness. Additionally, many benchmarks do not allow testing of features and configuration options specific to static analysis, and these benchmarks can be difficult to find for some programming languages. We propose an automatic approach to benchmark generation that reduces real-world programs to small benchmarks, allowing quick and realistic benchmark generation for static analysis tools in new languages. Given a configurable static analysis tool, this approach reduces an input program through a language-agnostic technique similar to delta debugging, returning a small program for which two configurations of the static analysis tool return different results. The resulting program is a generated benchmark that can be used to test similar features and options in static analysis tools. Our preliminary implementation of this approach has been able to reduce handwritten programs into benchmarks, and integration of this method with JavaScript static analysis tools is in progress. These early results suggest the utility of this technique for future benchmark generation.

(72)

Construction of stable fluorescent strains of uropathogenic *Klebsiella Quasipneumoniae*

Aaliyah Sherfuddin, Sam Cornelius, Ibrahim Salaudeen, Nicole De Nisco

Department of Biological Sciences, The University of Texas at Dallas

Klebsiella spp. is a major cause of urinary tract infections, which affect 150 million people each year worldwide. *Klebsiella quasipneumoniae*, a relatively newly defined species of *Klebsiella*, has been shown to be distinct from *Klebsiella pneumoniae* through its use of distinct pili to attach to bladder epithelial cells. However, because *K. quasipneumoniae* is a relatively new model system, we lack the ability to visualize how *K. quasipneumoniae* interacts with the bladder. The purpose of this work is to construct a *K. quasipneumoniae* strain that constitutively expresses green fluorescent protein (GFP) from the chromosome. We use a multi-step process to chromosomally insert an extremely bright version of the GFP gene (vsfGFP) into *K. quasipneumoniae* strain KqPF9. First, the λ-red system recombinase was introduced to KqPF9 via electroporation and induced to encourage homologous recombination. A positive/negative selection cassette (Kan/RelE) with flanking homology to the chromosomal SHV locus was then transformed into the KqPF9 chromosome. Recombinants were positively selected using kanamycin. We are currently working to replace the Kan/RelE cassette with the gene coding for vstGFP via negative selection. The RelE negative selection system will select against bacteria which have not replaced the Kan/RelE cassette with vsfGFP during homologous recombination. The genotype of the resulting KqPF9::vsfGFP will be confirmed by PCR and the fluorescent phenotype will be confirmed by confocal microscopy. The strain will allow us to actively monitor the pathogenesis of *Klebsiella quasipneumoniae* on bladder epithelial tissue and in mice.

(73)

Formation of Fluoro-bridged Rare-earth-based Metal–Organic Frameworks

Emad Siddiki, Simin Sheybani, Kenneth J. Balkus, Jr.

Department of Chemistry and Biochemistry, The University of Texas at Dallas

Metal–organic frameworks (MOFs) are crystalline and structurally diverse materials composed of both inorganic and organic components. MOFs self-assemble by forming coordination bonds between inorganic metal ions or clusters and multidentate organic linkers. The porosity of MOFs leads to many applications including separations, sensing and drug delivery. Rare-earth metal ions have high coordination numbers and form clusters. MOF crystal growth can be regulated by utilizing modulators. Modulators are small organic molecules that coordinate to the metal ions slowing crystallization. It was recently discovered that RE metal ions can extract fluorine from various organo-fluorine molecules resulting in fluoro-bridged RE clusters.in this research, organo-fluorine modulators such as perfluorhexanoic acid were utilized for the first time to synthesize fluoro-bridged RE-based nonanuclear and trinuclear cluster MOFs. PFAS are extensively used as a surfactant in industrial applications and consumer products. Due to their strong carbon–fluorine bonds they are persistent in the environment. The extraction of fluorine from PFAs by RE metal ions results in formation of fluoro-bridged metal–organic frameworks. The synthesis of a new MOFs will be described. The MOFs were characterized by single crystal X-ray diffraction crystallography, powder X-ray diffraction and energy dispersive X-ray spectroscopy.

(74)

Mixed Reality using the HoloLens 2

Omar Siddiki, Hung-Jui Guo, Balakrishnan Prabhakaran

Erik Jonsson School of Engineering and Computer Science, The University of Texas at Dallas

Mixed reality blends both the virtual and physical worlds to allow for an integrated experience with many new possibilities not previously available. VR or Virtual Reality uses a screen to create an entirely virtual environment around the user. The user is able to interact with the environment using a controller or other similar mediums. AR or Augmented Reality projects virtual objects into the physical world on a screen, these objects can be interacted with, however, only through the AR device itself. Mixed Reality combines these two technologies. It blends holographic objects into the environment by taking input from the environment. These objects can be interacted with in real-time. This is done through both gaze and hand tracking allowing users to use their physical body to interact with virtual objects. The HoloLens 2 also contain the ability to create spatial anchors. This allows for the creation of persistent objects that will stay at the same location even when viewed by different users. Using the Mixed Reality Tool Kit 2.7 (MRTK) allowed me to develop programs using the Unity engine for the HoloLens 2. I was then able to use the HoloLens 2 Emulator to virtualize a HoloLens 2 on my computer allowing me to test my programs. This allowed me to experiment with the basics of 3D object interactions, grids, and intelligent object tracking.

(75)

Analysis of the Fallopian Tube Microenvironment in a *Pdgfra* reporter mouse model

Zaara Siddiki, Umar Patel and Purna Joshi

Department of Biological Sciences, The University of Texas at Dallas

High-Grade Serous Carcinoma (HGSC) is the most common and aggressive form of ovarian cancer. Accumulating evidence points to the fallopian tube rather than the ovary as the site of HGSC origin. Thus, research has focused on studying the involvement of fallopian tube epithelial cells in HGSC. Aside from the parenchymal epithelium, the fallopian tube is also home to a variety of stromal cell lineages including

mesenchymal cells. However, the identity and role of mesenchymal cells in fallopian tube biology and cancer are poorly understood. Platelet Derived Growth Factor Receptor Alpha (PDGFRα), a marker of mesenchymal cells in diverse tissues, has been associated with aggressive disease and poor prognosis in HGSC patients. To begin to understand the role of PDGFRα^{+} cells in the normal and cancer fallopian tube, the objective of this research was to define the expression of PDGFRα alongside epithelial markers in the fallopian tube. We employed a Pdgfrα$^{H2B\text{-}GFP}$ reporter mouse model in which GFP fluorescence represents endogenous Pdgfrα gene expression. Fallopian tube tissues isolated from these mice were analyzed by immunofluorescent staining for GFP and markers specific to epithelial and mesenchymal cells. We found that both endogenous Pdgfrα expression and PDGFRα membrane receptor protein localized to the stromal compartment adjacent to Pax8^{+} secretory and TUBB4^{+} ciliated epithelial cells in the fallopian tube. Future studies will examine the contribution of PDGFRα^{+} mesenchymal cells to fallopian tube epithelial dynamics and cancer pathogenesis. Identification of the role of PDGFRα^{+} cells will enable novel targeted screening and therapeutic approaches for HGSC.

(76)

Peer Modeling on Body Image Discontent in Male and Female Young Adults

Sheza Siddiqui, Melissa Heinrich, Shayla Holub

Department of Psychology, The University of Texas at Dallas

The relationship between peer modeling and body image (a person's self-perception of their physical attributes) has rarely been observed in experimental manipulations in male and female young adults. Previous research has found that females show greater concern about peer influences on their body image and their appearance itself relative to males, which could lead to harmful eating habits. The present study investigated how peer modeling affected short-term changes in body image in men and women. Men and women completed measures of their body image and internalization of societal messages about the thin ideal (BESAA, SATAQ-3). Next, they watched a video where a gender-matched peer compared themselves to models in clothing advertisements while making positive, negative, or neutral body image remarks about themselves. We measured body image again following the video. Men reported significantly lower internalization of societal messages about the thin ideal than women ($F(1, 76) = 10.53$, $p = .002$). There were no significant differences in weight body esteem for all conditions measured in both genders due to the experimental intervention alone. Further, males and females were not differentially impacted by the peer modeling manipulation. Results suggest that males may respond less to societal influences relative to their female counterparts, but no notable gender differences in peer modeling were found. Future work should investigate other factors that do impact male body image, such as internalization of ideal body types perpetuated by family and close friends.

(77)

Pipeline to Track Fluorescent protein expression in Time Lapse Microscopy of Mammalian cells

Siva Siripurapu[1], Ayaan Ahmed[2], Taek Kang[1], Leonidas Bleris[1]

[1] *Bioengineering Department, The University of Texas at Dallas*
[2] *School of Behavioral and Brain Sciences, The University of Texas at Dallas*

Monitoring the dynamics of gene expression of a single cell over time can offer valuable data and insights. However, due to the large size of the data and the complexity of the mammalian cell morphology, automating this analysis is difficult. To address this issue, we developed a software pipeline that employs a Trackmate-Stardist program and utilizes time lapse images taken from fluorescence microscopy. We configured the Trackmate-Stardist program and implemented post-processing algorithms to optimize the pipeline's tracking of fluorescent reporter expression in mammalian cells. After data collection, the pipeline sorts and filters the data to generate graphs as desired by the researcher. To demonstrate the utility of our pipeline, we analyzed fluorescent reporter expression under the control of microRNA (miRNA). MiRNAs regulate gene expression by binding with messenger RNA (mRNA) via sequence complementarity, inhibiting translation of the target mRNA.

Our pipeline was tested on an experiment featuring mammalian cells that naturally express both mkate2 and TagCFP being transfected with variable concentrations of miR-128, a microRNA that inhibits the production of only the mKate2 fluorescent protein.

(78)

Establishing Novel Models to Uncover the Effect of Chronic IL-1 on Breast Cancer Progression.

Aniketh Sudunagunta, Rafah Falah, Nikki Delk

Biological Sciences Department, The University of Texas at Dallas

Breast cancer (BCa) is the second leading cause of cancer-related death amongst females in the nation. BCa relies on the estrogen receptor (ER) for growth and proliferation. Thus, patients undergo therapies that reduce hormone levels or inhibit ER activity, but can develop treatment resistance. We previously discovered that chronic inflammation drives resistance to hormone receptor-targeting therapies in prostate cancer (PCa). Given the similar etiology of BCa and PCa, we hypothesized that chronic inflammation is responsible for BCa treatment resistance.

Inflammation contributes to the body's response to injury and wound-healing. The body senses tumors as wounds and elicits immune cells and cytokines, including interleukin-1 (IL-1), into the tumor microenvironment to kill cancer; however, cancer cells utilize cytokines for survival. We previously discovered acute (e.g., days) exposure to IL-1 selects for ER-positive BCa cells that survive independent of ER. However, acute inflammation is anti-tumorigenic while chronic inflammation is pro-tumorigenic. Therefore, we intend to determine if chronic exposure to IL-1 is advantageous to BCa. We established novel cell-line model systems by exposing ER-positive MCF7 BCa cells to IL-1 family members, IL-1α or IL-1β, for 6 months to create sublines. Quantitative PCR, western blot, and phenotype analyses are used to determine subline response to acute IL-1, ER-targeting therapy, and serum starvation. Our sublines will be used to characterize transcriptomic and epigenetic stability to determine if BCa cell response is stable or transient. Together, our studies will reveal the role of chronic IL-1 on BCa progression to help create treatment strategies for BCa patients.

(79)

Synthetic Processing System: A toolbox of novel secreted enzymes to activate signaling proteins *in vivo*

Leah Sullivan[1], Jaideep Kaur[1], Zain Syed[2], Milcah Taye[1], P. C. Dave P. Dingal[1,3]

[1] Department of Bioengineering, The University of Texas at Dallas, [2]Department of Biology, The University of Texas at Dallas, [3]Center for Systems Biology, The University of Texas at Dallas

The Vg1-Nodal heterodimer are signaling proteins that induce the mesendoderm, a population of cells that arise in the early vertebrate embryo. Without functional Vg1, a zebrafish embryo will not develop a mesoderm and endoderm. In wild-type embryos, Vg1 is activated when it is cleaved by an endogenous enzyme. Our research used mutant zebrafish embryos that lack Vg1 (MVg1) to test a novel set of synthetic enzymes. We developed a synthetic processing (SynPro) system of secreted enzymes that can cleave and thereby control the activity of Vg1. To develop the SynPro system, we engineered enzymes from the *Potyviridae* family – adding signal peptides and removing exposed cysteines and glycosylated asparagines – to allow the enzymes to be functionally secreted *in vivo*. For the engineered enzymes to recognize Vg1, the wild-type Vg1 cleavage site was replaced with a unique peptide sequence that each enzyme can specifically cleave. We then injected zebrafish embryos at the 1-cell stage with Synpro enzyme-Vg1 pairs and scored how many MVg1 embryos successfully developed. We identified new SynPro enzymes that can cleave Vg1 and rescue MVg1 embryos. This suggests that SynPro enzyme-cleaved Vg1 is functional in the mutant MVg1 embryo, allowing the embryo to develop properly. The SynPro enzymes we developed can be used as a tool to dissect vertebrate development by controlling the activity of secreted signaling proteins.

(80)

Rule-Shifting Test to Investigate the Effect of Ethanol Consumption on Cognitive Flexibility in Mice

Sanjana Tata, Yi Luo, Skylar Mendez, Sven Kroener

Cellular Synaptic and Physiology Lab, The University of Texas at Dallas

Alcohol addiction is a chronic disorder characterized by repeating stages of intoxication, withdrawal, and craving. The consumption of alcohol alters the prefrontal cortex, which influences cognitive flexibility: an individual's ability to adapt to new circumstances and make decisions based on their surroundings rather than habit. The loss of cognitive flexibility includes impaired decision-making, possibly contributing to the repeated abuse of alcohol. The rule-shifting test measures cognitive flexibility by analyzing an individual's response to altered circumstances or "rules". We used a rule-shifting test to investigate the effects of ethanol consumption on the cognitive flexibility of mice. Mice were placed in operant boxes for six days a week in 30-minute sessions to consume either 12% ethanol or 5% sucrose. Before they were put in operant boxes, they were placed in a T-maze with the cue present to test for their turn bias. They were then trained to turn against it while ignoring the cue to receive food rewards (first rule). After two months of consuming the solutions in the operant boxes, they were placed in the T-maze again to be trained to turn towards the cue to receive food rewards (second rule). Generally, the ethanol group were either unable to or took more trials to learn the new rule compared to the sucrose group. The mice that consumed 12% ethanol demonstrated a lower level of cognitive flexibility than the mice that consumed 5% sucrose by not adjusting to their changed circumstances. Therefore, alcohol abuse results in decreased cognitive flexibility and impaired decision-making.

(81)

Choosing Composite Materials for a Strong, Cheap, and Green Wind Turbine Blade

Alyssa Tran, Dongyang Cao, Todd Griffith

Griffith Research Group, Department of Mechanical Engineering, The University of Texas at Dallas

Wind turbine blades must be made of materials that are strong and inexpensive. Resultantly, fiberglass epoxy resin composite is the main component of modern blades due to its good properties and low cost. But this may not be the "best" composite available. There are lighter fibers that can be used in more sustainable, recyclable, and cost-efficient blade designs. Also, there are natural fibers and reusable resins that can be used to make decomposable and recyclable blades. In the lab, we manufactured two typical blade composites to analyze their properties. Through vacuum assisted resin transfer molding, we created a unidirectional fiberglass and epoxy resin composite and a biaxial carbon fiber and epoxy resin composite. Then, we ran them through two mechanical tests, which tested the composites' tensile strength and compressive strength." Finally, we compared the scores of the composites to each other and the scores of alternative composites found in external research papers. The properties related to the strength, cost, and sustainability of each composite were compiled into a table. With this information in hand, it is possible for one to weigh the benefits and shortcomings of each composite relative to each other. The data can be used to deduce an opinion of what the "best" composite is. We can also use it to imagine which composite would be most advantageous to use at certain parts of the blade structure. Optimizing this information can greatly reduce wind turbine costs and avoid waste of material.

(82)

Role of glucocorticoids in stress-induced migraine-like behavior in mice

Suhas Vakalapud[1], Ya-Yu Hu[1,2], Gregory Dussor[1,2], Christa McIntyre[1,2]

[1]The Department of Neuroscience, The University of Texas at Dallas, Texas, [2]Center for Advanced Pain Studies, The University of Texas at Dallas, Texas

Migraine is the 2nd most disabling disorder worldwide and it is more common in women. Although there are many different treatments, none of them are 100% effective. Stress is one of the most identified triggers for migraine. Stress leads to the adaptive release of glucocorticoids from the adrenal cortex, preparing an individual for a threatening event, while exposure to repetitive stress leads to sustained elevations in glucocorticoid levels and causes maladaptive effects. Therefore, we hypothesized that glucocorticoids are involved in the mechanism of stress-induced migraine.

We have established a pre-clinical mouse model showing stress-induced migraine-like behaviors and priming to the nitric oxide donor sodium nitroprusside (SNP). We use repetitive restraint stress to induce migraine-like behaviors in both male and female mice. In the present study, we observed changes in their facial expressions using the grimace score and tested their mechanical hypersensitivity using the von Frey test at various time points. The results showed that repetitive stress can induce mechanical hypersensitivity in both male and female mice. Moreover, SNP injections induced mechanical hypersensitivity in stressed mice but not in control mice.

We then measured levels of the glucocorticoid corticosterone (CORT) in blood serum before, during, and after stress in mice. The CORT levels increased during the stress and decreased 1h post-stress in both males and females. Moreover, the fluctuations of CORT in females were higher than males on the 1st stress and 3rd stress day. These results support the hypothesis and may provide a target for development of novel migraine therapies.

(83)

Verifying the Binding Ability of Recombinant Cry1ab

Lavanya Vumma, Jiahe Zhi, Stefanie Boyd, Duane Winkler

Department of Biological Sciences, The University of Texas at Dallas

Using naturally occurring and environmentally safe insecticides protects crop health and prevents food insecurity. The soil bacterium *Bacillus thuringiensis* (Bt) has been used as a natural insecticide for decades due to its ability to fatally target the *Manduca Sexta,* a species of the tobacco hornworm. This mechanism occurs due to the Cry1Ab toxin, produced by the Bacillus thuringiensis, and its ability to bind to the Bt-R1 receptor located in the midgut of the *Manduca Sexta.* When Cry toxins bind to Bt-R1, it activates a signal cascade triggering apoptosis or cell death.

With our research focusing on the binding ability of the Cry1Ab protein, our objective is to verify if recombinant Cry1Ab has the same binding ability as native Cry1Ab. A recombinant Cry1Ab was designed to express high protein levels and allow modifications to be made to Cry1Ab. The Cry1Ab protein was obtained from Bt and inserted into the pEt28a plasmid. The pEt28a plasmid allowed for efficient amplification, expression, purification, and experimentation with a nickel pulldown assay of the recombinant Cry1Ab protein and the BT-R1.

(84)

Identification and Characterization of Chondroitin Sulfate Degradation and Metabolism by Uropathogenic *Proteus Mirabilis*

Serena Zhou[1], Braden Shipman[1], Belle Sharon[1], Philippe Zimmern[2], Nicole De Nisco[1,2]

[1]The University of Texas at Dallas Department of Biological Sciences, [2]The University of Texas Southwestern Medical Center Department of Urology

Urinary tract infection (UTI) is a common bacterial infection that affects around 150 million individuals annually. The glycosaminoglycan (GAG) layer is a layer of proteoglycans, namely chrondroitin sulfate (CS), coating the bladder luminal epithelium. The GAG layer is thought to prevent adherence of UTI-causing bacteria to uroepithelial cells, reducing uropathogen colonization. While screening urinary isolates for GAG degradation ability, we discovered the urpothogenic bacterium Proteus mirabilis (P. mirabilis) can degrade CS and potentially utilize it as a carbon source. Through generating closed genome assemblies of seven P. mirabilis isolates, we identified shared genes cABC I and cABC II. To determine if these genes are required for CS degradation, we employed homologous recombination and sacB negative selection to generate a “knockout” mutant that lacks the cABC I and cABC II loci. Briefly, we amplified two 1 kilobase regions surrounding the targeted genes, cloned via restriction enzyme digestion, and ligated into the pDM4 suicide vector (□pir ori) that encodes both antibiotic resistance and the sacB gene, which is toxic during growth on sucrose. We electroporated this product into Escherichia coli S17 cells and will mate it into Pm1673. Recombinants will be isolated via antibiotic selection, then plated on sucrose to select for loss of the integrated plasmid. Resulting colonies will be screened via PCR for loss of the targeted loci and tested for their ability to degrade CS. Ultimately, we hypothesize that the ability to degrade CS may be a virulence mechanism shared between P. mirabilis strains allowing for urinary tract colonization.

(85)

Reproduction and Doping of $Cs_3Cu_2I_5$ Single Crystals

Kayla B. Cooper[1], Andrew J. Gruber[2], Emily J. Brand[2], Kyle M. McCall[3]

[1]Department of Chemistry, Oglethorpe University, [2]Department of Chemistry and Biochemistry, The University of Texas at Dallas, [3]Department of Materials Science and Engineering, The University of Texas at Dallas

Environmentally friendly luminescent materials are sought to provide a safer, less toxic, option for optoelectronic devices. Stable, non-toxic copper halides have demonstrated bright self-trapped exciton luminescence, with long lifetimes and high quantum yields. Here, we seek to further enhance the self-trapping efficiency of cesium copper iodides by doping the material with silver iodide. First, an evaporation solvent crystallization method of single crystals $Cs_3Cu_2I_5$ was reproduced. At room temperature conditions, precursor materials CuI and CsI were mixed with the solvent DMF in varying size containers. After various lengths of evaporation of each $Cs_3Cu_2I_5$ sample, the techniques of UV – VIS, and photoluminescence spectroscopy were used as characterization and compared to known literature values. $Cs_3Cu_2I_5$ crystals were observed to have bright emissions of about 445nm with excitation of about 315nm, in congruence with literature values, exhibiting potential photoluminescence properties. Following the optimized procedure, samples with 2%, 5%, and 10% doping of AgI were prepared for characterization to observe possible shifts in emission spectra.

(86)

Modeling of Thin Film Semiconductor Conductivity for Oxygen Sensor

Kaelyn Lipscomb[1], Liya Chen[2], Matthew Bergschneider[2], Kyeongjae Cho[2]

[1]Department of Computer Science, Dillard University, [2]Department of Materials Science and Engineering, The University of Texas at Dallas

Biosensors are used to detect biological components. Biosensors can also be indicated as one of the fastest developing sensor-technologies. Blood oxygen level tests measure the amount of oxygen and carbon dioxide in blood. An imbalance of oxygen and CO_2 content in your blood can arise from lungs not working well, indicating sickness, as symptom e.g. of COVID-19 infection. If a person has been infected with COVID-19, it would be beneficial to take blood from the patient to measure the change in current over the biosensor. Using the information found from doing that, the next step would be to detect how much oxygen is in the blood to improve the device. Though many methods exist for the measuring of blood oxygen levels, the variety of biosensors in practice and literature make a great testbed for novel device development by simulation approach. Through Ginestra Simulation Software by Applied Materials ™, we apply such a multiphysics approach to explore potential semiconductor devices and biosensors. By simulating surface level defects, I-V character may allude to effects of surface bound oxygen or CO/CO_2 chemisorbed functional groups. Further development of such techniques with novel semiconductor channel materials could result in high sensitivity biosensors for detection of chemisorbed functional groups.

(87)

High-throughput tensile testing of boron nitride nanowires

Giselle Rodriguez, Brizeida Ojeda, Rodrigo A. Bernal

Department of Mechanical Engineering, The University of Texas at Dallas

Boron Nitride (BN) is a promising material that has high mechanical strength, good resistance to oxidation, and excellent thermal properties. However, in the literature it is uncommon to find information about their mechanical characterization at the nanoscale, unlike other frequently tested nanomaterials (Ag, Au, etc.) making it important to expand on this subject. In the past the tensile testing of nanowires (NWs) has been mainly conducted with the use of nanomanipulators on single NWs, which can be time consuming when intended for statistical quantification. In this work, we present a technique that allows the mechanical testing of multiple aligned BN NWs at the same time. Laser engraving of a PDMS microfluidic chip is performed to make channels for the NWs to align by following the flow on top of a previously treated polymer substrate. A study of the desired speed of the flow is also performed by comparing alignment of the NWs and the width of the channels on the chip. Afterwards, we conducted a tensile test of the substrate which was analyzed through digital image correlation (DIC) in order to find the strain of each individual NW.

(88)

Carbon Nanotube Forest Growth for Sensors and Energy

Bosco S. Rusine, Eunjin Kim, Suh Bokyung, and Gil S. Lee

Department of Electrical Engineering, The University of Texas at Dallas

Growing spin-capable carbon nanotube forests (CNT) is feasible by using the chemical vapor deposition (CVD) technique. Generally, Helium (He) is used as a carrier gas to regulate the environment to inert conditions to avoid hydrogen (C_2) from reacting with (C_2 H_2). Due to the high cost of Helium (He), Nitrogen (N_2) was used to synthesize spinnable CNT forest. In combination with Nitrogen (N_2), and iron (Fe) catalyst is used to maximize the CNT forest growth.

Further investigations can bring favorable advantages and show inexpensive methods of producing long CNT forests at a high rate. Because of CNTs' unique properties, they have many industrial applications such as being used in lithium batteries and supercapacitors.

(89)

Assessment $HF_{0.5}Zr_{0.5}O_2$ (HZO) Ferroelectric capacitors at different temperatures and precursors

Luis Soto, Heber Hernandez-Arriaga, Yongchan Jung, Minjong Lee, Jinhyun Kim, Jiyoung Kim

Department of Materials Science and Engineering, The University of Texas at Dallas

Ferroelectricity in $HF_{0.5}Zr_{0.5}O_2$ (HZO) materials is highly sought out as it is compatible with complementary metal-oxide-semiconductor flow and can show strong ferroelectricity at extremely thin (<10nm) thicknesses. As with many things people seek to improve these materials and notable characterizations to reach a wider range of applications. In this report, we tested and compared Ferroelectric HZO thin films using different precursors and different temperatures in order to see the resistivity of HZO memory capacitors. This test was done on a thin film of Platinum (Pt) with HFO2 deposited (30nm) by atomic layer deposition (ALD) at 150C, 200C and 250C using Ozone (O3), water (H20), Hydrogen Peroxide (H2O2) as precursors. Then did a lift-off process by doing a pattern photolithograph and then deposited 100nm Ruthenium (Ru) by DC sputtering. The differences where then analyzed by evaluating the switching voltages with I-V measurements.

(90)

Predicting the Entropy Forming Ability of Alloys using Machine Learning

Jaelyn Sykes, Cormac Toher

Department of Materials Science and Engineering, The University of Texas at Dallas

Through machine learning with the Python based sci-kit learn libraries, we worked to predict the ability of multi-component compositions to form a high entropy single phase. This can be predicted using the Entropy Forming Ability (EFA) descriptor which is based on the energy distribution of different decorations of the parent lattice. Since there are a great number of different possible combinations, we used previously generated data for two-component and multi-component systems to train these models. We started with a previously trained model that used a set of 56 carbides with a specific set of features. Following that, we successfully extended it to include new features which were found to have a higher importance than the original set. We applied the new features to different systems such as perovskites and silicates, as well as the original carbides. These materials have applications in aerospace and energy-generation technologies, including in high-temperature components of gas turbine energies and in solar cells. We also tested various different machine learning algorithms, and were able to compare various results to identify the best model. This project used the five fold cross validation method to measure the size of the errors.

(91)

Nanomagnet Simulations For Efficient Skyrmion Reservoir Computing

Jingran Tang[1], Peng Zhou[2], Alexander Edwards[1], Joseph Friedman[1]

[1]Department of Electrical and Computer Engineering, Arizona State University, [2]Department of Electrical and Computer Engineering, The University of Texas at Dallas

A magnetic skyrmion texture-based approach is presented to realize the application of reservoir computing in size, weight, and power (SWaP) constrained environments. Reservoir computing allows for simpler application of neuromorphic networks by limiting machine learning and training processes to the readout layer with its reservoir remaining as a fixed, nonlinear system. Nanomagnet reservoirs are simulated under varied conditions to diversify skyrmion behavioral inhomogeneity. Skyrmion reservoirs have demonstrated dynamical responses

to given input current pulses under various initial conditions, leaving it a promising candidate in recurrent neural networks applications.

(92)

Characterization of Electrically Active Defects in Low-Temperature Processed ZnO-based Thin-Film Transistors with Al2O3 gate dielectrics

Santiago Ponciano Valdez, Kian Nawaby, Rodolfo Antonio Rodriguez-Davila, Manuel Quevedo-Lopez, Chadwin Young

Department of Materials Science & Engineering, The University of Texas at Dallas

Semiconductor technology (i.e., integrated circuits) is an ever-evolving field diligently working to increase performance and functionality to improve our livelihoods. Meanwhile, there is a desire to continue to shrink the size of this technology to enable new ways of implementation in everyday life. As part of this shrinkage, the semiconductor industry is working towards stacking functionality on underlying integrated circuits. This stacking – known as 3D monolithic integration (3DMC) – will require relatively low temperature, cleanroom device fabrication using different semiconductors (i.e., not silicon) than what is typically done in high-volume, mainstream semiconductor manufacturing. A critical device type needed for future 3DMC will be thin-film transistors. These non-silicon devices will need to go into the backend of line (BEOL) manufacturing process to facilitate specialized and/or new on-chip functionalities, such as sensors, high-speed input/output, optoelectronics, and power management. However, due to the low temperature fabrication of these BEOL devices compared to conventional integrated circuit devices, new challenges exist in minimizing the creation of electrically active defects (i.e., charge trapping) to achieve the required performance and improve their long-term reliability. These defects, often referred to as traps, can inevitably become barriers to achieving maximum device performance, and can serve as the facilitators of the device failing over time, thereby rendering a loss of operation of the prescribed functionality. Therefore, this research attempts to explore the origins of the traps potentially caused by the low temperature processing and assess their impact on long-term reliability. This is done using various electrical characterization and subsequent data analysis.

(93)

First Principle Calculations and Characterization of $SrIrO_3$

Justine Vidallon[1,2], Himani Mishra[1], Dr. William Vandenberghe[1]

[1] The University of Texas at Dallas, Materials Science and Engineering, [2] Arizona State University, Materials Science and Engineering

$SrIrO_3$ is part of the strong, spin-orbit coupling (SOC) iridate family. SrIrO3 is a materials system that possesses strong competing forces from spin-orbit coupling, crystal-field splitting, and on-site Coulombic interactions (also denoted as the U-parameter). At different on-site Coulombic interactions, $SrIrO_3$ possesses different states. Here, we run first principles calculation using the Vienna Ab initio Simulation Package (VASP) software for electronic and vibronic characterization of the materials system at different strengths of on-site Coulombic interactions (0, 2, and 4 eV). As we increase the Coulombic interaction, the bandgap increases from around 0.6 eV to 0.970 eV as well as shifts from a direct to an indirect bandgap; the type of bandgap changes due to the conduction band minimum (CBM) shifting. The CBM shifts from the gamma point to between the X and gamma points. We have also calculated the phonon dispersion curve, as well as the electronic density of states for $SrIrO_3$.

(94)

Data-enhanced physics-based wake modeling for wind farms

Michael Lingad, Nicolas Burgess

Department of Mechanical Engineering, The University of Texas at Dallas

Low-fidelity analytical engineering models have been used for many years for predicting the expansion of turbine wake flows in the context of wind farm planning, performance evaluation, and the assessment of control strategies for increasing energy production. However, these static models do not account for the dynamics of atmospheric turbulence and its interactions with turbine wake flows. Thus, they tend to underpredict wake recovery leading to errors in predicting power generation and dynamic loads. On the other hand, high-fidelity models that are based on the Navier-Stokes equations capture the complexities of wake turbulence but are computationally expensive. In this project we investigated the efficacy of stochastically forced linearized Navier-Stokes in augmenting the predictions of conventional engineering wake models. Two predictive models are considered: (i) a two-dimensional (2D) model of the fluctuating velocity field cross-sectioned at the hub height of wind turbines; and (ii) a slightly more computationally intensive three-dimensional (3D) model that accounts for the normal dimension to the hub-height plane. Our results demonstrate the flexibility of 2D models in accounting for the yaw misalignments and wake recovery. We also show that their predictions can be enhanced by shaping the input stochastic forcing to match data from high-fidelity models. Our 3D models enable us to capture for several more complicated features of turbine wakes (e.g., curl and ground effects) providing a basis for account for the presence of turbine nacelles and towers. Our findings will aid the development of real-time wind forecasting and control strategies for large-scale wind farms.

(95)

Using Neural Networks to Predict Temperature Distribution of Composite Turbine Blades During Manufacturing

Sarah Eddin[1,2], Runyu Zhang[1], Yingjian Liu[1], Hongbing Lu[1], Dong Qian[1]

[1]Department of Mechanical Engineering, The University of Texas at Dallas, [2]Department of Mechanical Engineering, The University of North Carolina at Charlotte

Vacuum Assisted Resin Infusion Molding (VARIM) is a widely used process for the manufacturing of wind turbine blades. This process is highly temperature sensitive and current physics-based models are too computationally expensive to provide rapid predictions for process optimization. The aim of this project is to develop a data-driven approach to predicting the temperature distribution of the composite blade during the manufacturing process using machine learning. In this approach, convolutional neural networks (CNNs) were employed to determine deep features while long short term memory (LSTM) enabled recurring neural networks (RNN) are being trained to make predictions based on CNN outputs coupled with key processing parameters. The results show that the CNN can produce high accuracy generalizations of the input data, with deep features having about 95% accuracy compared to the ground truth. The LSTM/RNN model, which is under development, can produce predictions based on input process parameters. Future developments in this project are directed toward using new data sets to further train the RNN/LSTM model.

(96)

Effects of Topography on the Performance of Wind Farm in Brazil

Zainab Faheem

Department of Mechanical Engineering, The University of Texas at Dallas

The Brazilian wind farm, Umburana de Cheiro (UMC), has been experiencing repetitive failure of some of its Siemens Gamesa SG132-3.465MW turbines with excessive gearbox oscillation. It has been proposed that the topographical layout of the wind farm has been causing turbulence and variation in wind speeds in the prevailing wind direction thus leading the turbine control system to constantly adjust to the changing wind directions resulting in the premature failure of the gearbox. Supervisory Control and Data Acquisition (SCADA) data collected over several months from the wind farm has been analyzed for patterns and discrepancies in the power production of the wind turbines in relation to the wind speeds and directions. Then, for comparison, numerical simulation analysis was done with the UMC turbines to model the incoming wind profiles to the turbines and how they have been influenced by the topography of the area. From the analysis done so far, it is clear that the topography in the prevailing wind direction causes variation in the velocity boundary layer of the incoming wind. Oscillations in power production has also been observed for specific wind directions and over various wind speeds such that the turbine often performed below its rated power. The analysis also proved that wake interaction of the turbines was not the primary reason for variation in power production as the prevailing wind directions did not result in wake interactions. In addition to this, the data displayed that the prevailing wind tends to oscillate between two major directions and is partially responsible for the power production variation that occurs between the switches in wind directions.

(97)

A Techno-Economic Analysis on Co-Located Wind Energy and Green Hydrogen Plants

Mirabella Herrera

Department of Mechanical Engineering, The University of Texas at Dallas

The goal throughout this program is to use collected data and the REopt optimization tool to find the optimal size of an integrated wind and hydrogen plant for an area in need of hydrogen production. First, we identified the two largest hydrogen-consuming types of industries which are Oil refineries and ammonia production plants. We then collected the locations and hydrogen demands of all refineries and ammonia production plants throughout the United States and plotted them on a map of the United States using leafmap. This allowed us to visualize a select three areas of high hydrogen demand and low hydrogen production. Using the collected data on hydrogen consumption in tons per day and the location of these consumers, by plugging this data into REopt, we can obtain the optimal size of the wind farm and hydrogen plant. The goal of our project is to achieve the production of green hydrogen from wind energy to meet the hydrogen demand. Therefore, we input the three areas and the hydrogen demand in that area into the REopt tool to get the optimal wind farm size.

(98)

Design of Hurricane-Resilient Wind Turbines for the US Offshore Environment

Bradley Humphreys

Department of Mechanical Engineering, The University of Texas at Dallas

The offshore regions around the United States have large untapped wind resources. The gulf coast specifically has high and consistent wind speeds that make this region suitable for large-scale multi-megawatt wind turbines. In this study, the performance of an offshore wind turbine is analyzed in various locations of the Gulf of Mexico. The locations selected for study were chosen by evaluating trade-offs based on port proximity,

water depth, hurricane activity, and average wind speed. The IEA 15 MW reference turbine was simulated using OpenFAST. Using OpenFAST, real world hurricane forces from historical data were used to determine the IEA 15 MW reference turbine's response (which depends on the control system, aerodynamic and structural properties of the turbine). The metrics used to determine the wind turbine blade performance were two Design Load Cases (DLC), DLC 1.4 steady wind with an extreme gust and DLC 6.1 a steady 50-year extreme wind event. After the baseline responses were recorded, the blade of the turbine was redesigned to have 15 degrees offset in the orientation of the carbon fiber layers in the spar cap (the main structural member in the turbine blade) with the intent of creating a bend-twist coupling effect. Bend twist coupling is a passive load alleviation technique. Data from these simulations was collected such as tip deflection, root bending moment, and blade pitch. These were used to assess trade-offs of the turbine blade designs.

(99)

Wake steering of turbines within windfarms – experiments and theoretical modeling

Aminah Sumayyah Hussain[1,2], Emmanuvel Joseph Aju[1], Yaqing Jin[1]

[1] Department of Mechanical Engineering, The University of Texas at Dallas, [2]Department of Mechanical Science and Engineering, The University of Illinois at Urbana Champaign

The objective of this study is to investigate the effect of wake steering on the power output of a subgroup of turbines. Three scaled model turbines were aligned directly downstream of each other. The power outputs of all three turbines were measured independently using a datalogger at 10,000 hertz. Seven different yaws were tested for the first two upstream turbines between the angles of -30 to 30 degrees. Power was measured for 60 seconds after the turbine was yawed. The power output was summed for the group of turbines and averaged over the time domain. The yaw angles of -20 and -20 produced the highest total power output for the turbine group, with a 9% increase in power output compared to the non-yawed case.
In addition to the physical experiment, a low-order wake model was developed using an extension to the Qian-Ishihara wake model which incorporates yaw and wake deflection with the aim of incorporating complex terrain into the model in the future. The new model incorporates a wake deflection term which allows for accurate prediction of the wake deflection caused by the yaw of the turbine. We are planning on implementing complex terrain into this model through pressure gradient effects. Complex terrain introduces a pressure gradient on the wake which causes distortion and deflection which can be modeled.

(100)

Scaled Wind Turbines for Wake Steering via Yaw Control

Joshua Jang

Department of Mechanical Engineering, The University of Texas at Dallas

Wind turbines are at its optimal orientation when the face of the rotor is facing directly in the wind direction. This also means that the wakes generated behind the turbine are greatest and will affect the turbines downstream. To study the effect of the wakes on the total wind farm power production under yawing conditions, we 3D printed the blades and build three scaled wind turbines. Roughness elements were placed at the bottom surface of the test section to develop a turbulent boundary layer. The wind turbines were 0.2m in diameter and were placed 5D apart, one behind another in a column. We yawed the two turbines upstream, T1 and T2, and created a contour plot to find the optimal yaw misalignment angles for both turbines. Most downstream turbine, T3, was not yawed as the wake created by T3 will not affect the total power generated. The code for data acquisition and servo control was developed in NI LabVIEW. By varying the yaw angles of T1 and T2 from -30 degrees to +30 degrees every 10 degrees, the total power generated by the three scaled turbines were measured with the NI USB 6210. The data collected was analyzed to identify the effect of varying yaw angles on the total wind farm power.

(101)

Influence of microstructure during machining of directed energy deposited stainless steel 316L

Jonathan Ramos[1,2]

[1]Department of Mechanical Engineering, The University of Texas at Dallas, [2]Department of Mechanical Engineering, Rutgers University

As renewable wind energy continues to become ever so important, downtime for repairs of metal components is a serious area of concern. A proposed solution to decrease downtime of the turbine is to use directed energy deposition of metals to make on-location repairs. Finite element analysis simulations are useful to analyze the effects of post-processing machining which is necessary to smooth out the geometry of the metal. When simulating this process two levels of complexity are considered. One simulation contains grain structures that were produced using a Kinetic Monte Carlo (KMC) simulation. The KMC simulation predicts grain structures based on a scan path that mimics the directed energy deposited stainless steel 316L process and more accurately represents it on a small scale. The inhomogeneity of the microstructure causes a variation in the size of grains that could produce differing results when compared to the baseline simulation that has homogeneous grains. Once results of the KMC simulation are produced, they are transferred into the simulation software where a Johnson-Cook Plasticity model and Hall-Petch equation are used to describe the yield strength of the material based on the size of the grains, temperature during machining and material properties. Results from the two simulations show that stress and distortion along the Y-direction varies for the same machining process. Microstructure being impactful in the results demonstrates a clear need to increase complexity and introduce more accurate representations of metals to better understand the behavior of additively manufactured metals for potential repair applications.

(102)

Introduction to Digital Twin Modeling and Sensitivity Analysis of a Horizontal Axis Wind Turbine

Robin Reeves

Department of Mechanical Engineering, The University of Texas at Dallas

In the field of wind energy, one very promising avenue for operational decision-making support is to develop a digital twin model for an operating wind turbine. A digital twin model is an aero-servo-elastic model of an actual operating wind turbine, which consists of structural, aerodynamic, and control system specifications such that the structure and behavior of the model accurately represents the measured performance behavior of the turbine in the field. The digital twin model is developed and implemented using the OpenFAST code, which allows us to perform simulations of the turbine's response to varying weather conditions and predict the fatigue, ultimate loads, and power generated over the lifetime of the turbine.
A sensitivity analysis of the model can be conducted by making incremental changes to the input parameters of the digital twin model and performing simulations using the altered model Such analysis allows us to determine which variables in the design of the turbine contribute the most to the uncertainty of the predicted outcome and sensitivity of the turbine output responses. The results of these analyses can be used to validate the digital twin model and facilitate wind farm operators, designers and manufacturers in making decisions to minimize the levelized cost of energy of the turbine and improve the annual energy production (AEP) of the turbine.

(103)

Wind farm flow analysis via sparsity-promoting dynamic mode decomposition

Jonathan Rogers, Armin Zare, Federico Bernardoni, Stefano Leonardi

Department of Mechanical Engineering, The University of Texas at Dallas

We use computational fluid dynamics and modern data-driven analysis tools to investigate terrain-induced irregularities in the performance of a wind turbine in Brazil. Using data collected by the shuttle radar topography mission, we construct a realistically rough terrain model for the high-fidelity large-eddy simulation of the turbulent flow impinging on the turbine at issue. The results of large-eddy simulations provide a detailed picture of the complex velocity and pressure fields surrounding the turbine that is often obscured by the presence of dynamically insignificant velocity and pressure modes. Dynamic mode decomposition and its sparsity promoting variant address this issue via an optimization-based framework for extracting an ordered set of dynamically dominant modes that best represent the underlying physical mechanisms in the formation of the flow. Our preliminary results show that application of sparsity promoting DMD to a sequence of snapshots generated by high-fidelity simulations can indeed identify the dynamically significant events in turbulent flow over the complex terrain. Our ongoing effort is directed at further analysis of the identified modes in comparison with those resulting from flat terrains. We anticipate that this work will uncover key features of rough terrains that should be accounted for in early stages of planning and construction of wind farms.

(104)

Floating Offshore Wind Turbine Emulator

Gabriel Shurtleff, Rachel Perry, Basel Jazzar

Department of Mechanical Engineering, The University of Texas at Dallas

The purpose of this research is to emulate offshore wind turbine in the wind tunnel. By using the Floating Offshore Wind Turbine Emulator (F.O.W.T.E.) we look to mimic the wave of the ocean to study the behaviors of offshore wind turbines as they operate in the field. For the emulator to function, we created a control code to achieve sinusoidal motion profiles that mimic the real motion of the ocean by controlling the code the four degrees of freedom that the emulator currently has. These degrees of freedom are pitch, roll, surge, and heave, and the code controls the angular and linear displacement for each of these motions. We plan to study the effects of the turbine wakes, turbine structure, and power production in a controlled environment and compare the data to an actual dataset from a full-size offshore wind farm. Our focus has been model turbine design and porous disks that simulate the wakes. These models will be placed on top of the emulator and positioned in the boundary layer test section of the UTD's BLAST wind tunnel to study power, force measurements, and wake profiles. Currently, the emulator and motor for the wind turbine are characterized to be used for future tests and experiments. For the future, the emulator and the models will be used to optimize the design and set-up of offshore wind turbine experiments.

(105)

Using functionalized graphene for enhanced mechanical properties of glass fiber composites for wind turbine blades

Gabriel R. Morel Torres[2], Hongbing Lu[1], Ning Bian[1]

[1]Department of Mechanical Engineering, The University of Texas at Dallas, [2]University of Puerto Rico Mayagüez Campus

As the wind energy sector continues to grow, larger turbines are being constructed. Larger turbine sizes also mean the size of turbine blades increases significantly. Wind turbine blades currently manufactured in the industry are made of glass fiber (GF) composites and their service life is around 20-25 years. This increase in size requires turbine blades to have a higher specific strength, enhanced mechanical properties, and lighter

weights. However, such advancements have proven challenging to achieve using conventional methods and materials. The focus of this research is to achieve these objectives using aminated graphene (AG) as a nanofiller in the glass fiber composite. The amine groups from AG can form covalent bonds with epoxy providing stronger bonding strength, which resulted in increased strength of glass fiber composite. AG was mixed with a thermoset two-part epoxy resin system before vacuum infusion molding, the AG-glass fiber/epoxy composite plates were fabricated with the same processing conditions as that does in the industry. The transverse tensile strength and fatigue behavior of AG-glass fiber epoxy composite were investigated experimentally. The results showed that the addition of 0.02 wt.% AG in glass fiber composite yields an 11.6% increase in transverse tensile strength over the reference sample. The preliminary fatigue experiment results showed a sixfold increase in fatigue life of 0.02 wt.% AG-glass fiber composite compared with the reference composite. And the fatigue results translate to an extension of up to 125 years in the service life on wind turbine blades.

(106)

Chaos Through an Ecocultural Lens: Concordance Between Subjective and Objective Measures of Home Chaos in Latinx Families

Rodrigo Bezanilla Davila[1], Dr. Jackie Nelson[2]

[1]Center for Children and Families NSF Research Experiences for Undergraduates, The University of Texas at Dallas, [2]School of Behavioral and Brain Sciences, The University of Texas at Dallas

Chaos in the home, such as noise, disorganization, and a lack of routine can adversely impact family functioning. Research states there are three essential aspects of chaos to consider through an ecocultural lens: 1) subjective, 2) objective, and 3) links to well-being. Although past literature demonstrates the consequences of chaos, research has yet to utilize an ecocultural perspective to examine what chaos means in the Latinx community and whether there is a connection between our objective and subjective measures of this construct among Latinx families. Thus, this study tested the concordance between objective (recordings of noise in the environment) and subjective (parent perception) measures of home chaos.
In a sample of 19 Latinx families, mothers reported on their perceptions of home chaos. Listening devices (LENA) were also utilized in the household to gather critical data on speech and noise in the house. Average family income was $65,000 per year, most families had more than 5 total members in the home, and 100% of the families were Spanish-speaking.
We tested our research question on concordance using partial correlations that controlled for family income and number of children in the home. These demographic factors were related to greater parent-report chaos and percentage of overlapping noise from the LENA recordings. Interestingly, mother-reported chaos was unrelated to all objective measures of noise in the home environment. Results suggest cultural specificity in what mothers perceive to be chaotic, with Latinx cultures differing from past research's portrayal of home chaos as noise and overlapping speech.

(107)

Relation of Preschool Bilingual Spanish-English Language Production and English Reading Comprehension in Third Grade

Enrico L. Di Castro Young[2], Raúl Rojas[1]

[1]School of Behavioral and Brain Sciences, The University of Texas at Dallas, [2]Center for Children and Families NSF Research Experiences for Undergraduates, The University of Texas at Dallas

The population of English learners (ELs) in U.S. public schools continues to increase, including several states where ELs exceed 40 percent. On average, Spanish-speaking ELs exhibit less favorable academic outcomes that may be attributed to early differences in second language acquisition when entering English-speaking schools. The purpose of this study was to identify early predictors of English reading comprehension in 3rd grade based on Spanish and English language production in preschool.

Secondary data from 35 ELs were analyzed including 3rd grade scores from the Measure of Academic Progress (MAP) English Reading test and preschool narrative language sample analysis (LSA) measures including: code switching (CS), grammaticality, and vocabulary in Spanish and English. Multiple linear regression models were used to examine the degree to which bilingual preschool LSA measures explained the variability in 3rd grade English reading comprehension.
The findings indicated that preschool LSA measures in English significantly explained 30% of the variability of 3rd grade English reading comprehension. On the other hand, measures of CS, Grammaticality, and Vocabulary in Spanish did not predict English reading comprehension. Specifically, increased CS during English language production in preschool predicted decreases in 3rd grade English reading comprehension. In addition, increased English grammaticality during preschool trended towards predicting increases in 3rd grade English reading comprehension. Use of these findings could better inform interventions applied to early pre-school language education to better address the academic gap experienced by Spanish-speaking ELs.

(108)

Association between household chaos measures and parental feeding practices.

Kani Mirza, Shayla Holub

Department of Psychology, The University of Texas at Dallas

Family interactions during meals are potent periods for parents to engage in socializing activities with their children, and these feeding practices can be effective instruments into looking into parent-child relationships. Chaos in the house may have an adverse influence on how well children and adolescents function, as well as on the strategies that parents can use during feeding. This study investigated the connections between self-reported chaos and coercive control, structure, and autonomy-supportive feeding behaviors observed amongst mothers and fathers throughout the duration of mealtime. Utilizing LENA recordings and self-reports of family chaos, two raters reviewed transcripts of meals times from four households and coded for coercive controlling feeding practices, structure-related practices, and autonomy-supportive practices. Differences between raters were resolved through discussion. Results suggest correlations found between chaos and maternal coercive control, but not between chaos and paternal coercive control. Mothers who reported greater chaos used more controlling feeding practices. Furthermore, there were correlations connecting chaos and structure-related practices for mothers and fathers, as more chaos was related to greater employment of these feeding practices. Autonomy-supportive practices were solely practiced by the fathers and the use of this practice was limited. In addition, fathers deployed more autonomy-supportive practices in households with less self-reported chaos. There will be further discussion of the implications for child outcomes and future directions for this study.

(109)

Controlling Feeding Practices During Childhood and their Effects on College Students

Ikram Mohamed, Shayla Holub

Department of Psychology, The University of Texas at Dallas

Controlling parental feeding practices are associated with body image concerns and eating disturbance during young adulthood. However, most research on parental feeding practices focuses on mothers more than fathers. The current study examined college students' retrospective reports of their mothers' and fathers' controlling feeding practices as children in association with, their current body image concerns and problematic eating behaviors.. Sixty college students (76% females, Mean Body Mass Index (BMI) =26.3, Range 18-50) completed an online survey in which they reported on their mothers' and fathers' feeding during childhood (5- to 10-years old) and their current body image (body esteem, body dissatisfaction) and problematic eating behaviors (emotional eating, dietary restraint, disinhibited eating, dieting, bulimia). Results suggested that

maternal use of pressure during childhood was related to more emotional and disinhibited eating during young adulthood. Reports of paternal pressure, maternal restriction, and paternal restriction were not related to concurrent body image or eating disturbance. Restriction for weight by both moms and dads was related to dieting, bulimia symptoms, lower body esteem, and body dissatisfaction. Hierarchical regression analyses suggested that restriction for weight by fathers predicted body esteem and body dissatisfaction over and above maternal restriction for weight, gender and body mass index. Although paternal feeding practices have been less often explored, the current study suggests these practices may be important to the etiology of eating disorders.

(110)

Family Mealtimes and Gender Socialization

Giselle Reyes, Shayla Holub

Department of Psychology, The University of Texas at Dallas

Parents are important agents of gender socialization in childhood, and everyday activities like mealtimes can provide such opportunities. For example, parents can convey gender expectations by the types of food and portion sizes they provide children. Much of the research on gender stereotypes around food has focused on adults and adolescents and not on whether gender norms impact food selection for children. In this study, college students completed an online survey where they created meals for a 3- and a 10-year old boy or girl, and answered questions about their motivations behind the types of foods and portion sizes selected for each meal. We hypothesized that meals created for boys would contain larger portion sizes and more meat than meals for girls. The main motivations for choosing foods were expected to be centered on health, nutrition, and convenience, with motivations for girls to be more focused health & nutrition. Results showed no differences in types of food or portion sizes based on child gender for both the 3- and 10-year old meal creation task. There were gender differences in motivations for feeding 3 year old children, but not 10 year old children. Convenience was a more important factor in feeding 3 year old boys than girls. Further research needs to be done surveying parents with young children and of diverse backgrounds to learn more about how parents are feeding their children.

(111)

The Effect of Reported Household Chaos on Parenting Behaviors Among Latine Mothers

Aurora Rochin[1], Jackie Nelson[2]

[1]Center for Children and Families NSF Research Experiences for Undergraduates, The University of Texas at Dallas, [2]School of Behavioral and Brain Sciences, The University of Texas at Dallas

The experience of chaos in the home is plural and not rigidly defined by environmental ambience, disorganization, or unpredictability; however, there is insufficient literature that examines household chaos in different cultural contexts – particularly in non-English speaking households. Household chaos is a stressor that compromises the quality of parenting behaviors, resulting in less responsive, less sensitive, and less stimulating parenting. The current study examines the relationship between household chaos and parenting (warmth & involvement, directiveness, and verbal hostility) among Latine mothers.
In a sample of 19 Latine families from Spanish-speaking households, mothers reported on their perceptions of household chaos using the Confusion, Hubbub, and Order Scale (CHAOS) and characteristics of interactions with their children using an abbreviated version of the Parenting Styles and Dimensions Questionnaire (PSDQ). A Language ENvironment Analysis (LENA) device was worn by children in the home to collect data on the signal-to-noise ratio as an objective measure of chaos. Mothers were primarily from Mexico (80%), children were 58 months old on average, and families reported an average income of $65,600 ($20,000-$180,000).

Parents tended to be warmer with older children and were more directive when there were fewer children present in the home. Greater family income was related to greater perceived chaos. Thus, linear regression analyses controlled for family income, number of children in the home, and child age. Results showed greater mother-reported chaos related to more verbal hostility and marginally less warmth and involvement. Mothers were more directive in homes with lower signal-to-noise ratios.

(112)

Latinx mothers' perceptions of chaos, acculturation, and parenting stress

Paloma E. Salas[1], Jackie A. Nelson[2]

[1]Center for Children and Families NSF Research Experiences for Undergraduates, The University of Texas at Dallas, [2]School of Behavioral and Brain Sciences, The University of Texas at Dallas

Chaotic home environments have been shown in past research to be a key stressor for mothers of young children. However, ecocultural research is needed to understand this association among culturally and linguistically diverse families. The present study examined the relation between Latinx mothers' perceptions of home chaos and their parenting stress, as well as the potential moderating role of acculturative stress. We hypothesized that parents who may be experiencing acculturative stress may feel unsupported as a parent. Participants included 19 Spanish-speaking mothers participating in a larger study of child language and environment noise. Mothers completed questionnaires to report on their perceptions of home chaos using the Chaos Hubbub and Order Scale, their acculturative stress using the Riverside Acculturation Stress Inventory, and their parenting stress using the Parenting Daily Hassles Scale. Average family income was $65,000 per year, and most families had more than 5 total members in the home. A linear regression analysis was applied to explore these relations while controlling for family income, which was positively related to home chaos. We found a significant and positive association between chaos and parenting stress. Consistent with past research, mothers who reported greater home chaos also reported experiencing more parenting stress. However, data did not support the hypothesis that intercultural relations and cultural isolation (aspects of acculturative stress) would moderate the association between chaos and parenting stress.

(113)

Paternal participation and practices during family mealtime

Venise Z. Shaw, Shayla C. Holub

School of Behavioral and Brain Sciences, The University of Texas at Dallas

Mealtime provides an avenue for parent socialization around food. Family mealtime interactions are influenced by routines, rituals, and parent feeding behaviors. To effectively feed children, parents should avoid coercive control (restricting food intake or pressuring children to eat) while providing adequate support for children to be successful. In many two-parent families, mothers take on primary responsibility for meal-related tasks and duties, so most research has focused on maternal feeding practices. Previous research exploring how fathers exert their control or show support to children during meals is scant. Fathers likely play a distinctive role during family meals, and direct or indirect contributions of fathers during mealtime can impact a child's cognitive, social, and emotional development. The current study examined how fathers are involved during family mealtime, specifically, their use of controlling, autonomy-supportive, and structure-related feeding practices. Unobtrusive LENA recordings were coded to assess Hispanic mothers' and fathers' coercive, autonomy-supportive, or structure-related feeding practices during meals. Codes were developed based on previous coding manuals and using a theoretical framework for food-related parenting practices. Sample transcripts from four families with preschool-aged children were coded by two raters. Codes were resolved through discussion. Mothers used more coercive control during meals than fathers. Mothers and fathers used similar amounts of structure-related practices. No mothers engaged in autonomy supportive feeding practices, while two dads infrequently used these practices. Differences in mothers' and fathers' roles and responsibilities during feeding will be discussed to contextualize these findings.

(114)

Latinx Mothers' Home Environments Through an Eco-cultural Lens

Melissa Mendez Ulloa, Jackie A. Nelson

Department of Psychology, The University of Texas at Dallas

Literature shows that everyday routines reflect cultural practices and values. Although some developmental contexts are universally considered chaotic and undesirable for parents and children, it is important to use a cultural lens to appreciate that the daily activities, interactions, and environments in a home may be perceived differently by different people. To gain a better understanding of parents ’perception of home chaos from an eco-cultural lens, we conducted structured qualitative interviews asking Latinx mothers what they perceive to be chaotic and meaningful in their home environment, activities, and routines and how that affects their sense of well-being.

Participants included eight mothers, all Spanish-speaking from Mexico (62.5%) and El Salvador (37.5%), who participated in a larger study on home noise and child language among Spanish-speaking families. Mothers ’ average family income was $63,625 and they had 3 children on average. Interviews took place over the phone at a time selected by each woman and lasted approximately 45 minutes. Interviews were recorded, transcribed, and translated from Spanish to English for thematic coding.

Phenomenological qualitative coding revealed four themes from the mothers ’responses: organization, emotion regulation, support, and family time. When Latinx mothers have strong support, able organization, healthy regulation of emotions, and habitual moments of positive family time, they perceive their home environments as calm, happy places – as opposed to chaotic and out of control. Results will be further discussed in terms of Latinx cultural values, such as the importance of children in every aspect of mothers ’daily efforts.

(115)

Screening, Referral, and Follow Up: Bridging Clinical Service Gaps for Primarily Spanish-Speaking Children

Sandra Banesa Ventura-Lopez[2], Raúl Rojas[1]

[1]School of Behavioral and Brain Sciences, The University of Texas at Dallas, [2]Center for Children and Families NSF Research Experiences for Undergraduates, The University of Texas at Dallas

Evidence has shown that early and accurate screening dramatically improves children’s developmental outcomes. The Ages and Stages Questionnaire-3 (ASQ-3) is a widely administered developmental screening tool available in English and Spanish. Although the importance of developmental screening is well established for monolingual English-speaking children, there is a need to better understand the accuracy and impact of screenings on primarily Spanish-speaking children who are acquiring English as a second language. The Center for Children and Families (CCF) has administered developmental screenings, including the ASQ-3, to hundreds of Spanish-speaking children across the DFW metroplex. The purpose of this study was to determine the patterns of follow-up exhibited by families whose children’s performance on the ASQ-3 was of developmental concern, and what factors influenced these patterns.

Referrals for speech and language evaluations were provided to families whose children failed the communication area of the ASQ-3. Additionally, families were given pre-screening tools and techniques to support their child’s development. This study examined CCF follow-up data from 2018 to 2021 that included the families of 659 children. A total of 101 children failed the communication area, of which more than half (59.4%) were followed up with a referral. Given that there is a substantial number of children who fail this screening and approximately 40% that do not follow up on referrals, understanding the patterns that limit families from accessing tools to help the child’s development is vital to their healthy development.

(116)

Retrograde Viral Tracing of Neural Pathways from the Central Nucleus of the Amygdala to Various Brain Regions

Amulya Bhaskara[1], Jonathan Ploski[1,2], Benedict J. Kolber[1]

[1]Department of Neuroscience and the Center for Advanced Pain Studies, University of Texas at Dallas, Richardson, TX [2]Pennsylvania State University School of Medicine, Hershey, PA

The central nucleus of the amygdala (CeA) is implicated in the pain and stress response pathways of the brain, and it has been known to communicate with a number of brain different regions. Many studies exploring these connections focus on anterograde tracing of neural pathways looking primarily into communication originating from the CeA and extending into these other regions. In this project, we sought to confirm these known projections using retrograde tracers. By replicating the methods of retrograde neural tracing studies done to track communication like this from the final destination rather than the starting point, we hypothesize that we can pinpoint the exact coordinates of each region that receive pain signals from the CeA. The three regions we focused on are the substantia innominata (SI), zona incerta (ZI), and the bed nucleus of the striate terminalis (BNST). In this study, we used precise injections of AAV-ret-CMV-GFP virus in these areas, alongside fluorescent Cholera Toxin Subunit B (CTB), to test virus efficacy, region coordinates, and of course, potential connections. We got a series of curious results from our efforts over the past summer and past year, and this summary focuses on those findings, along with the obstacles encountered and knowledge gained regarding the use of fluorescent virus, stereotaxic injections, and pain signaling. Upon the successful mapping of these CeA pathways, we will move to employ innovative approaches to manipulate each CeA projection pathway to determine each route's role in pain.

(117)

The efficacy of naloxone nanoparticles in opioid antagonism

Mursal Hussein[1], Alejandro Morales[1], and Saadyah Averick[2], Benedict Kolber[1]

[1]Department of Neuroscience, Center for Advanced Pain Studies, The University of Texas at Dallas, TX [2]Alegheny General Hospital, Pittsburgh, PA

The mu opioid receptor is the binding site for opioids such as fentanyl. Opioids are commonly used as analgesics to treat pain. Patients can easily become addicted to these opioids and continue to take them. Opioids produce respiratory depression and dependence among users. Naloxone, a mu-opioid antagonist binds to the mu-opioid receptors and competes with the opioid reducing receptor activation. Naloxone is administered intranasal or intraperitoneal to reverse opioid overdose. The half-life of naloxone is 30-90 minutes while the half-life of fentanyl is 8-10 hours. Since the half-life of fentanyl is greater than the half-life of naloxone the opioid can bind back to the mu-opioid receptor and the user may relapse into respiratory depression. Unfortunately, re-dosing with high concentrations of the antagonist causes severe opioid withdrawal symptoms. We hypothesized that with a novel naloxone nanoparticle, the body would be able to slowly metabolize the opioid while the sustained release of naloxone throughout a period greater than the half-life of the opioid would prevent respiratory depression. To test the analgesic effects of the opioid and the efficacy of the novel naloxone nanoparticle, we used the hot-plate apparatus. We hypothesized that the mice that were given the nanoparticle would exhibit greater thermal nociception when placed on the hot plate (due to inhibition of fentanyl antinociception) and would exhibit a lower % Maximum Potential Effect (%MPE) of fentanyl compared to free naloxone or saline.

(118)

Evaluating the Analgesic Potential of a Cameroonian Natural Product

Alejandro Morales[1], Connor Criswell[1], Télesphore Ngeulefack[2], Benedict Kolber[1]

[1]Center for Advanced Pain studies, School of Behavioral and Brain Sciences, The University of Texas at Dallas [2]University of Dschang, Dschang, Cameroon

Chronic pain management is dominated by opioid prescriptions and their accompanying deleterious side effects. The most problematic aspect of an opioid-based approach is addiction, which has been the root cause of the current opioid epidemic. Our lab has sourced Cameroonian natural plant-based products to assess their analgesic potential. We strive to develop alternative therapeutic approaches to treat common conditions like chronic pain. This experiment focused on *Drypetes goswelery*, a tree that grows in central Africa who's bark is commonly used for a wide variety of medical treatments, specifically to relieve different types of pain. Previously we have found that an aqueous extract of the plant was analgesic at 100 and 200mg/kg. In the present study, we tested the direct effect of the extract on mouse sensory neurons (dorsal root ganglion cells). We have preliminary data that suggests these natural Cameroonian products alter the sensitivity of DRGs to capsaicin (a TRPV1 receptor agonist). Here, we have evaluated a dose dependent response curve to measure an effective working concentration to further analyze. Cells are analyzed through calcium imaging using a genetically encoded Ca^{2+} sensor, GCaMP6f; however, the opacity of our working solutions may interfere with the general intensity of fluorescence generated by cells when exposed to working concentrations. As we establish a dose response curve, we seek to find a concentration without opacity issues that can modulate DRG. This does will then allow us to evaluate the analgesic potential of these Cameroonian natural products in future studies.

(119)

Assessing Affective and Cognitive Phenotypes in TMEM97 KO Mice

Avaneesh Rade[1], Veronica Hong[1], Daniel Liebl[2], Saad Yousef[1], Theodore Price[1], Benedict Kolber[1]

[1]Center for Advanced Pain Studies, School of Behavioral and Brain Sciences, The University of Texas at Dallas, Richardson TX, [2]University of Miami School of Medicine, Miami, FL

The Sigma-2 receptor is known to play a role in Alzheimer's disease, cancer, chronic pain and mental disorders. Previous pharmacological studies discovered and tested putative ligands, like Siramesine, as potential anxiolytics/antidepressants. Still, there is limited scientific evidence for the biological function of the Sigma-2/TMEM97 receptor in emotion and cognition. This makes it difficult to define ligands (e.g. agonist vs antagonist) and introduce this target in a clinical setting. There has been little-to-no genetic characterization of affective and cognitive phenotypes associated with the Sigma-2 receptor. Here, we tested affective and cognitive phenotypes of Sigma-2/TMEM97 wildtype (WT) and conventional global knockout (KO) mice to assess the role the Sigma-2/TMEM97 receptor in regulating emotional and cognitive responses. We used light and dark preference, tail suspension test, marble burying, and novel object recognition to test depression, anxiety, and various aspects of cognition (i.e. spatial, recognition memory). Our results show that Sigma-2/TMEM97 plays a role in modulating depression and anxiety but does not play a significant role in cognition. This is important because previous literature has shown that Sigma-2/TMEM97 is expressed highly in the hippocampus and cortex. Since the hippocampus is involved in emotional regulation and learning/memory, it is important to separate these effects to characterize the Sigma-2/TMEM97 receptor. Therefore, these results suggest that Sigma-2/TMEM97 expression in various regions of the brain is associated with affective aspects of behavior, but not with the cognitive aspects of behavior. Overall, these data demonstrate that Sigma-2/TMEM97 may be pursued as a therapeutic target for anxiety and/or depression.

(120)

Amygdala calcitonin gene-related peptide signaling heightens pain in chemotherapy-induced peripheral neuropathy

James A Widner[1], Lakeisha Lewter[1], Heather Allen[2], Benedict J Kolber[1]

[1]Department of Neuroscience and Center for Advanced Pain Studies, University of Texas at Dallas, [2]Pittsburgh Center for Pain Research, University of Pittsburgh

Chemotherapeutic agents are potent cell-cycle inhibitors that have reduced remission rates of many cancers. Despite their widespread use and efficacy, chemotherapy-induced peripheral neuropathy (CIPN) remains a dose-limiting side effect due to the intense pain it causes. The exact physiology of the neuropathy is poorly understood and there is significant variability in the severity of the pain between patients. The amygdala is a limbic brain region involved in emotional appraisal, affective response, and more recently, nociceptive signaling. As such, it is uniquely positioned to modulate the physiological and affective experience that is seen with CIPN. Functional analyses have identified the central nucleus (CeA) as the primary modulator of nociceptive information via calcitonin gene-related peptide (CGRP) signaling. Previous findings from our lab have revealed CeA lateralization in the context of bladder pain, with CGRP exhibiting a pro-nociceptive effect in the right hemisphere and an anti-nociceptive effect in the left. The current study seeks to characterize the role of CeA CGRP signaling in the context of CIPN. Mice were cannulated in the right CeA and subjected to a 7-day paclitaxel (cumulative 16mg/kg) regimen to induce CIPN. Afterward, CGRP (100μM) or aCSF was directly administered into the right CeA and mechanical and thermal sensitivity were evaluated. CGRP administration was shown to significantly increase mechanical and thermal sensitivity. Taken together, our findings suggest that right CeA CGRP signaling intensifies pain during CIPN. Future studies will characterize the nociceptive role of CGRP in the left CeA and the molecular basis of its action.

(121)

Characterizing the expression of leukemia inhibitory factor receptor in human sensory neurons and peripheral immune cells

Samhita Bandaru, Aishni Shrivastava, Keerthana Natarajan, Juliet Mwirigi, Theodore J. Price

Department of Neuroscience, The University of Texas at Dallas

Oncostatin M (OSM) and leukemia inhibitory factor (LIFR) are pleiotropic cytokines belonging to the interleukin-6 (IL-6) family. Although this family is commonly targeted for clinical pain management, OSM remains the least studied in human context. OSM is released by macrophages in response to injury and can activate pain-sensing neurons. In mice, leukemia inhibitory factor receptor (LIFR) and Oncostatin M receptor (OSMR) are selectively activated by their respective ligands, however, in humans, OSM activates both the OSMR and LIFR. This species difference in OSM and its receptor usage prevents effective translation of mouse data into potential clinical applications. The aim of this project was to characterize the presence of LIFR in the human dorsal root ganglia (hDRG). To do this, we leveraged RNA sequencing datasets to assess LIFR expression in specific neuronal and non-neuronal subpopulations in hDRG. We validated these findings by sectioning frozen hDRGs from organ donors and performing immunohistochemistry. We utilized a monoclonal LIFR antibody in combination with peripherin, HEPACAM, and Iba1, which label neurons, satellite glial cells (SGCs) and macrophages respectively. The immunostained sections were then visualized using a laser confocal microscope. We noted the expression of LIFR in small- diameter neurons, SGCs and macrophages. Our computational and immunohistochemical analyses also suggest that there are sex-specific differences in the expression of LIFR in hDRG. Cumulatively, our findings suggest that OSM may act on specific cell-types by binding a secondary receptor such as LIFR. Thus, LIFR may be a potential target for the treatment of inflammatory pain.

(122)

Testing the Usability of the Virtual Interactive Management System

Jared Beltran

School of Arts, Technology, and Emerging Communication, The University of Texas at Dallas

Virtual Interactive Management (VIM) is a virtual reality (VR) training system that allows participants to practice employee communication with virtual humans. The VIM system is an IOS application resident on an iPhone and used with an inexpensive, highly distributable plastic VR headset. The application uses the Unity game engine and includes assessment and gaming elements. The realistic virtual humans are developed using actor performance capture and several software packages: Maya, Faceware, and the Creative Cloud Suite. The VIM system includes innovative user interface (UI) elements such as eye gaze navigation. The management training focuses on employee counseling, coaching, performance reviews, difficult conversations, and situational supervision.
Initial participants are JSOM students as a proxy for actual workplace employees. Our research aims to determine if participants can assemble the VIM system and successfully navigate the interface.
We hypothesize that users will be able to understand instructions and assemble and navigate through the system. Our methods are observation and quantitative data analysis through pre-and-post surveys. The pre-survey collects participant demographics and prior VR experience. The post-survey gathers participant feedback on system setup; affordances such as virtual humans, UI, and gaming elements; and the overall development utilizing the validated system usability scale and other subjective measures. We will conduct the experiment in the ATEC Usability Lab. We will use research results to make iterative system changes as indicated in a design-based research paradigm. Through this methodology we will create an easily distributed, user-driven system to deliver management communication training throughout the workforce.

(123)

The Role of Glycolipids in *Streptococcus* sp. 1643

Guan Chen, Kelli L. Palmer, Yahan Wei

Department of Biological Sciences, The University of Texas at Dallas

The emergence of superbugs threatens the effectiveness of antibiotics and public health. It is imperative that we explore alternative mechanisms for controlling populations of pathogenic bacteria. This study aims to identify the functions of glycolipids in *Streptococcus* sp. 1643 (SM43), a hybrid strain of *S. mitis* and *S. oralis* and an isolate from an endocarditis patient. Glycolipids serve as the membrane lipid anchor of lipoteichoic acid (LTA). LTA is a cell surface polymer that is essential for many bacteria and plays roles in host-microbe interactions. I hypothesize that removal of SM43 glycolipid anchors will stunt growth and modify antibiotic susceptibility. In SM43, the glycolipid anchor is synthesized through the function of two genes, *cpoA* and FDR735_RS04125. These genes were deleted individually through homologous recombination with DNA fragments generated through SOEing PCR. Successfully generated mutants were confirmed through Sanger sequencing, followed by lipidomic analyses and test of growth efficiency and antibiotic sensitivity. As expected, the corresponding glycolipid anchor for each mutant was missing from the extracted total lipids. Additionally, a significant growth deficiency was observed in both mutants comparing to the wild-type strain. Finally, mutants were found to have increased susceptibility to various types of antibiotics through Etest strip analyses, which suggests that glycolipid anchors play a role in cellular recognition. In general, our study indicated that glycolipid anchors play critical roles for efficient growth and drug resistance. Better understanding of glycolipid anchors may yield answers in restoring and improving antibiotic potency.

(124)

The Impact of Socioeconomic Status on Temporal Discounting and Risk Taking

May Chinn, Christopher “Dominic” Garza, Kendra Seaman

Department of Psychology, The University of Texas at Dallas

Does socioeconomic status influence decision making? Understanding the impact of socioeconomic status on decision making, specifically temporal discounting (the tendency to perceive a future reward as being worth less than an immediate reward) and risk taking, may help researchers to explain what exactly influences our everyday decisions. We hypothesized that temporal discounting and risk taking are correlated with socioeconomic status (SES) in that as SES decreases, temporal discounting and risk taking both increase. Likewise, we hypothesized that as socioeconomic status increases, temporal discounting and risk taking both decrease. Five hundred twenty-five participants were given a survey asking about their savings and safety nets and giving them two tasks assessing their temporal discounting and risk taking tendencies. A factor analysis was performed to estimate each participant’s socioeconomic status, and each participant’s temporal discounting and risk taking scores were estimated by calculating the proportion of the time the participant chose the smaller/sooner or riskier option, respectively. Temporal discounting was indeed found to be negatively correlated with socioeconomic status, however there was no correlation found between risk taking and socioeconomic status. More research must be conducted to determine whether these results are replicable in order to conclude that temporal discounting correlates with socioeconomic status whereas risk taking does not. Such studies could use different rewards for temporal discounting and/or different domains for risk taking.

(125)

Coefficients of Catalan States of Lattice Crossings

Ethan Conner

Department of Mathematical Sciences, The University of Texas at Dallas

Catalan states of lattice crossings and their coefficients are used to find closed-form formulae for the multiplication of curves in a three-puncture disk, which is an important problem in Topological Quantum Field Theory. The coefficient *C(A)* for a Catalan state *C* of an *m x n* lattice crossing *L(m, n)* can be calculated in the Relative Kauffman Bracket Skein Module expansion for *L(m, n)*. Skein modules were introduced in 1987 by J. Przytycki to generalize classical knot theory from the 3-sphere in R^3 to an arbitrary 3-dimensional manifold. Formulae for the coefficients of a family of Catalan states with maximal returns and no nesting were found by M. K. Dabkowski and A. D. Merrill in 2018. We use these equations to find closed-form formulas for the coefficients of Catalan states in this family for a specific *n* and arbitrary m. We also comment on the s-polynomial defined in the paper and its relation to Chebyshev polynomials; we also prove product-to-sum formulae for the s-polynomial and give a formula for an arbitrary S_n. Furthermore, we use the plucking polynomial for a plane rooted tree with a delay function to calculate the coefficients of a family of Catalan states with no bottom returns, maximal side and top returns, and an arbitrary number of returns in the top corners. Future research could investigate the relationship between the plucking polynomial the *q*-hook length formula, as well as find formulae and algorithms to calculate the coefficients of other families of Catalan states.

(126)

Proving Inequalities in Machine Learning via Calculus

Purvi Contractor, Jaime Mena Padilla, Allavi Ullah

Department of Mathematical Sciences, The University of Texas at Dallas

The aim of this project is to show how esoteric aspects of a first calculus course play a role in modern machine learning. We will focus on the so-called concentration inequalities. Concentration inequalities bound the

probability of a random variable deviating from its mean in the non-asymptotic regime. Famous examples include the Hoeffding's and Bernstein's inequalities. Typically skipped in most textbooks, these proofs will utilize little known facts from calculus. The research objectives are to fill in the proofs of the Hoeffding's and Bernstein's inequalities. In addition to discussing these proofs, the presentation will describe the connections between concentration inequalities and PAC agnostic binary supervised learning algorithms as well as highlight results from a literature review that illuminates how these inequalities are used in various industries. Future research will focus on the applications of the Hoeffding's and Bernstein's inequalities to other machine learning algorithms.

(127)

Modification of fibrillization conditions to analyze human islet amyloid polypeptide growth and structure

George Kidane, Łukasz Joachimia

Department of Biochemistry, The University of Texas Southwestern Medical Center

Amyloids are ordered protein deposits of misfolded proteins mainly characterized by their composition of cross linked beta sheet secondary structures. Over time, the misfolding and aggregation of amyloidogenic proteins can develop into plaques which are unable to degrade. Proteotoxicity from amyloid accumulation is thought to lead to cell death. Human islet amyloid polypeptide (i.e., amylin) is a thirty-seven amino acid peptide hormone co-secreted with insulin in pancreatic beta cells and is involved in homeostatic regulation of sugars through satiation. The deposition of amylin in pancreatic tissues has been associated with the development of diabetes mellitus in people with hyperglycemia. Recent cryogenic electron microscopy analysis of recombinant amylin fibrils has uncovered structural diversity of assemblies, but it remains unknown how different structures lead to toxicity. I am interested in determining what conditions are optimal for inducing amylin fibrilization *in vitro* and whether a variety of structures are formed by varying experimental growth conditions to reproduce previously published fibrils. Thioflavin T fluorescence assays were performed to quantify the rate of aggregation. Transmission electronic microscopy analysis was performed to visualize the diversity of structures formed. Biosensor seeding and toxicity assays were performed to relate fibril morphology to activity in cells. Our data shows a variety of fibril structures with different aggregation kinetics, suggesting local molecular interactions contribute to aggregation. Further experiments will use this method to better understand how to control fibril assembly, and how the principles of amyloid aggregation can be applied to other protein sequences associated with amyloid diseases.

(128)

Reprogramming "Cold" NF1 Malignancies into "Hot" Tumors for Immunotherapy

Laasya Madana, Bandarigoda N. Somatilaka, Renee M. McKay, Lu Q. Le

Department of Dermatology, The University of Texas Southwestern Medical Center

Neurofibromatosis Type I (NFI) results from inactivating mutations in the *NF1* gene that encodes the tumor suppressor, neurofibromin. Nonfunctional neurofibromin leads to hyperactive RAS proteins that cause upregulation of downstream processes leading to cell proliferation and predisposes NFI patients to tumor development including those on peripheral nerve sheaths. Some of these tumors can develop into malignant peripheral nerve sheath tumors (MPNST) which currently do not have a cure.
Immune checkpoint blocking (ICB) programs a patient's immune system to enhance tumor destruction and is an effective approach to target cancers. However, MPNSTs are cold tumors characterized by low T cell infiltration in the tumor microenvironment. Interestingly, MPNSTs show sufficient PD-L1 expression suggesting ICB as potential therapy for MPNST, given the ability to increase T cell density in the tumor microenvironment. Activation of the cGAS-STING-IFN pathway in the tumor cells could upregulate the production of cytokines and chemokines, leading to the recruitment of T cells within the tumor. Therefore, we hypothesize that treatment with STING agonists would turn MPNSTs into "hot" tumors making them susceptible to targeting with ICB.

Here we treated MPNST cell lines with STING agonist ADU-S100 for varying durations of time and determined STING-IFN pathway activation. Protein lysate analysis confirmed phospho-protein levels of the STING-IFN pathway increased by 8 hours after treatment which decreased with time. Target gene expression also was upregulated by 8 hours after ADU-S100 treatment. Our data suggest that ADU-S100 does in fact activate the STING pathway in MPNST cell lines leading to proinflammatory cytokine/chemokine production.

(129)

Archive of Unnamed Women

Nicolas Nguyen

School of Arts, Technology, and Emerging Communication, The University of Texas at Dallas

An Archive of Unnamed Women is a speculative remix that recovers photographs of unidentified women in digital photography collections. This project highlights a critical discussion about gendered power relations in archived visual materials that are saved as part of a digital object's metadata. First initiated with the New York Public Library digital collection, including photographs archived in the Schomburg Center for Research in Black Culture, this project has been supported at The University of Texas at Dallas for an edition with the Comer Collection. Visitors who search our re-presentation of unnamed women are presented with their photographs and, upon clicking for more information, a juxtaposed description drawn from a parallel collection of women's writing about women.
An Archive of Unnamed Women is presented on a website using the where users can view the collection. Each photograph displays a description, location, photographer, date, and a unique quote. The project presents the ability for one to submit a form if they identify the person.

(130)

Examination of the Co-Occurrence of Behavioral and Emotional Problems Found Using *the Child Behavior Checklist* (CBCL) in Children with Autism Spectrum Disorder

Lia Pelech, Rebecca Margolis, Meghan R. Swanson

Department of Psychology, The University of Texas at Dallas

Autistic people often display comorbidities with other psychological conditions. The *Child Behavior Checklist 6-18* (CBCL) is a screening tool that is used to detect underlying psychological problems within the age group of 6–18-year-olds. Numerous studies that used the CBCL have examined relationships between adaptive/maladaptive behaviors in various populations. However, published work using the CBCL to examine the relationship between those behaviors and autism is relatively sparse.
Using data from the Infant Brain Imaging Study (IBIS), we plan to evaluate the rates of comorbid psychological problems in a sample of school-age autistic children. The children in the IBIS study are either at a high or low likelihood of developing autism based on family history (e.g., presence of autism in an older sibling). Participants make up three groups: those that are at high-likelihood for autism and are autistic (HL-ASD), those that are at high-likelihood for autism but are not autistic (HL-Neg), and those that are at low-likelihood for autism and are not autistic (LL-Neg). Group differences in CBCL *t*-scores will be evaluated for two domain scores: internalizing and externalizing, and eight syndrome scales: anxious/depressed, withdrawn/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behavior, and aggressive behavior.
We predict that HL-ASD participants will have increased levels of emotional and internalizing problems when compared to the HL-Neg and LL-Neg groups. Understanding the connections between clinical concerns and autism will help caregivers, teachers, and mental health professionals better serve autistic children who may otherwise not receive needed mental health care.

(131)

Analysis into the Relationship between Maternal Education and White Matter Tract Structural Coherence of Autistic Infants

Isaias Salgado, Meghan R. Swanson

Department of Psychology, The University of Texas at Dallas

Fractional Anisotropy (FA) is a helpful tool in measuring structural coherence of white matter tracts during early development. FA is a scalar measure that ranges from 0 (highly isotropic) to 1 (highly anisotropic), with higher values thought to reflect more structural coherence. Higher levels of maternal education attainment are associated with more family resources and cognitive stimulation in the home, both of which support the well-being of a child. Previous studies have shown a link between higher levels of maternal education and higher FA values. The current study addresses a key gap in the literature by studying the association between maternal education and white matter structural coherence in autistic children. Diffusion tensor imaging (DTI) data came from the Infant Brain Imaging Study Network and included data from 49 children (44 male; 5 female) who were 24 months old and clinically diagnosed with autism. Maternal education was split into three groups: mothers with a high school degree or some college (n= 21); mothers with a college degree (n=18); and mothers with a graduate degree (n=10). FA values were generated from each of the following tracts of interest: the left temporo-frontal arcuate fasciculus (AF), left temporo-parietal segments AF, right fronto-parietal AF, bilateral uncinate fasciculus (UF), bilateral inferior longitudinal fasciculus (ILF), and the splenium of the corpus callosum. The analysis of the data is currently ongoing. The current study could highlight the importance of considering maternal education when creating specialized intervention plans for autistic children.

(132)

Efficient Two-Staged Delta Debugging to Assist Bug Fixing in Static Analysis Tools

Dakota Soles, Austin Mordahl

Department of Computer Science, The University of Texas at Dallas

It is critical to identify and fix bugs in software, but this process is costly. Static analysis tools can speed up the debugging process by automatically detecting bugs in software. But like any other software, these tools have bugs that need to be fixed. Since bugs are often triggered by only a small part of the input, finding the failure-inducing part can be difficult; this is especially true when the input is other programs. Delta debugging is an automated technique that can help address this: a delta debugger repeatedly reduces the input and reruns the program to check if it still exhibits a bug, attempting to reduce the input to only its failure-inducing features. However, delta debugging is traditionally applied on small inputs to quick-running test cases. Static analysis tools, conversely, run slowly with large inputs, making classical delta debugging inefficient for this task. We develop the first delta debugger that can efficiently reduce Java programs to failure-inducing features to assist debugging static analysis tools. By combining two reduction strategies that work on different granularities we improve the efficiency of the process. This has the effect of speeding up the delta debugging process without sacrificing accuracy. We apply the delta debugger on 68 bugs across 3 static analysis tools (Flowdroid, WALA, and SOOT) and reduced the size of their failure inducing inputs by 46% on average. This is strong evidence to show that our approach can minimize input programs to create useful bug-inducing test cases for tool developers.

(133)

The role of macrophage metabolism in ovarian turnover and fertility

Hanna Abdelhadi, Melissa Lenert, Michael D. Burton

Department of Neuroscience, School of Behavioral and Brain Science, The University of Texas at Dallas.

In the United States, approximately 15% of women face infertility. Inflammation plays a vital role in ovarian function, however, the underlying immune mechanisms have yet to be fully elucidated. We are interested in tissue-resident macrophages, one of the critical local immune cells that remove cell debris, controls inflammation, and initiates tissue repair. Shifts in macrophage reactivity are important for homeostasis and inflammation and are regulated by the cell's metabolic state. In our study, we investigated how macrophage metabolic state regulates inflammation, tissue repair, ovarian turnover, and fertility. The Liver Kinase B1 (LKB1) pathway is involved in maintaining metabolic homeostasis and is activated during metabolic stress. Previous literature shows that the LKB1 pathway drives an anti-inflammatory/tissue repair state in macrophages. We hypothesized that LKB1-positive/anti-inflammatory macrophages are important for ovarian turnover and normal fertility. Our study used transgenic mice with LKB1 removed from macrophages, compared to their cre negative (wildtype) counterparts as controls. Female breeders with LKB1 removed from macrophages have significantly smaller litters and a greater number of stalled follicles compared to wildtype females; these findings suggest that ovarian turnover is delayed. We believe, anti-inflammatory macrophages facilitate the breakdown and recycling of ovarian structures during vital turnover phases. Metabolic output from these LKB1 deficient macrophages was assessed using a mitochondrial stress test. We believe investigating the role that macrophage activation plays in regulating ovarian function can lead to novel therapeutics for improving fertility outcomes.

(134)

Optimizing the Activation of Phase Change Contrast Agents in a Phantom to Improve Uniform Pressure Estimation

Talia Alhammoud, Dominique James, Luca A. Forte, Kenneth Hoyt

Department of Bioengineering, The University of Texas at Dallas

In addition to cancer cells, a solid tumor consists of two important extracellular compartments, namely, the interstitial and vascular spaces. As a result, systemically administered molecules cannot reach the cancer cells without passing through each. One of the factors responsible for the poor localization of macromolecules in cancerous tissue is elevated intratumoral pressures that oppose the inward diffusion of therapeutic agents, lowering the treatment efficiency significantly. However, the direct measurement of intratumoral pressure is invasive and requires significant procedural experience. An accurate and noninvasive method would allow clinicians to improve the routine checkups of patients with cancer. Nanometer-sized phase-change contrast agents (PCCA) can be selectively activated from a liquid state (nanodroplet form) to form a larger echogenic gas microbubble using low-intensity pulsed ultrasound energy. Our lab has previously demonstrated that PCCA activation has a strong linear relationship with the hydrostatic pressure of the surrounding fluid thereby offering an opportunity for remote intravascular pressure estimation using ultrasound. The goal of this project was to further optimize PCCA activation (i.e., pressure sensing reporter signal) throughout a user-selected region-of-interest (ROI). By carefully adjusting the ultrasound system settings, we can induce PCCA activation and achieve uniform intravascular pressure estimation at tissue depth. This is beneficial for applying this technique to solid tumor studies and remotely estimating intravascular pressure throughout a tumor volume.

(135)

Making Connections with Physiological Data and Healthy Sleep

Miguel Barcellano

Department of Bioengineering, The University of Texas at Dallas

Sleep influences many aspects on the human body. Many research studies focus on illnesses or disorders that cause sleep problems. However, sleep shouldn't always be measured from a problematic perspective, but rather a healthy one. Sleep health is a concept that allows a positive frame of reference regarding any sleep related study. My plan is to make connections with sleep and physiological data to determine whether a person is experiencing healthy sleep. I used the Empatica E4 wearable watch sensor that measures electrodermal activity (EDA), blood volume pulse (BVP), acceleration, heart rate (HR), and temperature (in °C). The subject is asked to wear E4 watch up to 24 hours and will be asked questions based on the SATED test which determines whether a person achieved healthy sleep. The analytical portion would revolve around two main points. Can physiological data determine healthy sleep and how does the data change over the course of sleeping periods? Future studies that revolve around sleep can use this data as a benchmark to approximate what healthy sleep can look like. Then, comparisons can be made with data showing healthy sleep and used for patients who may experience sleeping problems or illnesses relating to sleep.

(136)

Developing novel proteases in vivo via complementation of split fluorescent proteins

Abeni Belay[3], Oreoluwa Adegoke[1], Anbarin Khalid[1], P. C. Dave P Dingal[1,2]

[1]Department of Bioengineering, The University of Texas at Dallas, [2]Center of Systems Biology, The University of Texas at Dallas, [3]Department of Computer Science, The University of Texas at Dallas

Potyviral proteases are plant virus enzymes that recognize specific peptide sequences. They can be adapted to function in diverse cell types ranging from bacteria to mammals, thus they can be a powerful tool to manipulate proteins involved in various cellular processes. For example, each protease can be fused to a unique receptor protein to manipulate receptor-signaling pathways. This study aims to engineer novel proteases that can each cleave a unique peptide sequence in vivo, using zebrafish embryos as a testbed. To test the proteolytic activity of the novel proteases, we fused beta-arrestin 2 (arrb2) and the first 10 beta strands of the fluorescent protein, sfCherry (sfCherry1-10). A cleavage site – predicted to be recognized by a unique protease – is inserted in between arrb2 and sfCherry1-10. If the protease recognizes the cleavage site, it will allow sfCherry1-10 to translocate into the cell nucleus, wherein the 11th beta strand of sfCherry (sfCherry11) resides. Proteolytic cleavage effectively allows the split sfCherry components to recombine and recover their fluorescence in the nucleus. We injected zebrafish embryos at one-cell stage with the engineered enzymes and their corresponding cleavable substrates. After 5 hours post-fertilization, we found sfCherry fluorescence in the nucleus, suggesting that the proteases are functional in vivo. We envision that our toolkit of engineered proteases will provide means to engineer the activity of multiple cellular functions.

(137)

Effectiveness of Domestic Travel Restrictions in reducing the spread of COVID-19

Shruti Bindingnavile

Naveen Jindal School of Management, The University of Texas at Dallas

As the technological advancements of the twenty-first century have given rise to increased transnational communication and interconnectedness, the need for understanding health on a larger scale has increased exponentially. The Coronavirus (COVID) pandemic is an ongoing pandemic that has affected millions around

the world since its emergence in late 2019. In response to the rapid spread of the virus, many measures have been put in place to help curb its spread. One such measure includes implementing limitations on travel on a global and local scale. While there is some research on the effect of global travel restrictions, there is not much focus on the effectiveness of domestic travel limitations on the spread of COVID-19. Thus, the purpose of this analysis is to determine the effect of domestic travel restrictions on the development of COVID-19 in the United States. We used statistical analysis methods such as difference-in-differences analysis and linear regression to provide the relationship between state-level quarantine mandates for travelers and COVID-19 cases. Our findings indicate that, on average, the states with a travel mandate saw a smaller spike in COVID cases than the states without restrictions. The significance level was 0.05. Since the p- value in the regression is less than 0.05, we can conclude that there was a statistically significant level of interaction between the implementation of statewide travel restrictions and COVID cases.

(138)

Evaluation of an internship program designed to increase the pipeline of high school students entering mental health careers.

Max Brenner[1], Amy Schmidt-Brenner[2]

[1]Department of Psychology, The University of Texas at Dallas, [2]Department of Psychiatry, The University of Texas Southwestern Medical Center

Because of a shortage of psychiatrists and other mental health providers in the United States, including in Texas, it is necessary to recruit mental health providers, especially minority providers who are more likely to serve underserved minority populations. Pipeline programs have been used in healthcare fields, including mental health, to recruit diverse providers via early outreach. One such program, UT Southwestern Medical Center's Inspiring Careers in Mental Health program, is a virtual internship for high school students that incorporates information about mental health careers and their training requirements, discussion with mental health professionals, observation of real and simulated patient care, and connections to further shadowing and mentoring opportunities. We administered questionnaires to 36 of 39 interns (response rate 92%) in the 2022 program cohort and found that their knowledge of the roles and paths to obtaining mental health careers, their belief that mental health providers offer effective treatments, and their belief that they could obtain a mental health career if they wanted to all significantly increased after the program. Interns' responses on four other items, including their interest in obtaining a mental health career, did not change significantly but were satisfactory to begin with. Our results reveal a substantial population of high school students who are interested in mental health careers but lack the resources or information to obtain them. Programs such as the one described can successfully fill in these gaps, but follow-up research is necessary to determine if they actually push students to pursue mental health careers.

(139)

A Task-Agnostic Cognitive Architecture for Machine Intelligence

Willie Chalmers III

Department of Computer Science, The University of Texas at Dallas

Designing a cognitive architecture that allows an AI system is a central problem in artificial intelligence. Although deep learning comprises a large category of methods for building intelligent systems that learn from data. The primary strength of deep learning is its ability to learn distributed representations of features using data without explicit rules, but this feature leads to machine intelligence that is brittle and does not scale across domains. Furthermore, a growing body of research suggests that AI architectures that learning explicit rules is necessary to solve to a wide body of tasks. In this work, we qualify common tasks used to benchmark intelligent systems, analyze a variety of machine learning models designed to solve these tasks, and propose a common cognitive architecture for evaluating the utility of the components of AI systems.

(140)

Comparison of different contrast agents for microvascular visualization using microCT

Dara Chanthavisay, Ryan Margolis, Brian Merlo, Junjie Li, Brian Trinh, Kenneth Hoyt

Department of Bioengineering, The University of Texas at Dallas

Visualization of the tissue microenvironment is crucial for cancer diagnosis, predicting metastatic growth, and evaluating therapeutic efficacy and protocols. In addition, vascular visualization is required as a baseline for super resolution imaging algorithms and other computer models to prove their validity. MicroCT imaging with the use of *ex vivo* contrast agents produces a high spatial-resolution vascular image. Currently, Microfil is the standard contrast agent to provide reliable visualization of the vascular network. The goal of this research was to compare other commercially available contrast agents, including a barium sulfate powder and Vascupaint qualitatively and quantitatively to Microfil to determine the optimal contrast agent for vascular visualization. Nude female athymic mice were implanted with human breast cancer cells in the lower mammary fat pad. To inject the contrast agents, a small incision was made to expose the carotid artery. Using sutures, a small arteriotomy was made and the tip of a PE10-polythlene tubing was inserted and secured. A syringe was attached to the other end of the tubing and 2 mL of the contrast agent was perfused at using an infusion pump. Following successful perfusion, mice underwent fully body and ultra-accurate high-resolution scans using a microCT system. Organs were then extracted and placed in formalin for 24 h before undergoing additional high-resolution microCT scans. Images were analyzed to extract average pixel intensity for each organ. Preliminary results depict Vascupaint and barium sulfate as strong contrast agents to use for vascular visualization, showing superior enhancement and visualization of smaller microvasculature.

(141)

Exploring the structure and mechanism of the Fluc exporter using MD simulation: An application of computational chemistry

Aru Chezhian, Abiola Akintayo, Hedieh Torabifard

Department of Chemistry and Biochemistry, The University of Texas at Dallas

The fluoride ion (F^-) is biologically significant as an excess or deficiency can be harmful to organisms. To resist F^- toxicity, some microbes have evolved a resistance mechanism in which the fluoride channel (Fluc) exports F^- with very high selectivity. The Fluc exporter is structurally unique in many ways: it has a dual topology dimeric architecture and past crystallography has shown a central Na^+ ion at the interface of the dimer. However, Na^+ usually coordinates with 5 or 6 ligands, and the proposed Na^+ is tetrahedrally coordinated. This study provides details about the role of a tetrahedrally-coordinated sodium ion in the exporter's structural stability, as well as identifying the contributing residues involved in high F^- selectivity. We are using molecular dynamics simulations to model Fluc with the proposed Na^+ cation, as well as the alternate cations Mg^{2+} and Li^+, to provide a comprehensive comparison of Fluc's structural stability and conformational changes as they relate to the central cation.. This work could have larger implications for future study of the Fluc channel and other cation-coupled transporters for antimicrobial drug design.

(142)

Exploration of the Landscape of Student-Faculty Relations Among UTD Students

Andrew Cobble

Department of Sociology, The University of Texas at Dallas

Relations with faculty are an important source of networking and guidance for college students in their academic and professional lives. Strong relationships with faculty have been shown to be an important predictor of student success, especially for lower status students. Although previous research has evaluated

the student-faculty relations by gender, there is a lack of research regarding student-faculty relations among other minority groups. Using quantitative data collected from UTD students by the Student Success Center, I explore the strength of faculty connections for students from various potentially vulnerable groups, including women, first generation students, and racial minorities. These groups are also evaluated in the context of STEM fields and the students' schools within UTD. My findings have implications for how UTD administrators conduct intervention programs for faculty mentorship, and how professors are trained to connect with students, especially those from potentially vulnerable groups.

(143)

Utilizing Open Data Cube to index multi-satellite data into one format, in Python, for more convenient use in Machine Learning applications.

Luke D. Frazeur, Lendel Deguia, John Waczak, David J. Lary

Department of Physics, The University of Texas at Dallas

Remote sensing involves the distant acquisition of information for a particular object, area, or phenomenon of interest via the utilization of reflected electromagnetic signals. The two prominent modes of operation, in remote sensing, are passive and active. Passive sensors solely detect reflected radiation from natural sources and operate primarily in the infrared and visible regions of the electromagnetic spectrum. Active sensors produce their own radiation and detect whatever is reflected back. Many remote sensing satellites use a variety of instruments to observe multiple wavelengths. Machine learning techniques can be used to create a variety of data products as well as to improve spatial resolution with super-resolution. Our intent is to use a type of active remote sensing known as synthetic aperture radar imaging coupled with machine learning to reproduce images generated by passive remote sensors as closely as possible. The Open Data Cube (ODC) is an open-source project that allows users to access different datasets using the same coding methods. By indexing satellite data from their sources into Python via the ODC, accessing a different satellite requires only a few lines of code change. We were able to index data from ESA Sentinel 2 and NASA Landsat 8 (Collection 2, Levels 1 and 2) and collect RGB, NDVI, and NDMI images over Richardson, TX, as well as lava tracking over La Palma, Spain, using the same coding methods. More satellites will be indexed in the future, and machine learning will be used to improve the information provided by these datasets.

(144)

Synthesis and Cadmium-doping of Inorganic 1D $CsCu_2I_3$ Powder for UV Down-conversion

Andrew J. Gruber[1], Kayla B. Cooper[2], Emily J. Brand[1], Kyle M. McCall[3]

[1]Department of Chemistry and Biochemistry, The University of Texas at Dallas, [2]Department of Chemistry, Oglethorpe University, [3]Department of Materials Science and Engineering, The University of Texas at Dallas

In recent years, lead halide perovskites have garnered a lot of attention for their light emission properties. One glaring issue with these perovskites is that lead is a toxic metal, which can be a problem for public health. Because of this, copper(I) has been used to fully replace lead in copper halides. These copper halides are proven to have strong air stability and bright luminescence through self-trapped excitons (STEs), as well as a Stokes shift large enough to avoid reabsorption by the material. Materials that exhibit efficient STE emission show promise towards applications of UV down-conversion and solid-state lighting. Here, a pre-existing isopropyl alcohol rapid antisolvent synthesis method for powdered $CsCu_2I_3$, a nontoxic 1D copper halide, was modified to form a cleaner product. Characterization of $CsCu_2I_3$ was done through UV-VIS analysis and photoluminescence spectroscopy, which showed that the modified method provided a cleaner product. The photoluminescence values of the $CsCu_2I_3$ created through the modified procedure compare well to those in previous literature, with a strong photoluminescence excitation (PLE) band at 331nm and a bright yellow emission at 563nm. Following this modified procedure, doped samples of $CsCu_2I_3$ at 2%, 10%, and 25% of CdI_2 were synthesized to observe changes, if any, to the photoluminescence properties.

(145)

Gain of Function Cytolysin Variant Expressed by Clinically Isolated *Enterococcus faecalis*

Irene Hau[1], Neha Hulyalkar[1], Belle Sharon[1], Vivian Nguyen[3], Philippe Zimmern[2], Nicole De Nisco[1,2]

[1]Department of Biological Science, The University of Texas at Dallas, [2]Department of Urology, The University of Texas Southwestern Medical Center, [3] Medical Scientist Training Program (MSTP), University of Wisconsin School of Medicine and Public Health

Enterococcus faecalis can cause serious nosocomial infections, most commonly urinary tract infections. While prescribed antibiotic therapies are available, UTIs are often refractory to these treatments, resulting in diminished quality of life. Cytolysin, an enterococcal exotoxin & bacteriocin encoded by the *cyl* operon, can enhance virulence in endocarditis models. Cytolysin targets various mammalian cells, including erythrocytes, macrophages, neutrophils, and even bacteria. Cytolysin is active against human, rabbit, and horse erythrocytes due to their high phosphatidyl choline (PC) content, but sheep erythrocytes (SE) with low PC content are resistant.

We identified a urinary *E. faecalis* isolate, C33, that demonstrated enhanced hemolysis against SEs. Studies using markerless gene exchange approach confirmed C33 SE hemolysis was dependent on the *cyl* operon, but sufficiency of *cyl* operon is yet to be confirmed. Since cytolysin has been previously reported to target bacterial cells, we hypothesized that C33 gain-of-function cytolysin is important for competition with the urinary microbiota. We observed that *E. faecalis* C33 inhibited the growth of *Enterococcus raffinosus* and *Streptococcus parasanguinis* isolated from the same urine. Additionally, under anaerobic conditions, C33 showed increased survival against *Staphylococcus capitis*, which was highly inhibitory in aerobic conditions. Interestingly, C33 Δ*cyl* mutant inhibited the growth of *E. faecalis* reference strains OG1RF (*cyl-) &* DS16 (*cyl+)*, hinting at the presence of an additional bacteriocin in this strain. We identified a candidate bacteriocin operon on a 72 kilobase plasmid in C33 and are currently evaluating the contribution of this operon to enhanced SE hemolysis and competition against the urinary microbiota.

(146)

Synthesis and Characterization of Three Isostructural Copper-Lanthanide Mixed-Metal Organic Frameworks Containing a Fluoro-bridged Hexacluster

Dax J. Hildebrand, Marie L. Mortensen, Kenneth J. Balkus Jr.

Department of Chemistry and Biochemistry, The University of Texas at Dallas

Metal organic frameworks (MOFs) are crystalline coordination polymers that have permanent porosity. MOFs containing lanthanide metal ions are of particular interest due to their magnetic and fluorescent properties. The modulator, 2-fluorobenzoic acid (2-Fba), was discovered to create lanthanide clusters instead of dimers, which are commonly found in lanthanide MOFs. Recently in our lab, it was determined that lanthanide ions will react with the 2-Fba. The fluorine is extracted from the modulator by the lanthanides and integrated into the cluster. This increases the fluorescence intensity, selectivity for CO_2, and affects the hydrophilicity. When creating a mixed metal MOF with both transition metals and lanthanides, a greater degree of tuning properties such as magnetism, fluorescence, and a greater variety of topography are possible.

In this research, we hypothesize that the reaction of 2-Fba, the organic linker, 2,2’ bipyridine 4,4’ dicarboxylic acid (BPDC), with lanthanide ions (holmium, gadolinium, or dysprosium) and copper ions will form a fluoro-bridged hexacluster containing mixed-metal MOF. Gadolinium and dysprosium were selected for their unique magnetic properties. Holmium was selected due to the possibility of neutron activation, which is used in cancer treatment. Due to their crystallinity, single crystal and powder x-ray diffraction are used to determine the structure and bulk purity of the sample. The presence of fluorine is determined through scanning electron microscopy/ energy dispersive x-ray spectroscopy (SEM/EDS). Accelerated surface area and porosimetry (ASAP) is used to measure the surface area of the sample.

(147)

Anatomically confirming the relationship between the lateral habenula and pessimism in mice

Madison Ibe, Srijani Biswas, Steven Shabel

Department of Psychiatry, The University of Texas Southwestern Medical Center

Pessimism is the tendency to anticipate or expect negative outcomes in any given situation. It has been linked to depression through several clinical studies and behavioral theories. Previous research has highlighted the lateral habenula (LHb), an epithalemic brain region linked to depression and addiction, as a region likely to encode for pessimistic behavior. The LHb has a subpopulation which encodes for Reward Prediction Error (RPE), the difference between the expected reward and the actual reward given. While LHb neurons are typically excited by negative RPE and inhibited by positive RPE, acute stress causes this response to change so both types of RPE cause the excitation of these neurons. Stress also causes a change in the licking behavior of mice. Using fiber photometry and a mouse behavior paradigm that observes licking behavior, we can observe the neural activity in the lateral habenula in pessimistic-like behaviors. We then further explore the accuracy of these recording through brain sectioning to separate the brain into coronal slices to look at different areas within the LHb. This is followed by histology to check the location of injection sites and differences in the regions of neural activity between mice. Future analysis of this neural data will give more context to the relationship between the LHb and pessimism, as well as give more insight into the specific subpopulations that may encode pessimistic behavior.

(148)

In-House Production of an Inexpensive Protein Ladder

Javier Flores, Junseok Jang, Rumaisa Shoib, Juliana Kikumoto Dias, Sheena D'Arcy

Department of Biochemistry, The University of Texas at Dallas

Protein ladders, also known as protein standards or markers, are widely used reagents in biochemical experiments. Protein ladders consist of highly purified proteins that serve as molecular weight standards to estimate the sizes of proteins separated by gel electrophoresis. Commercially produced protein ladders are relatively expensive, costing 1.00 USD per lane on average. Working as a team of 3 undergraduates with no previous laboratory experience under the guidance of a graduate student, we are assembling the ladders and providing the necessary materials for future production at UTD laboratories. We are basing our work on a previously established system for in-house production across six weeks. By following the procedure, we are creating a protein ladder that costs 0.0036 USD per lane, $1/100^{th}$ the cost of commercially produced protein ladders. This is accomplished by purifying nine individual ladder proteins (10, 15, 20, 30, 40, 50, 60, 80, 100 kDa) for 20,000 lanes. To produce a protein ladder in the laboratory, individual plasmids containing the genes of interest are expressed in E. coli cells and purified through metal affinity chromatography. Additionally, each purified protein is mixed in equimolar amounts to form the final protein ladder. The final product is confirmed through SDS-PAGE and compared to commercial protein ladders. The established protocol is being optimized to maximize protein yield and purity, improve overall efficiency, and further reduce cost. In addition, plasmid stocks are being created for the assembly of additional protein ladders with ease.

(149)

The Effectiveness of Music Therapy Intervention on Individuals Diagnosed with Autism Spectrum Disorder

Esha Kanna, Zaid Fazal

Department of Neuroscience, The University of Texas at Dallas

Autism Spectrum Disorder is one of the fastest growing neurodevelopmental disorders in the United States, affecting social interaction and communication abilities in millions of individuals. Music Therapy is a therapeutic treatment that helps stimulate expression and language development through musical interaction in the forms of music comprehension and production. We would like to study the effectiveness of music therapy as a primary or supplementary form of treatment for children and young adults diagnosed with Autism Spectrum Disorder. We included 10 studies that examined the effect of music therapy interventions in both one-on-one and group settings for children and young adults diagnosed with Autism Spectrum Disorder. The review draws conclusions from collecting and analyzing data from various controlled clinical studies in order to determine the effectiveness of music therapy on a wide range of symptoms that align with cognitive developmental disorders. The results of the studies have shown an overall improvement of patients' wellbeing following music therapy interventions; however, conclusive statements about the effect of music therapy on communication and social interaction cannot be determined from the available evidence. Thus, the study of music therapy as a primary or supplementary form of treatment for individuals diagnosed with cognitive neurodevelopmental disorders such as Autism Spectrum Disorder should continue to be explored as a form of treatment.

(150)

Development of a vagus nerve cuff electrode for mice

Deepika G. Krishnan, Ching-Tzu Tseng, Catherine A. Thorn

Department of Neuroscience, The University of Texas at Dallas

Vagus nerve stimulation (VNS) has been shown to improve symptoms of certain clinical disorders, including epilepsy and depression. Preclinical studies of VNS are most commonly done in rats due to the challenges of miniaturizing the VNS electrodes for use in mice. The ability to perform VNS in mice, however, would enable researchers to leverage the extensive genetic tools available in this species, enhancing our understanding of VNS efficacy and mechanisms. This project focuses on developing a VNS cuff electrode for mice. Miniaturized VNS cuff electrodes (mVNS) were constructed using a design modified from that currently used for rats. Two platinum iridium wire leads were glued inside a 1.5 mm length of small-diameter (0.025 inches) micro-renathane tubing, and additionally secured with silk suture. Due to the reduced cuff size, certain assembly procedures were modified. For example, in rat cuffs, the platinum iridium wires are looped around tubing wall to increase stability of the leads. However, the smaller tubing does not accommodate these loops. Further, visibility is reduced inside the cuff during the placement of the de-insulated wire leads, which is a key determinant of cuff impedance and proper function. Six prototype mouse VNS cuff electrodes were assembled, and lead security and acceptable impedance were confirmed, enabling us to proceed to *in vivo* testing of device performance.

(151)

Self-Assembly of Metal Organic Frameworks from Metal Organic Polyhedral Motifs for Selective CO_2 Storage

Amanda Maceda, Muhammad Abbas, Kenneth J. Balkus Jr.

Department of Chemistry and Biochemistry, The University of Texas at Dallas

Metal-organic frameworks (MOFs) are microporous crystalline materials formed through the connection of metallic nodes to organic linkers. These materials provide a high surface area (up to 10,000 m^2/g) through

well-defined and ordered cavities in structure. The possible variation in pore sizes and cavities is a direct result of the chosen linkers and metal nodes. Applications such as water harvesting, drug delivery, and gas separation & storage are prime areas for MOF research and development. Metal-organic polyhedrons (MOPs) are hybrid materials that could be converted into 1, 2, and 3D frameworks through coordination of rigid ditopic organic linkers to the uncoordinated metal sites of these MOP units. By modifying copper MOP-1 by with 2,2'-bipyridine, a new MOF structure was synthesized. With unit-cell parameters acquired through single crystal X-ray diffraction, the material was shown to extend in stacked 2-dimensional sheets, with sinusoidal pore channels. Powdered X-ray diffraction and infrared spectroscopy were employed to confirm phase purity and determine the functional groups of this MOF, and thermogravimetric analysis assessed its thermal stability. BET and Langmuir analysis provided us with the pore size, distribution, and quantification of surface area. Finally, gas absorption experiments were executed to quantitatively determine the CO_2 separation and storage potential of this MOF.

(152)

An evaluation of key factors in the policymaking process for health excise taxes in Latin America

Avirut Mehta

The University of Texas at Dallas

In Latin America, excise taxes have become the preferred method for managing negative public health externalities generated by particular categories of goods, key among which are tobacco, alcohol, and most recently, sugar-sweetened beverages. Such taxes, referred to across Latin America as *impuestos selectivos al consumo* (ISCs, "selective consumption taxes"), have over time morphed from pure public health measures to key facets of national macroeconomic systems. Today, many Latin American governments broadly rely on revenue from ISCs, such that incentives to raise tax rates or broaden the categories of taxed goods may be perceived by the public as a symptom of government mismanagement. Given these circumstances, we examine how the policymaking process for ISCs has morphed over time, focusing on the Peruvian case as a representative example of changes occurring across Latin America. Through a systematic review of interviews, news articles, and legislation related to changes in ISCs from 2018 to the present day, we quantify the most common arguments used in favor of and against increases in excise taxes. Furthermore, we explore key differences in the development and extent of health excise taxes across countries within Latin America, noting the common strands of history that have led to the patterns observed today.

(153)

Analyzing the relationship between rat behavior and the posterior body representation in the cortical motor map

Umair J. Mohammed, Bhavishya Gullapalli, Gayathri Vijayaraghavan, Ching-Tzu Tseng, Catherine A. Thorn

Department of Neuroscience, The University of Texas at Dallas

Learning motor skills has been shown to cause neurophysiological changes to the motor cortex, which are reflected through motor maps. Recent studies have shown that reorganization and plasticity within cortical motor maps is possible through motor skill acquisition. The topography of the motor map is often found to reflect the specific motor requirements of the learned skill. Past analysis of rat motor maps by our lab has shown that male rats have a larger cortical representation of posterior body regions when compared to female rats. Male rats are also significantly more engaged in lever pressing tasks compared to female rats. It is unclear whether this increased motor activity in male rats is related to their larger posterior map representation, however. We hypothesized that larger posterior body representations in motor maps may be correlated with higher levels of motor activity in rats. To test this hypothesis, we performed new analyses of lever-pressing performance and motor map organization in male and female rats. We also conducted new experiments to assess the open-field locomotor activity of male (n = 3) and female (n = 3) rats. Results of this exploratory work will inform our understanding of how behavior may be related to body representations in the motor cortex.

(154)

Prdm12 knockout model of a painless mouse reveals properties of nociceptors across development

Grace E. Moore[1], Helen C. Lai[2]

[1]Department of Neuroscience, The University of Texas at Dallas, [2]Department of Neuroscience, The University of Texas Southwestern Medical Center

Prdm12 is a transcription factor that regulates the development and expression of nociceptors, the pain-sensing neurons, in the peripheral nervous system. When mutated, as in Congenital Insensitivity to Pain, affected individuals lack nociceptors and are unable to feel pain. We sought to determine whether *Prdm12* is required for the proper development of the nociceptive pathway by using a mouse model of embryonic *Prdm12* knockout prior to nociceptor development. To further characterize the role of *Prdm12* across development, we also used a model of adult *Prdm12* knockout to investigate its effect on the regenerative potential of peripheral nerves.

The embryonic *Prdm12* knockout mouse is a previously uncharacterized line, which histology revealed to have a near complete absence of nociceptors and nociceptive pathway neurons in the spinal cord. Embryonic *Prdm12* knockout mice displayed limited response to painful behavioral assays but notably not those involving a noxious heat stimulus. Continuing studies into our painless mouse will reveal which behaviors are mediated by nociceptors.

To determine the function of *Prdm12* in adult, sciatic nerves of control and *Prdm12* adult knockout mice were crushed and analyzed by histology for axon regeneration, and dorsal root ganglia (DRG) were analyzed for cell proliferation. The *Prdm12* adult knockout mice displayed limited sciatic nerve regeneration and proliferation in the DRG compared to control mice. Our work indicates that *Prdm12* has a previously unrecognized role in directing axonal regeneration and cell proliferation in the adult, supporting *Prdm12* as a promising target for regenerative therapeutics.

(155)

Pragmatism or Idealism? Evaluating Public Support for International Courts in Backsliding Democracies

Samantha Mussell

Department of Political Science, The University of Texas at Dallas

Recently, the ability of domestic courts to curb authoritarianism and human rights abuses has weakened from excessive partisan influence, encouraging a trend of democratic backsliding in the international community. This encompasses a series of indirect moves to erode legal and electoral limits on those in power. As a result, international courts are now relied on as a means of enforcing conformity to democratic principles. However, because they have neither monetary nor militaristic power, the capacity of these courts to directly address and prevent anti-democratic legislation is partially reliant on public perceptions of them as legitimate avenues for upholding governmental accountability. Therefore, the purpose of this project is to examine the effects of public support on an international court's ability to monitor the quality of democracy within a state. We hypothesize that both pragmatic and idealistic attitudes, the first indicated through approval of international tribunals and the second through endorsement of democratic values, affect support for international court decisions. Moreover, we contend that the influence of these attitudes is conditioned by one's partisanship, with supporters of the government motivated solely by pragmatic concerns while opposition supporters are influenced by both pragmatic and idealistic attitudes. We tested this theory with original data collected from a nationally representative survey of 2000 Hungarians taken in March of 2022 regarding Hungary's ongoing political conflict with the European Union Rule of Law Mechanism, a punitive measure for EU member states that breach democratic standards. Current results from this data are generally in support of the stated theory.

(156)

School Quality Affects Word Learning Ability in Homes Where Maternal Education is Less Than a College Degree

Sindhuja Naru, Kathleen Denicola-Prechtl, Stephanie Castro, Mandy Maguire

Department of Psychology, The University of Texas at Dallas

Children who grow up in homes that provide high quality interactions start their education off with larger vocabulary sizes than children in homes with less linguistically rich environments. Children with large vocabularies are less likely to struggle with reading comprehension and have higher predicted academic outcomes because of their ability to infer a word's meaning from context. While inferring a word from context is not always explicitly taught in school, we predict that children in higher quality schools (as measured by Children at Risk score) will have increased accuracy in a word learning task. To better understand this relationship, we compared the word learning abilities of 67 eight-to-eleven-year-old monolingual English-speaking children to their school quality rating. When controlling for age and maternal education, as predicted, a significant positive correlation was found between word learning and school quality (r =.218, p = .043). Further analysis was conducted to assess if maternal education level played a role in this correlation. We found a strong positive relationship between school quality and word learning abilities in children whose mothers had not obtained a college degree. We found no relationship between school quality and word learning abilities in children whose mothers had obtained at least a college degree. These findings indicate that school quality is especially important for children with lower-educated mothers.

(157)

Investigating the Relationship Between the Chinese Property Sector Debt Crisis and Systemic Economic Risk

Omar Ansari, Shane Piel

Department of Political Science, The University of Texas at Dallas

The Chinese real estate sector has grown substantially in the past few decades, but the high debt levels exhibited by major property developers have produced substantial economic risks. Over time, policy strategies instituted by the Chinese State, including easy access to loans and assistance in achieving high initial growth, have set the conditions for instability in the national real estate market. The wide-ranging effects of the current situation can also be seen in the damage to local government revenues—of which up to 40 percent stem from land sales—as well as stress on local financial institutions, which have begun to experience widespread bank runs and the impacts of civil unrest.

We look at recent violations of newly crafted Central Government policy guidelines by large real estate and property development companies. These policies, which are aimed at ameliorating the ongoing crisis, include various controls to promote corporate financial health—such as lowering the ratios of liabilities to assets, net debt to equity, and cash to short term debt.

Recent trends in the real estate market—including declines in real residential property prices—constitute a possible warning sign of increasing instability. We investigate the ways in which the financial indicators in the Chinese property sector track with other significant trends in the broader Chinese economy, such as growing debt to GDP ratios and increases in the overall market volatility index. In doing so, we seek to determine if strong correlations exist, and whether a prediction of imminent financial disaster is well-founded.

(158)

Quantification of virus-mediated channelrhodopsin expression in the locus coeruleus of TH-Cre+ rats

Sahiti Pydimarri, Tanushree Mamidi, Ching-Tzu Tseng, Catherine A. Thorn

Department of Neuroscience, The University of Texas at Dallas

The locus coeruleus (LC) is the primary location for the production of neuromodulator noradrenaline (NE), which influences many cortical and subcortical brain regions. The current study aims to test whether optogenetic LC stimulation paired with skilled forelimb training is sufficient to induce experience-dependent plasticity in the primary motor cortex (M1). Male and female TH-Cre+ Long-Evans rats were injected with AAV virus to express channelrhodopsin (ChR2) specifically in the LC. Rats were trained on a skilled reaching lever pressing task that stressed proximal forelimb musculature usage. Once the rats achieved stable behavioral performance, they received optogenetic stimulation of the LC at 3, 10, or 30 Hz paired with correct lever pressing during five final training sessions. Preliminary data suggests that 10 Hz LC stimulation increases the task-relevant proximal forelimb representation in M1. Here, we perform histological validation of the LC-targeted ChR2 expression and cannula placements for rats in this study. Three LC slices per rat were stained for tyrosine hydroxylase (TH) and green fluorescent protein (ChR2-GFP). Images were analyzed for TH and GFP overlap using ImageJ. Based on these analyses, rats with insufficient virus expression will be excluded from the study.

(159)

Vagus nerve stimulation enhances longevity of conditioned fear extinction in rats

Ciro D Randazzo, Melissa Krauth, Rimenez R Souza, Christa K McIntyre

Department of Neuroscience, The University of Texas at Dallas

Vagus nerve stimulation (VNS) has emerged as a promising strategy to enhance extinction of conditioned fear in rats and is currently in early-stage clinical trials as an adjunct to exposure-based therapy for post-traumatic stress disorder (PTSD). However, the longevity of VNS-enhanced extinction memories compared to repetition-based extinction memories remains unknown. In the present study, we investigated the effects of VNS during extended extinction (EE) on fear relapse. Long-Evans rats were implanted with VNS cuffs. After recovery, rats underwent auditory fear conditioning (day 1) followed by a conditioned fear response test to assess baseline levels of fear (CFRT; day 2), 2 days of 20-trial EE paired with either VNS (4, 2s, 0.8mA VNS trains evenly spaced during each trial) or sham stimulation (days 3-4), and an extinction retention test (day 5). Three forms of fear relapse were tested: a) spontaneous recovery in the extinction context 15- and 43-days post-extinction; b) fear renewal in a novel context 48 days post-extinction; and c) footshock-induced fear reinstatement 50 days post-extinction. VNS and sham groups both displayed robust extinction learning, and no differences in conditioned fear between groups were observed in spontaneous recovery or renewal. However, fear reinstatement was significantly lower in VNS-treated rats than in sham-treated rats. This suggests that VNS paired with EE produces a more resilient extinction memory, preventing fear relapse. This robust, long-term protective effect has clinical implications for PTSD treatment and supports a distinct neural mechanism for VNS enhancement of extinction learning.

(160)

Understanding the Efficacy of Mask Mandate Policies on COVID-19 Infections

Avanthi Reddy

Naveen Jindal School of Management, The University of Texas at Dallas

The COVID-19 pandemic has taken the lives of over six million people and infected over five-hundred million people so far. Evidently, the pandemic dramatically impacted many communities and the livelihoods of millions of people. Being vaccinated, maintaining physical distance (practicing “social distancing”), and wearing a mask are a few but extremely effective methods of protecting one against the virus. Studying the efficacy of mask use, specifically through statistical analysis, will allow people to be better protected and prepared now and for the future.
Previous research regarding this topic explains that masks are effective in decreasing the number of COVID-19 cases which is proven through analysis of data from various communities and different intervention methods. The goal of this research is to use new methods such as regression analysis to understand how the factor of wearing a mask is impactful in decreasing the number of COVID-19 cases when specific mask mandate policies are implemented. The central question that this research focuses on is regarding the efficacy of masks in preventing the spread of the virus when public and business face mask mandate policies are implemented. The data used to conduct the research comes from the CUSP (COVID-19 US State Policy) database as well as the COVID-19 statistics that have data gathered from Wikipedia, The New York Times, JHU CSSE COVID-19 Data, and Our World in Data.
Through the regression analysis, it is found that the mask mandate policies allow for a reduction in the number of COVID-19 infections.

(161)

Computational Design of Bio-Based Ionic Liquids

Daniel Relix, Dineli Ranathunga, Hedieh Torabifard

Department of Chemistry and Biochemistry, The University of Texas at Dallas

Ionic liquids (ILs) are salts that exist as a liquid at or below room temperature. Interest around ILs has increased dramatically over the last thirty years, primarily due to their low volatility, making them potentially useful as green alternatives to volatile organic solvents. Despite this potential, ILs are yet to be commonly used as green solvents since many are toxic and non-biodegradable. A solution to this problem lies in developing ILs from biological sources. Computational methods, such as molecular dynamics (MD) simulations, offer a systemic approach to analyzing possible candidates. For an MD simulation to adequately model a system, an appropriate force field (FF) must be selected. AMOEBA polarizable FF is currently the most developed polarizable FF which can capture changes to the charge distribution of each ion in the simulation. Including polarizability in AMOEBA FF creates a more accurate model that can better represent the behavior of ILs. In the present study, polarizable AMOEBA FF parameters were developed to model ILs containing a 1-ethyl-3-methylimidazolium cation ($EMIM^+$) and an amino acid (AA^-) anion (alanine, glycine, and serine). The $[EMIM^+][AA^-]$ systems were modeled over a temperature range of 293.15 K to 363.15 K, and their properties, including density, heat of vaporization, and diffusion coefficient were determined. Results were compared to data from experiments with good agreement.

(162)

Stressing Success: Emotional Intelligence and Workforce Productivity

Ahana Samat

Department of Economics, The University of Texas at Dallas

Recent years have seen a growing workforce face the intense stressors of increasing competitive labor markets. Simultaneously, the role of emotional intelligence, measured through an Emotional Quotient (EQ) in

the workforce is becoming an area of interest for Human Resource (HR) professionals, team leaders, researchers, and writers. In fact, a growing number of organizations provide related training designed for employees. Does a focus on emotional intelligence enhance workplace productivity? In other words, do positive emotions yield positive outcomes? This paper uses an extensive literature review to determine the role of EQ and positive emotions in navigating workplace stress and achieving desired outcomes. It then applies economic theory and a marginal product (MP) curve to show how developing emotional intelligence translates into higher productivity for firms. Relevant policy changes can be suggested to improve the focus on maintaining and growing the emotional intelligence and well-being of the 62.2% of individuals in the United States making up the labor force.

(163)

Fabrication of a Portable Pesticide Electrochemical Sensor: A Novel Label-Free Detection Of Glyphosate in Human Urine

Manish Samson, Durgasha Poudyal, Shalini Prasad

Department of Bioengineering, The University of Texas at Dallas

The increasing ambient toxicity levels and exposure to glyphosate, a widely used herbicide and desiccant, are significant public health issues. In this study, we aim to design a highly sensitive, label-free, portable sensor for the direct detection of glyphosate in human urine. The sensor platform consists of a portable, circular circuit platform with gold working and reference electrodes to enable non-faradaic electrochemical impedance spectroscopy. The sensing platform is comprised of an immunoassay-based electrode surface immobilized with a monolayer of dithiobis succinimidyl propionate (DSP), a thiol-based cross-linker, which was then modified with a glyphosate antibody (Glyp-Ab) through the bonding of the ester group of DSP with the amide of the antibody (Glyp-Ab). The sensor was tested electrochemically through two methods - the laboratory-based Gamry benchtop method and the custom portable sensing platform. Using the bench-top method for the glyphosate-spiked urine samples resulted in a dynamic response in the concentration range of 0.1–72 ng/mL with a limit of detection (LOD) of 0.1 ng/mL. This platform showed high selectivity in the presence of major interfering analytes in urine [malathion (Mal), 3-phenoxybenzoic acid (PBA), and chlorpyrifos (Chlp)] as well as high reproducibility with low inter-chip variation. Performance between the benchtop method and the portable platform were compared - creating a Pearson performance correlation of r = 0.994 between the two methods. This illustrates the development of a portable sensing approach that can be a highly reliable alternate sensor platform for the direct detection of pesticides in human bodily fluids.

(164)

Evaluating the Impact of Intergenerational Programs: Lessons Learned from TimeOut@UCLA and the Tellegacy Program

Owais Sayeed[1], Jeremy Holloway[2]

[1] Department of Neuroscience, The University of Texas at Dallas, [2]Department of Geriatrics, The University of North Dakota School of Medicine and Health Sciences

As the number of older Americans that make up the total US population increases over the next several decades, so too will the cases of Alzheimer's dementia. Despite such projections, the US lacks the workforce necessary to care for this aging population. The COVID-19 pandemic has exacerbated the need for geriatric care as lockdowns and social distancing measures increased social isolation and loneliness among older adults (OA). Intergenerational programs (IP) uniquely resolve both problems as they not only provide a developmental opportunity for university students but facilitate cognitive stimulation and social connection in an effort to slow disease prognosis and reverse isolation in OA. This study expanded upon previous evidence in an effort to analyze the implications of two different IP conducted during the pandemic. In both programs, university students met with OA weekly and engaged in structured conversation to promote goal setting, positive mindset, and visualization. Results revealed that mental attention, cognitive stimulation, and entertainment were the primary benefits of such programs to OA. Surveys of students in each program

respectively indicated overwhelmingly positive experiences with qualitative responses highlighting a growth in interest to help with Alzheimer's disease and socially isolated OA in the future. Future studies require larger, geographically diversified samples to corroborate these findings and discover best practices to maximize the benefits of IP.

(165)

Oncostatin M receptor expression in the human dorsal root ganglia

Aishni Shrivastava, Samhita Bandaru, Keerthana Natarajan, Juliet Mwirigi, Theodore J. Price

Department of Neuroscience, The University of Texas at Dallas

Oncostatin M (OSM) is a cytokine that primarily activates cells under conditions of inflammation, notably upregulated in patients suffering from chronic back pain and rheumatoid arthritis. Despite its relevance in pain research, OSM remains to be one of the least studied cytokines in the Interleukin 6 (IL-6) family. This can be attributed to the differences in OSM structure and function across species. In this research, we primarily focused on human dorsal root ganglia (hDRG) and we hypothesized the presence of OSMR in neurons and satellite glial cells. We first performed computational analysis with hDRG transcriptomic sequencing datasets to assess the presence and spatial distribution of OMSR gene transcripts in male and female hDRGs. To pinpoint the location of OSM release itself, we also investigated the secretion of OSM by IBA1 macrophages. Here we utilized the cryostat to section tissue from healthy organ donors and performed immunostaining with OSM, OSMR antibodies and various markers of neuronal and non-neuronal cell-types. Both male and female tissues were used to study sex differences in OSMR localization. Following immunostaining, the slides were imaged with the FV2000 laser confocal microscope. Our findings cumulatively demonstrate that OSMR is expressed in hDRG nociceptive neurons and satellite glia. We observed that surrounding IBA1 macrophages release OSM, which selectively binds to its cognate receptor, OSMR. We also noted differences in the expression of OSM between male and female tissue samples. We conclude that exploring OSM and its receptor in human sensory ganglia allows for more targeted and effective pain treatments.

(166)

A Novel Intracortical Microstimulation Behavioral Paradigm for the Evaluation of Stimulation-Evoked Somatosensory Percepts in Rodents

Hari Srinivasan[1], Thomas J. Smith[3], Yupeng Wu[1], Justin R. Abbott[1], Jeffrey R. Capadona[2], Crystal T. Engineer[3], Stuart F. Cogan[1], Joseph J. Pancrazio[1], Ana G. Hernandez-Reynoso[1]

[1]Department of Bioengineering, The University of Texas at Dallas, [2]Department of Biomedical Engineering, Case Western Reserve University, [3]Department of Neuroscience, The University of Texas at Dallas

Microelectrode arrays (MEAs) are used in neuro-prostheses to evoke sensory feedback through intracortical microstimulation (ICMS). However, a behavioral paradigm for assessing chronic sensory microstimulation without aversive techniques has not been demonstrated. Here, we modified a widely-used positive-reinforcement operant conditioning paradigm based on nose-poking to assess perception thresholds in response to ICMS. Our goal was to develop a protocol that enables researchers to investigate the reliability over time of ICMS on perception and MEA performance in-vivo. Sprague Dawley rats were randomly assigned to either an experimental group (MEA implantation targeting the primary somatosensory cortex (S1FL) or control group (no implantation). Both animal groups were introduced into a custom nose-poke apparatus. The treatment group was trained to nose-poke following ICMS to receive a sugar pellet; the control group attempted this task without ICMS. Previously established ICMS parameters were employed: charge-balanced, biphasic waveforms, 320 Hz frequency, 200 µs pulse width, 40 µs interface interval, 0-10 nC/phase charge. Confusion matrices (True/False pokes vs. non-pokes) were generated. Results over 291 trials showed the treatment group had an accuracy of 74.9%, precision of 75.6%, true-poke rate of 70.7%, true non-poke rate of 78.8%, and F1-score of 73.1%. In contrast, the control group demonstrated an accuracy of 49.7% over 1231 trials with decreases in precision, true non-poke rate, and F1-score (52.0%, 13.3%, and 63.4% respectively).

These findings were statistically significant, as determined by a chi-square test, suggesting that this non-aversive paradigm may be used to examine ICMS consistency under chronic implantation conditions.

(167)

Impact of Antioxidant Coatings on Multi-Shank Intracortical Microelectrode Array Performance in Rodents

Teresa Thai[1], Joshua Usoro[1], Brandon Sturgill[1], Sourav Patnaik[1], Tania D'souza[1], Olivia Krebs[2], Jonathan Duncan[2], Mrudang Desai[1], Jeffery Capadona[2], Joseph Pancrazio[1]

[1]Department of Bioengineering, The University of Texas at Dallas, [2]Department of Biomedical Engineering, Case Western Reserve University

Intracortical microelectrode arrays (MEAs) remain at the forefront of brain-machine interface research; however, shortly after implantation, the performance of multi-shank MEAs decay rapidly over time. In this study, we evaluated neural recording performance of antioxidant (superoxide dismutase mimetic) coated (n=5) or uncoated (n=5) 16-channel multi-shank (MS) probes in Sprague-Dawley rats. Proportion of active electrodes (AEY), peak-peak voltage (Vpp), noise levels (root mean square (RMS) noise), and signal to noise ratios (SNR) were compared across the two groups. The AEY for coated probes was significantly higher than the control for first two weeks - week 1: (33.75% vs. 21.25%; p = 0.0369); week 2: (28.75% vs. 17.50%; p = 0.0443). Although not statistically significant between groups, AEY dropped by almost 89% and 29%, respectively, towards 8 weeks (Week 8: 3.75% vs. 15.0% (p = 0.9936)). Coated MEAs showed slightly less noise than the control group during implantation (4.63 ± 0.05µV vs. 5.35 ± 0.12µV; p < 0.0001). However, noise levels in the coated probes were significantly higher than the control group from week 2 (4.89 ± 0.15µV vs. 4.20 ± 0.18µV; p < 0.0001)) to week 7 (3.73 ± 0.19µV vs. 3.05 ± 0.14µV; p = 0.0022)). Despite this, minimal differences in Vpp and SNR were observed between probes over time. Overall, the antioxidant coating improved signal quality and performance of MS MEAs in the acute time period. Future studies will focus on immunohistological response of the coated devices over the chronic time periods.

(168)

High-fat Diet drives mechanical allodynia in the absence of previous injury, obesity, or diabetic pathology

Calvin Uong, Jessica Tierney, Michael Burton

Department of Neuroscience, The University of Texas at Dallas

A typical Western diet is rich in fats producing high levels of circulating bioactive metabolites. This energy-dense, poor nutritional diet is contributing to rising levels of obesity and diabetic pathology that is often comorbid with painful neuropathy. However, no research has delineated the influence of a high-fat diet (HFD) on pain sensitization towards non-painful stimuli in the absence of obesity and diabetic pathology. To investigate this, we tested the ability of a HFD to stimulate diet-induced hyperalgesic priming, or diet sensitization in male and female mice. After eight weeks on HFD, mice were confirmed to have unaltered baseline pain sensitivity. However, exposure to a subthreshold dose of intraplantar Prostaglandin E_2 (PGE_2), an inflammatory mediator, prompted the development of mechanical hypersensitivity in both HFD males and females in comparison to control counterparts. Using calcium imaging to determine neuronal activity and sensitization, sensory neurons from HFD males and females revealed an HFD-induced increase in percentage of capsaicin-responsive neurons compared to their control counterparts. Immunohistochemistry showed an HFD-induced upregulation of ATF3, a neuronal marker of injury, in lumbar dorsal root ganglia (DRG). This reveals how the dietary components from a HFD can cause allodynia in the absence of pathological conditions. With this new-found understanding of how specific aspects of a traditional Western diet can contribute directly to the onset of chronic pain, we can better tease out the immunology behind the comorbidities associated with obesity, such as heart disease, and develop pharmacological interventions to more efficiently treat them.

(169)

Spanish Bilingualism Not Predictive of Error Type in Word Learning Task

Reyes Veliz, Kathleen Denicola-Prechtl, Stephanie Castro, Prasanth Chalamalasetty, Mandy Maguire

Department of Speech, Language, and Hearing Sciences, The University of Texas at Dallas

The ability to infer a word from context is critical to vocabulary growth and, consequently, academic achievement. Furthermore, analyzing errors is important to understanding the learning process of language acquisition. We analyze the error patterns of 81 eight-to-nine-year-old monolingual English and bilingual Spanish speakers during a word learning task. Children read three sentences that ended in a final nonsense word and were asked to identify the meaning of the word. Previously, we reported that children with smaller vocabularies tended to make more errors in general, but we did not identify why or in which instances that was the case. All responses were recorded, and errors were coded into the following categories: pragmatically odd (i.e., physically possible but highly unlikely), structural (i.e., morphological, or syntactic errors), semantic (target word and error are semantically related), lack of background knowledge (i.e., error reflective of non-familiarity of other words in context), and unrelated/out-of-category (i.e., error is not semantically related to target word). Our findings indicated vocabulary size predicted the tendency to make an unrelated error ($r = -0.28$, $p = 0.011$), but not the others and that the differences in error frequency between the monolingual and bilingual groups were not statistically significant for any of the error types. This indicates that not all error types are linked to vocabulary size, and that the type of error children make does not differ by bilingual status. Additional research is necessary to understand why children make other types of common errors now that vocabulary and bilingualism have been ruled out.

(170)

The Effects of One-Year Aerobic Exercise on Cerebral Blood Flow Regulation in Cognitively Normal Older Adults

Aryan Verma[1], Tsubasa Tomoto[2], Rong Zhang[3]

[1]Department of Neuroscience, The University of Texas at Dallas, [2]Institute of Exercise and Environmental Medicine, Texas Health Presbyterian Hospital Dallas, [3]Department of Neurology, The University of Texas Southwestern Medical Center

Age-related decline in cerebrovascular function is associated with cognitive impairment and may lead to neurodegenerative diseases. Aerobic exercise may improve cerebral blood flow (CBF) regulation; however, the impacts of aerobic exercise on CBF and cerebrovascular resistance (CVR) in older adults are inconclusive. The purpose of this study was to investigate the effects of aerobic exercise on CBF and CVR in cognitively normal older adults. Seventy-three cognitively normal older adults were randomized to 12-months of progressive, moderate-to-vigorous aerobic exercise training (AET, n=37) or stretching-and-toning (SAT, active control, n=36). Cardiorespiratory fitness was assessed by peak oxygen uptake ($\dot{V}O_{2peak}$). CBF was measured as the sum of volumetric blood flow from both the internal carotid and vertebral arteries using ultrasonography and divided by total brain tissue mass measured by magnetic resonance imaging to obtain normalized CBF (nCBF). Mean arterial pressure (MAP) was calculated by the area under the curve of the brachial artery pressure waveform that was obtained using applanation tonometry. CVR was calculated as MAP divided by total CBF. 56 subjects (AET, n=28, SAT, n=28) completed the one-year intervention. One-year AET improved $\dot{V}O_{2peak}$, increased CBF, and decreased CVR. Increases in $\dot{V}O_{2peak}$ were associated with increased nCBF ($r = 0.621$, $p = 0.001$) and decreased nCVR ($r = -0.412$, $p = 0.037$) in the AET group but not in the SAT group. These results suggest that aerobic exercise improves cerebrovascular function, which may benefit brain health and delay cognitive impairment in older adults.

(171)

Analysis Of Foreign Body Responses from Ultramicroelectrode Arrays Impanated in Rodent Brains

Gayathri Vijayakumar, Armaan Sood, Yusuf Mehmood, Pegah Haghighi, Justin Abbot, Joshua Usoro, Brandon Sturgill, Sourav Patnaik, Stuart Cogan, Joseph Pancrazio

Department of Bioengineering, The University of Texas at Dallas

Magnitude of immunological response or foreign body reaction (FBR) to neural microelectrode arrays (MEAs) implantation are typically characterized by end-point histological characterization using biomarkers such as glial fibrillary acid protein (GFAP), neuronal nucleus (NeuN), etc. Prior studies have shown that a reduced cross-sectional area of MEAs produces a lower magnitude of FBR in the brain tissue. The goal of this study is to quantify the GFAP response to the larger Neuronexus (NNx) probes (630 μm^2) versus the smaller amorphous silicon carbide (a-SiC) UMEAs (160 μm^2). Nine adult rodent brains were used in the study, and they were previously implanted with NNx probes (n=2), a-SiC probes (n=5), or sham (n=2). After implantation for a chronic period (16 weeks), the animals underwent perfusion, brains were extracted, and tissues were processed for histology (GFAP, NeuN, etc). To evaluate the immunohistological response from these devices, we compared the proportion of “hits” (or areas of very high GFAP activity) obtained from a-SiC, control, or sham (no implant) brains across various depths (0-400 microns – “superficial”; 600-800 microns – “middle”; and 1000-1200 microns – “deep”). Proportion of “hits” for a-SiC group was significantly lower than the control for superficial (0.34% vs. 1.2%; $p<0.05$), middle (0.33% vs.0.97%; $p<0.05$), and deep layers (0.17% vs. 0.88%; $p<0.05$), respectively. Stained cortical tissue surrounding the presumptive a-SiC probe insertion site was indistinguishable from sham tissue indicative of virtually no immunohistological response, at either superficial or deep layers of the cortex. We are currently evaluating the neuronal cell count for the obtained immunohistological images.

(172)

The Association between White Matter Tract Microstructure and Social Communication Skills in Typically Developing Infants

Bernadette Weigman, Meghan R. Swanson

Department of Psychology, The University of Texas at Dallas

Deficits in social communication are core features of autism spectrum disorder (ASD). The Communication and Symbolic Behavior Scales-Developmental Profile (CSBS-DP) is a clinician administered assessment designed to evaluate infants' social communication skills at 12- and 24-month of age and is an effective early detection method of social developmental delays. Aberrations in the development of white matter tracts, specifically the inferior longitudinal fasciculus (ILF), inferior fronto-occipital fasciculus (IFOF), arcuate fasciculus (AF) and uncinate fasciculus (UF), have been implicated in ASD. In this study, using data from the Infant Brain Imaging Study, we examine the white matter correlates of social communication in typically developing infants with the goal of providing a framework for future studies of a similar nature involving ASD participants. Specifically, we hypothesize that participants with greater structural coherence of the ILF, IFOF, AF, and UF at 12- and 24-months, as measured by fractional anisotropy (FA), will also have better social communication skills at 24-months, as measured by the CSBS-DP. Following linear regression analyses we found a significant association between FA values of the left temporofrontal AF at 12-months and the CSBS-DP total scores at 24- months, after controlling for chronological age at scan, data collection site, sex of the infant, and maternal education attainment. Our results provide mild but compelling evidence that white matter structural coherence is associated with better social communication skills in the first two years of life in typically developing infants.

(173)

Does birth order negatively affect younger siblings' vocabulary growth when compared to older siblings?

Krishna Yalavarthy, Kathleen Denicola-Prechtl, Stephanie Castro, Prasanth Chalamalasetty, Mohammad Hossein Behboudi, Mandy Maguire

Department of Psychology, The University of Texas at Dallas

A prior study has shown that having older siblings has a significant, negative effect on a child's verbal skills; however, how birth order impacts vocabulary growth of school-aged children is less studied. The purpose of this study is to analyze the relationship between increased birth order and vocabulary size in 122 eight-to-fifteen-year-olds from families with a minimum of three children in the home. We predict that each increase in birth order corresponds to a stronger negative effect on vocabulary size. Parents reported demographic information, including the number of children in the home and their child's birth order. Vocabulary measures were obtained utilizing the Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4). Results showed an increased effect of birth order on vocabulary size with additional children in the home, when controlling for child age and maternal education level. First-borns' vocabulary size was relatively unaffected by other children in the home, whereas second-borns showed a slight decrease in vocabulary size. Moreover, third-borns showed the greatest decrease in vocabulary scores with the presence of other children in the home, indicating the effect of increased birth order. These results suggest that later-born children may be at a risk of having smaller vocabularies during their school years. More research is needed to investigate why this negative correlation exists, as well as to explore possible interventions.

Index

Save the Date
SPUR 2023: July 28