

# 27th Annual Graduate Student Research Symposium & Exhibit

*Sponsored by*  
the Graduate Student Association  
& the Graduate School

April 24, 2024

University Student Commons,  
Commonwealth Ballrooms

April 25, 2023





# VCU

## Graduate School

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April 24, 2024

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Dear Participants and Guests,

I am pleased to welcome you to the 27<sup>th</sup> Annual Graduate Student Research Symposium and Exhibit sponsored by the Graduate Student Association (GSA) at Virginia Commonwealth University. The Symposium is organized by graduate students and provides them an opportunity to display their scholarly work and cutting-edge research.

The Research Symposium and Exhibit also gives our faculty, staff, undergraduate students, and other members of our university community a chance to witness the outstanding work of our graduate students. The work presented today covers an array of topics reaching across many academic disciplines, representing the impressive scholarship of our graduate student body. I congratulate all of this year's presenters for their contribution to the success of this important program.

I would particularly like to thank Mallory Stephenson, chairperson of the Symposium, and the officers of the GSA who have helped in planning this Symposium. This event is an excellent example of how an active GSA can benefit all graduate students.

Thank you for attending this year's Symposium. I hope that you enjoy the event.

Sincerely,

Manu Gupta, Ph.D.  
Interim Dean, Graduate School

# Graduate Student Association

## What is the GSA?

The Graduate Student Association (GSA) provides many valuable services to the graduate student body at Virginia Commonwealth University (VCU). The GSA organizes events throughout the academic year including Graduate Student Orientation, Meet & Greet events and social mixers, and the Graduate Research Symposium & Exhibit. The GSA also appropriates funds for graduate student organizations to enhance the quality of the graduate student experience at VCU. Finally, the GSA helps to place graduate students on campus committees, where they represent the voice and express the concerns of VCU's graduate student body.

## Our Mission:

The purpose of the GSA is to serve as an advocate for the issues and needs of the graduate students at VCU. The GSA is committed to facilitating programs that enhance the academic skills, professional development, and social environment of all graduate students. There is no fee to join the GSA, every graduate student is a member and eligible to participate in and contribute to the GSA and GSA activities. However, the GSA-sponsored events are not limited to graduate students – all students and faculty are welcome.

## Executive Committee:

The purpose of the GSA Executive Committee is to represent, advocate, facilitate communication and provide social activities for the VCU graduate community.

### 2023-2024 Executive Committee

**Guleer Shahab, President**  
School of Public Health

**Anabeel Sen, Vice President**  
School of Public Health

**Jenee Lee, Symposium Chair**  
School of Social Work

**Chineme Jeanfrances Onukwughara,  
Appropriations Chair**  
College of Humanities and Sciences

**Keandra Davis, Secretary**  
L Douglas Wilder School of Government and Public  
Affairs

**Tamim Chiba, Events Chair**  
School of Pharmacy

**Shruti Sampath, Communications Chair**  
College of Health Professions

## GSA Council:

The purpose of the GSA Council members is to represent VCU graduate schools, programs and departments by relaying student concerns to the GSA and the Executive Committee. The GSA is looking for representatives from each school to form the Graduate Student Council. Applications may be found at: <https://graduate.vcu.edu/life/graduate-student-association/>

## More Information:

For more information about the GSA, please visit: <https://graduate.vcu.edu/life/graduate-student-association/>

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Follow us on Twitter: @VCUGSA

Contact us at [gsa@vcu.edu](mailto:gsa@vcu.edu)



# 2024 Symposium Judges

*A heartfelt thank you to all the faculty and staff who supported the graduate students presenting today, as well as those faculty who were involved in the symposium but not named below. We could not host such an innovative event without your help!*

## **College of Engineering**

Charles 'Chas' McGill, Ph.D.  
Priscilla Hwang, Ph.D.

## **College of Humanities & Sciences**

Sarah Seashols-Williams, Ph.D.  
Ryan Garten, Ph.D.  
Oliver Speck, Ph.D.  
Derek Prosser, Ph.D.  
Ronald Evans, Ph.D.  
Arlenis Santana, Ph.D.  
Alicia Borre Montealegre, Ph.D.  
Daeha Joung, Ph.D.  
Grace Gipson, Ph.D.  
LaChelle Waller, Ph.D.  
Brendan Dwyer, Ph.D.  
Alvin Bryant, Ed.D.  
Zachary N. Ghahramani, Ph.D.

## **L. Douglas Wilder School of Government and Public Affairs**

Chernoh Wurie, Ph.D.  
Lindsey Evans, Ph.D.  
Nancy Morris, Ph.D.

## **National Scholarship Office**

Meredith Sisson, Ph.D.

## **Office of Research and Innovation**

Mahesh Jonnalagadda, Ph.D.

## **College of Health Professions**

Faika Zanjani, Ph.D.

### **Graduate School**

Melissa Tyler, Ed.D.  
Sarah Steele, M.Ed.

## **School of Education**

Staci Carr, Ph.D.  
Hillary Parkhouse, Ph.D.  
Jeffery Wilson, Ph.D.  
Kristen Brown, Ed. D.  
Jose Alcaine, Ph.D.

## **School of Medicine**

Kristy Dixon, Ph.D.  
Russell Boyle, M.A.  
Hannah Fulenwider, Ph.D.  
Marcel Ferreiro, MD  
Esha Madan, Ph.D.  
Molly Hyer, Ph.D.  
Javier Gonzalez-Maseo, Ph.D.  
Rita Shiang, Ph.D.  
Carlos Escalante, Ph.D.  
Laxmikant Deshpande, Ph.D.

## **School of Pharmacy**

Barbara Exum, Pharm. D.  
Balaji Nagarajan, Ph.D.

## **School of Social Work**

Nicole Lee, Ph.D.  
Karen Chartier, Ph.D.  
Jacob Goffnet, Ph.D.  
Shenita Williams, MSW  
Liano Fino  
Traci Wike, Ph.D.  
Gary Cuddeback, Ph.D, MPH  
Elizabeth Cramer, Ph.D.

## **Strategic Enrollment Management and Student Success**

Shay Lumpkin

# 2024 Symposium Judges

## **VCU Libraries**

Nia Rogers, M.S.  
Stacey Wahl, Ph.D  
Julie Arendt, M.S.I.  
Hope Kelly, Ph.D.

## **Office of Student Engagement and Leadership**

Lisa Cooper, Ed.D.

## **Richard T. Robertson School of Media and Culture**

Judi Crenshaw, APR

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## College of Engineering

**Charles Cutler & Scott Taylor, Computer Science**

*Continual Knowledge Extraction: A Pathway to Enhanced Chemical Patent Mining*

**Background**

Chemical patents serve as invaluable resources for advancing chemical research by providing crucial insights into reactions and experimental conditions. Extracting chemical entities from patents through Named Entity Recognition (NER) poses a significant challenge due to the distinct and protective language used in patents and the constant influx of new patent applications.

### **Methods**

This study introduces a novel NER model developed using a BERT-based architecture enhanced by a Student/Teacher model. Our approach aims to address the continuous need for improvement in NER systems, especially in adapting to the evolving landscape of patent language and the emergence of new entity types. Special attention is given to mitigating "catastrophic forgetting," ensuring the model's ability to recognize both established and new entity types.

### **Results**

Our methodology demonstrates promising results in recognizing chemical entity types extracted from chemical patent texts. Additionally, we plan to explore the potential of Generative AI to automatically generate training data, streamlining the model development process and enhancing scalability. Furthermore, continual reinforcement learning techniques will be investigated to enhance the model's adaptability and performance further.

### **Conclusions**

This innovative framework promises to enhance the efficiency and accuracy of extracting chemical entities from patents and extend its applicability to scientific journal articles. By facilitating deeper insights into chemical research, our model contributes to accelerating scientific discovery and innovation. Through ongoing refinement and adaptation, it holds the potential to address global challenges, such as expediting the discovery and manufacturing of critical solutions like vaccines.

## **Reem Mahmoud, Computer Science**

### *Graphic Coloring Reconfiguration*

#### **Background**

Reconfiguration is the concept of moving between different solutions to a problem by transforming one solution into another using some prescribed transformation rule (move). Given two solutions  $s_1$  and  $s_2$  of a problem, reconfiguration asks whether there exists a sequence of moves which transforms  $s_1$  into  $s_2$ . Reconfiguration is an area of research with many contributions towards various fields such as mathematics and computer science.

The  $k$ -coloring reconfiguration problem asks whether there exists a sequence of moves which transforms one  $k$ -coloring of a graph  $G$  into another. A move in this case is a Kempe swap. An  $\alpha, \beta$ -Kempe swap in a properly colored graph interchanges the colors on some component of the subgraph induced by vertices colored  $\alpha$  and  $\beta$ . Two  $k$ -colorings of a graph are  $k$ -equivalent if we can form one from the other by a sequence of Kempe swaps (never using more than  $k$  colors). The  $k$ -coloring reconfiguration problem has applications in statistical physics and

mechanics; in particular, it has positive implications on the Markov chains defined for the Ising model in statistical physics and the antiferromagnetic Potts model in statistical mechanics.

The reconfiguration graph  $C_k(G)$  associated with the  $k$ -coloring reconfiguration problem is defined as follows: The vertices of  $C_k(G)$  are the  $k$ -colorings of  $G$  and two vertices in  $C_k(G)$  are adjacent if their corresponding  $k$ -colorings differ by a single Kempe swap. We study  $C_k(G)$  for certain classes of graphs  $G$ . In particular, we study the connectedness and the diameter of  $C_k(G)$ . Indeed, the connectedness of  $C_k(G)$  is equivalent to the  $k$ -colorings of  $G$  being pairwise  $k$ -equivalent. On the other hand, the diameter of  $C_k(G)$  is the smallest integer  $d$  such that, for every two  $k$ -colorings of  $G$ , there is a sequence of length at most  $d$  from one to the other. Our results on the connectedness of  $C_k(G)$  imply the Markov chain for the models mentioned above is ergodic, while lower bound results on the diameter of  $C_k(G)$  imply lower bounds on the mixing time of the Markov chain.

We also explore list-coloring reconfiguration. For a list-assignment  $L$  and an  $L$ -coloring of  $G$ , a Kempe swap is called  $L$ -valid if performing the Kempe swap yields another  $L$ -coloring. Two  $L$ -colorings are called  $L$ -equivalent if we can form one from the other by a sequence of  $L$ -valid Kempe swaps. The associated reconfiguration graph in this case is  $CL(G)$ .

## Results

Project 1: The triangulated toroidal grid,  $T[m \times n]$ , is formed from (a toroidal embedding of) the Cartesian product of  $C_m$  and  $C_n$  by adding parallel diagonals inside all 4-faces. We prove that all 5-colorings of  $T[m \times n]$ , are 5-equivalent when  $m, n \geq 6$ , i.e.,  $C_5(G)$  is connected for such toroidal graphs  $G$ .

Project 2: Let  $G$  be a connected  $k$ -regular graph with  $k \geq 3$ . We prove that if  $L$  is a  $k$ -assignment, then all  $L$ -colorings are  $L$ -equivalent unless  $G \cong K_2 \times K_3$ , i.e.,  $CL(G)$  is connected for every  $k$ -assignment  $L$ . This generalizes an analogous result about the  $k$ -colorings of  $k$ -regular graphs.

Project 3: It is conjectured that the diameter of  $C_k(G)$  is  $O(n^2)$  for every  $d$ -degenerate graph  $G$  whenever  $k \geq d+2$ . As a step towards proving this conjecture for triangle-free planar graphs, we show that  $C_5(G)$  is  $O(n^2)$  for every planar graph  $G$  with no 3-cycles and no 5-cycles.

## Tyrell Simmons, Mechanical & Nuclear Engineering

### *Energy Resolution and Modeling of Scintillator Detectors*

#### Background

The most common radiation detectors are sodium iodide (NaI) detectors, which may have lower energy resolution than detectors such as High-Purity Germanium detectors, but they are far more cost-effective and don't require extensive cooling. Today, similar detectors, such as lanthanum bromide ( $\text{LaBr}_3$ ) and cerium bromide ( $\text{CeBr}_3$ ), have begun to rise in popularity. This project aims to study the energy resolution of these detectors and model and validate them in radiation transport codes to test their capabilities further.

#### Methods

Experimental measurements were taken with three radiation detectors LaBr<sub>3</sub>, CeBr<sub>3</sub>, and NaI. Each detector measures multiple different point sources. This experimental data was then used to accurately find the full width half max (FWHM) for each detector. This data was then compared to previous data taken in different software and the same software. The radiation transport codes MCNP and GADRAS were utilized to model the detectors and validate the models against experimental measurements.

### **Results**

Both MCNP and GADRAS models were made, with GADRAS overestimating the total counts in the peaks and MCNP underestimating the total counts in similar scenarios. The energy resolution of each detector got worse over time compared to years prior, with noticeable differences found based on the software utilized.

### **Conclusions**

Due to the difference in the energy resolution of the data measured in two different software programs, the FWHM can change based on the software. Overall MCNP performed better than GADRAS compared to experimental measurements.

## **Khosh Rafei, Chemical & Life Sciences Engineering**

### *Guided Data Collection in Chemical Systems with Machine Learning Methods*

#### **Background**

Chemistry heavily relies on data collection, employing advanced technology to gather information on chemicals and reactions. Machine learning assists in interpreting this data by identifying patterns and making predictions. Our research combines data collection with machine learning methods, specifically utilizing Chemprop, to identify effective approaches in chemical systems, focusing on datasets like Quantum Chemistry Molecules, Free Solvation Energy, Toxicity Lethal Dose, Aqueous Solubility, and Lipophilicity.

#### **Methods**

We detail our research methods, including handling uncertainty methods such as: MVE, Evidential, Ensembles and Dropout, and defining Active Learning within chemical systems. We discuss active learning results from diverse datasets, using clustered starting points on the QM9 dataset. Additionally, we introduce a novel data selection method and analyze outcomes for both scattered and clustered starting points.

#### **Results**

Our research provides important insights into how different models perform. We found that ensembles of MVE and Evidential models do well when the data is spread out evenly. However, their performance drops when the data is clustered together. Additionally, our study of the multi-method switching approach shows that it can work well across various types of data distributions, helping to reduce performance differences.

#### **Conclusions**

Our findings underscore the critical importance of strategic data selection, particularly in scenarios with clustered starting points. Additionally, we recommend further exploration of the multi-method switching approach as a



versatile solution in chemical systems. Furthermore, it's worth noting that ensemble models exhibited exceptional performance in our research.

## **Kusal Debnath, Computer Science**

### *AI in Oncology: Evaluating Deep Learning Applications in Cancer Drug Discovery*

#### **Background**

Conventional drug discovery, known for its costliness and time-consuming nature, is being revolutionized by Artificial Intelligence (AI) technologies. These technologies offer promising alternatives, demonstrating effectiveness and reliability in various fields. As showcased in this study, the AI-powered repurposing of approved drugs presents a straightforward approach, reducing reliance on extensive lab testing and clinical trials.

#### **Methods**

This study evaluates several deep learning-based drug repurposing models for their effectiveness in identifying potential drugs against breast cancer. These drugs have already been approved and shown efficacy against various other diseases. The evaluation involves testing three models (DeepPurpose, DeepDTA, GraphDTA) using a dataset comprising drug-target interaction pairs and corresponding affinity values (Kd) related to breast cancer targets in humans.

#### **Results**

Among the three models evaluated, DeepPurpose emerges as the best performer, achieving an AUROC of 0.921. These results highlight the potential of the examined models in predicting candidate drugs for repurposing across different diseases.

#### **Conclusions**

The findings of this study underscore the potential of deep learning-based models, particularly DeepPurpose, in identifying potential drugs for repurposing across a spectrum of diseases. These insights can significantly advance the field of cancer drug repurposing and de novo drug design.

## **Michael Dexheimer, Biomedical Engineering**

### *Investigating the Electrophysiological Features of Post Traumatic Epilepsy in Rat Hippocampus*

#### **Background**

Epilepsy occurs as a result of moderate to severe traumatic brain injury (TBI) in 10-20% of cases. Some risk factors of post traumatic epilepsy (PTE) are known, but the mechanisms by which PTE arises are not. Loss of mossy cells and interneurons within the dentate gyrus (DG) has been implicated in the development of hippocampal (HC) seizures, including after TBI.

**Methods:** We use a fluid percussion injury model (FPI) of PTE in rats and laminar silicon probes to interrogate the microcircuitry of the HC. We aim to characterize changes in the post-synaptic response to entorhinal input within the DG as well as its downstream influence on HC microcircuitry. We quantify the morphology of distinct electrophysiological events in the DG after TBI. In order to address challenges in TBI associated morphological changes, we generate current source density (CSD) representations of local field potentials in conjunction with independent component analysis (ICA).

## **Results**

Our preliminary results show examples of post-injury morphological changes in post-synaptic electrographic events (“dentate spikes”) in the DG that may reflect pathological alterations in the patterns of entorhinal inputs to the HC.

## **Conclusion**

This analysis allows us to define and classify distinct patterns of post-synaptic activity in the DG and CA1 sub-region that reveal the distinct combinations of entorhinal inputs contributing to post-synaptic patterns. Further, this use of ICA improves interpretability of CSD representations when altered parameters are unknown and may allow us to reveal alterations within the temporal lobe after TBI that could lead to PTE.

## **Coral O’Brien, Pharmaceutical Engineering**

### *Attachment of Phycocyanobilin Chromophore to a de novo Protein*

#### **Background**

Photosynthetic cells rely on energy from the sun to produce sugars, but they need light harvesting proteins to absorb the solar energy to initiate the photosynthesis reaction. The unique absorbance characteristics of these light harvesting proteins also extend to their fluorescence properties, making them desirable for use in other applications such as fluorescence tagging agents or light absorbers in solar cells. A current limitation with natural photosynthetic proteins is tunability. Here, we use de novo proteins, having no homology to nature and made entirely by design, to make a light harvesting mimetic protein by covalently attaching a chromophore called phycocyanobilin (PCB).

#### **Methods**

Cysteine residues were introduced to the S824 de novo protein via site-directed mutagenesis. The effectiveness of autocatalytic binding of the de novo protein to PCB was tested by measuring its UV-Vis absorbance.

#### **Results**

Preliminary studies show that de novo proteins with cysteine mutations bind more PCB than the control S824 de novo protein. However, the effectiveness of autocatalytic PCB binding overall is low. PCB binding could be increased significantly with the utilization of the PCB lyase and de novo protein coexpression system.

#### **Conclusions**

PCB was not found to bind to cysteine mutated de novo proteins autocatalytically. Future work will use a coexpression system to attach PCB, enabling fully tunable biliprotein mimics that cover the entire visible spectrum of light.

## **Josephine Wallner, Biomedical Engineering**

### *Changes in Gpi Local Field Potentials During Freezing-of-Gait in Patients with Parkinson's Disease*

#### **Background**

Excessive beta oscillation in local field potentials is a hallmark of PD and has been identified in motor cortex, STN, and GPi. Beta oscillation reflects paused motor activity and is diminished with action but in PD, the beta activity is excessive, resulting in bradykinesia and rigidity. Previous studies, which were limited to STN-DBS, showed that FoG was associated with beta bursts, more prolonged beta just prior to freezing, and excessive synchronization in the 18Hzbeta band.

#### **Methods**

This study evaluates the LFPs of the output nucleus of the GPi in a real world setting with a superior sensing device (Percept), and simultaneous ankle motion data. Five individuals with PD-related FoG and a Percept DBS system will be evaluated ON medication/OFF stimulation.

After a baseline walk, participants will walk an obstacle course of five FoG-triggering scenarios to induce FoG. LFPs were analyzed during periods of freezing, standing, and walking. The Kullback-Leibler divergence between the theta phase and gamma amplitude was computed as a measure of phase-amplitude coupling.

#### **Results**

Theta-gamma phase-amplitude coupling is greater during freezing than standing, but less than during walking.

#### **Conclusions**

Changes in phase-amplitude coupling could be used to identify periods of freezing-of-gait directly from Gpi LFPs.

## **Rafael Gonzalez Rosario, Pharmaceutical Engineering**

### *Identifying Unique De Novo Proteins for Nanoparticle Synthesis using LSPC Synthesized Metal Oxide Nanoparticles*

#### **Background**

Biomineralization, the process organisms use to produce materials, uses proteins that bind to material surfaces influencing the size, shape, and morphology. Because biomineralization is performed under ambient temperatures and pressures, this method is ideal for producing semiconductor nanoparticles for photocatalysts and photovoltaics in a sustainable way. However, synthesizing highly efficient semiconductors through biomineralization remains challenging because natural proteins do not produce such materials. To overcome this limitation, *de novo* proteins are carefully designed with strong metal-binding amino acid groups, capable of interacting with the semiconductor surface.

## Methods

Binding experiments were performed with the *de-novo* protein S824, designed following a heptad polar-nonpolar motif, as well as a mutation modified with extra cysteine at the 78<sup>th</sup> amino acid (G78C). The binding strength was quantified by tracking the protein concentration in solution before and after binding to the semiconductors using spectroscopic measurements.

## Results

The effects of temperature, ceria concentration, and addition of DTT were tested for binding strength of the protein. S824 presented binding strengths ranging from 28% to 32% at different temperatures and ceria concentrations. The G78C mutation presented a 10.4% binding strength in samples without DTT, while samples containing DTT the binding strength showed a value of 13.2%.

## Conclusion

The results showed that the temperature and ceria concentration at which this experiment was conducted do not have a significant effect on the protein binding. Furthermore, the addition of DTT in G78C mixtures suggests that there is an increase in free cysteine in the solution, leading to a higher protein binding.

## Rebecca Jarrell, Chemical and Life Science Engineering

### *Biosynthesis of CdS Quantum Dots Using Enzymatic Generation of Hydrogen Sulfide*

## Background

Quantum dots (QDs) have now become an indispensable commodity across a broad spectrum of industries, including the medical and scientific communities, due to their tunable optical and electronic properties. They are ubiquitous among common place items such as solid-state lighting and electroluminescent light-emitting displays found in many of our electronics today. QD technology has expanded rapidly in the past few years with the global market of QDs projected to grow from 4.0 billion USD in 2021 to 8.6 billion USD by 2026. Burgeoning demand necessitates the need for an economical green process diverging from energy-intensive practices while maintaining a high throughput of quality QDs. The biomineralization of CdS-QDs using cystathionine gamma-lyase enzyme (CSE) for the enzymatic generation of hydrogen sulfide can be a feasible solution.

## Methods

Notably, L-cysteine plays a dual role in the biomineralization of CdS-Qds, whereas (1) it is the source of H<sub>2</sub>S important for the initial spontaneous nucleation and growth of the CdS nanocrystals, and (2) it is the capping agent that restricts crystal growth and quantum confinement. Therefore, varying L-cysteine concentrations and CSE reactivity will affect (1) the amount of H<sub>2</sub>S available for nucleation and growth, and (2) the availability of the remaining L-cysteine to participate in capping and size-control of the nanocrystals.

## Results

Herein, results for the tunability of the biomineralization of CdS-QDs using CSE through L-cysteine manipulation. CdS-QDs ranged from 3-6 nm.

## Conclusion

Ultimately, by modifying L-cysteine concentrations in the biomineralization of CdS Qds we can achieve

desirable optoelectronic properties through size-control.

## **James Cahill, Mechanical & Nuclear Engineering**

### *Viability of X-Ray Fluorescence for Detecting Surface Defects on Cr-Coated Zr4*

#### **Background**

Cr-coated Zircaloy-4 (Zr4) is a popular proposal for cladding to be used in advanced nuclear reactors. Surface defects present a performance concern that is inherent to any coated material. This work aims to assess the viability of using X-ray fluorescence (XRF) analysis for the rapid detection of such defects using Monte Carlo N-Particle Transport Code (MCNP).

#### **Methods**

The XRF response of a cylindrical Zr4 sample with a Cr-coating varying from 0 to 5  $\mu\text{m}$  in 250 nm increments was modeled using MCNP. Another model was used with a constant Cr thickness of 6.36  $\mu\text{m}$  (based on a physical reference sample) and a semicircular scratch which was varied in diameter from 0 to 10  $\mu\text{m}$  in 2  $\mu\text{m}$  increments. The difference between incremental photopeak areas was plotted along with the  $3\sigma$  value of the initial photopeak. The theoretical detection threshold was determined by the point where these curves intersect.

#### **Results**

Based on the MCNP results, a deviation in coating thickness of a little as 250 nm was found to be detectable for samples with a coating thickness of up to 5  $\mu\text{m}$ . Using linear interpolation, it was found that a scratch diameter of 50  $\mu\text{m}$  would be detectable on a sample coated with 6.36  $\mu\text{m}$  of Cr.

#### **Conclusions**

These results are promising, as Cr-layer thicknesses of approximately 5-10  $\mu\text{m}$  are commonly proposed. To confirm the veracity of the model, physical testing will need to be done in the future.

## **Lineth Pérez, Mechanical & Nuclear Engineering**

### *Inverse Prediction of Static Shape of Magnetic Field-Actuated Soft Robots through Neural Network Machine Learning*

Soft robots represent a pioneering frontier in robotics technology, distinguished by their remarkable flexibility and compliance, soft robots possess the unique ability to contort, elongate, and adapt to their environment, effectively emulating the fluidity and agility observed in living organisms. This research integrates image processing, inverse kinematics, and neural networks to analyze soft robot movements induced by magnetic fields, aiming to predict optimal parameters for desired morphologies. Leveraging neural networks for predictive solutions, the study yields an adaptable model capable of reversing morphology generation. Methodologically, controlled tracking under varied environments and magnetic fields, coupled with high-resolution video capture, image digitalization

streamlines analysis, while a neural network model correlates frames with magnet positions. The interdisciplinary methodology provides a framework for understanding and enhancing soft robot adaptability. Ongoing efforts aim to extend neural networks into 3D models, promising insights into soft robotics' response to diverse magnetic fields. Ultimately, this research advances understanding of soft robot behavior and morphology in complex environments, with potential applications in healthcare and beyond.

## **School of Medicine**

### **Laura Pedersen, Epidemiology**

#### *Candida Auris Screening Of High-Risk Patients: A Descriptive Comparison Of 2 Strategies*

##### **Background**

*Candida auris* infection is associated with high morbidity and mortality.<sup>1</sup> *C. auris* can persist in the healthcare environment and is associated with outbreaks.<sup>2</sup> We compare screening strategies for *C. auris* in two high-risk patient populations.

##### **Methods**

Our center is a tertiary, 865-bed hospital. In the context of known outbreaks of *C. auris* in post-acute care (PAC) facilities, we experienced clusters of *C. auris* acquisition across several hospital units. We performed point prevalence surveys (PPS) on affected units weekly until all tests were negative for two consecutive weeks. We also initiated admission screening for *C. auris* for patients admitted from PAC. All tests were collected per CDC's procedure.<sup>3</sup> We compared the overall positivity rates of PPS versus PAC admission screenings using Z-test for two proportions with statistical significance set at  $p < 0.05$ .

##### **Results**

From 2/2023-12/2023, 533 tests on 367 unique patients were processed during PPS; 21 were positive (3.9%). 68 patients had repeat testing weekly for  $\geq 2$  weeks. Five tested positive after variable amounts of negative-week intervals.

From 8/2023-12/2023, 89 patients underwent admission screening. Three patients were positive (3.4%), each from a different facility. The difference in the positivity rates between PPS and PAC was not statistically significant (Z-score 0.25,  $p = 0.79$ ).

##### **Discussion**

We found similar positivity rates for patients admitted to the hospital from PACs compared to targeted PPS. These screening strategies are considered complementary. Facilities experiencing acquisition events should consider screening high-risk admissions, particularly if standard infection prevention practices are being performed with high fidelity.

## Holly Byers, Human Genetics/ Genetic Counseling

### *DDI2 supports tumor cell growth through regulation of the pro-cancer NF- $\kappa$ B and c-myc pathways*

#### **Background**

Cancer cells rely on cellular pathways that promote proliferation, inflammation, and resistance to normally programmed cell death to survive and form tumors. In our work we have discovered that inhibiting the expression of the gene *Ddi2* (DNA damage inducible 1 homolog 2) results in dramatic reduction in tumor cell growth in mouse xenograft models. To investigate the cellular processes that are affected upon loss of DDI2 expression, we employed a range of *in vitro* assays which enabled us to identify two prominent cancer pathways which are downregulated in the DDI2-deficient state: the pro-cancer inflammation pathway NF- $\kappa$ B and c-myc, a master regulator of cell proliferation.

#### **Methods**

We used human cancer cell lines such as MDA-MB-231 (human triple negative breast cancer or TNBC), EW16 (Ewing sarcoma, a childhood onset bone cancer) to demonstrate our findings in *in vitro* and *in vivo* assays such as bulk RNA-seq, CRISPR and siRNA for genetic knockout/knockdown, immunoblotting, qRT-PCR, flow cytometry, cell proliferation assays, co-immunoprecipitation, and others.

#### **Results**

Loss of DDI2 results in dramatic reduction in tumor size *in vivo*, as well as decreased proliferation, cell size, and colony formation *in vitro*. Using RNA-seq and dual luciferase NF- $\kappa$ B reporter assay, we observed that the NF- $\kappa$ B pathway is downregulated in DDI2-deficient TNBC and Ewing sarcoma cells. Additionally, we elucidated that DDI2-deficient cells display a protein synthesis rate defect resulting in the depletion of shorter-lived proteins, including oncogene c-myc. Restoration of both p65-p50 (NF- $\kappa$ B) and c-myc expression levels in DDI2-KO cells leads to a rescue of tumor cell proliferation.

#### **Conclusions**

DDI2 supports high proliferation and tumor growth by regulating protein synthesis levels and pro-tumorigenic pathways such as NF- $\kappa$ B and c-myc signaling in the human cancer cell.

## Nayyereh Hosseini, Human Genetics

### *Investigating the Role of DDI2 in Autophagy*

#### **Background**

In response to proteasome dysfunction, cells initiate compensatory autophagy to manage proteotoxic stress, which impacts cancer therapy efficacy. The protease DNA damage inducible 1 homolog 2 (DDI2) acts as an ubiquitin shuttling factor, and its depletion causes the accumulation of highly ubiquitinated proteins, resulting in increased sensitivity to proteasome inhibition in cancer cells. However, cancer cells might trigger compensatory autophagy in response to DDI2 depletion to degrade ubiquitinated protein aggregates. Here, we demonstrated that DDI2 depletion plays a role in autophagy induction.

## Methods

A panel of cell lines of different origins either control or DDI2-deficient were examined for autophagy activity following treatment with the autophagy inhibitor chloroquine (CQ). Through total proteome analysis, we identified an increase in cellular communication network factor 1 (CCN1) protein levels in DDI2-depleted cells, which plays a role in autophagy induction. To determine whether CCN1 is required and sufficient to induce autophagy, viral constructs were applied.

## Results

The autophagic flux measurements in different DDI2-deficient cell lines revealed elevated LC3B-II protein levels, a known autophagy marker. Western blotting analysis confirmed increased CCN1 protein levels in the same cell lines. The autophagy induction observed in DDI2-deficient cells was diminished by CCN1-siRNA, demonstrating that CCN1 may be required for autophagy induction. Furthermore, overexpressing CCN1 in wild-type cells resulted in increased LC3B-II protein levels, indicating that CCN1 alone is sufficient to induce autophagy.

## Conclusions

In this study we demonstrated that upon depletion of ubiquitin shuttle factor DDI2, secretory protein CCN1 accumulates leading to the subsequent induction of autophagy.

## David Zhu, MD/PhD

### *US drug overdose and alcohol-related deaths among the Non-Hispanic American Indian and Alaskan Native population, 1999-2020*

Amidst the escalating drug crisis, especially driven by synthetic compounds like illicit fentanyl, understanding trends in drug and alcohol-related mortality among the non-Hispanic American Indian or Alaskan Native (AIAN) population is imperative. This cross-sectional study analyzed data from 1999 to 2020 from the CDC WONDER database. Between 1999 and 2020, we identified 9832 drug overdose deaths, 4127 alcohol poisoning-related deaths, and 14,901 alcohol liver disease-related deaths among non-Hispanic AIAN populations. Alcoholic liver disease consistently remained the leading cause of death, more-than-tripling from 17.62 (95% CI, 15.62-19.62) to 57.28 (95% CI, 54.34-60.21) deaths per 100,000 individuals. Alcohol poisoning deaths rose by nearly eight-fold during the same period from 2.81 (95% CI, 2.14-3.61) to 21.69 (95% CI, 19.89-23.49) per 100,000 individuals. Fatal drug overdoses also surged over time. From 1999 to 2020, age-adjusted mortality rates from drug overdoses rose nearly three-fold from 5.98 (95% CI, 4.93-7.03) to 16.79 (95% CI, 15.16-18.42) by 2010 and seven-fold to 41.90 (95% CI, 39.40-44.41) by 2020. With regard to polysubstance profiles, opioid overdoses co-involving heroin, fentanyl, and other synthetic compounds exhibited similar patterns until the early 2010s, at which point notable divergences emerged. From 2010 to 2020, opioid overdoses excluding fentanyl only slightly increased from 8.59 (95% CI, 7.43-9.76) to 11.30 (95% CI, 10.00-12.59) deaths per 100,000 individuals, while fentanyl-involved opioid overdoses tripled from 9.32 (95% CI, 8.11-10.53) to 27.32 (95% CI, 25.31-29.34) deaths per 100,000 individuals. These trends, notably affecting males more than females, reflect the urgent need for enhanced drug testing, surveillance, and integrated harm reduction strategies. The study underscores the necessity for collaborative efforts between clinical, public health, and Indigenous community leaders to address these



alarming trends effectively. Limitations include reliance on death certificates, susceptibility to misclassification, and the lack of analysis on socio-demographic factors, urging consideration in future research.

## **Emily Zboril , Biochemistry & Molecular Biology**

### *Assessment of New Generation Endocrine Therapy as Effective Treatments for PDX Models of ESR1-MUTANT ER+ Breast Cancer*

Estrogen receptor (ER) signaling is the main driver of tumorigenesis in ER+ breast cancers by inducing proliferation and survival through genomic and non-genomic means. Therefore inhibition of ER signaling has been a mainstay of treatment for decades. While primary ER+ breast cancer has a relatively good initial prognosis, ~30% of patients will develop treatment-refractory recurrence or metastasis. Although advances in treatment approaches have prolonged average progression free survival, metastatic breast cancer remains an incurable disease. In addition, up to 30% of advanced or metastatic tumors will acquire an activating mutation to ESR1, the gene which encodes ER. These mutations often make tumor cells less responsive to ER-targeting compounds. New generation endocrine therapies such as Elacestrant and Lasofoxifene are approved, or seeking approval, for the treatment of ER+, ESR1-mutant advanced or metastatic breast cancer. While targeted treatment for ESR1-mutant disease is a necessary advance in breast cancer therapeutic development, not all ESR1 mutations are equivalent. The central hypothesis of this study is that mutant alleles differentially affect the efficacy of specific endocrine therapies. To evaluate this, we observed changes to ER expression and downstream transcriptional alterations following treatment with Elacestrant and Lasofoxifene in two ESR1 mutant (Y537S and D538G) cell lines. Although Elacestrant has been shown to degrade the estrogen receptor in wild type ER-expressing breast cancer models, both Elacestrant and Lasofoxifene significantly upregulate ER expression in Y537S mutant cells, suggesting that Elacestrant may act as a selective estrogen receptor modulator (SERM) in this context. Because SERMs often display tissue specificity, we sought to determine if any common markers of ER modulation were present in tissues such as the uterus, bone, or in Y537S-mutant breast cancer models themselves. However, we found no evidence to support the conclusion that Elacestrant is capable of SERM activity. Ongoing studies include evaluating the physiological significance of Elacestrant induced ER-upregulation, as this may contribute to a unique mechanism of action. We are also currently evaluating whether this effect results in any therapeutic vulnerability which may be leveraged clinically as a targeted therapy for patients with Y537S-mutant ER+ disease.

## **Valerie Ericsson, Biochemistry**

### *SPAG17 Deficiency Promotes Accelerated Female Reproductive Aging and Fibrosis Leading to Reduced Fertility and Parturition Defects*

#### **Background**

Advanced female age is associated with fibrosis in the reproductive tract causing uterine and cervical dysfunction. These changes lead to infertility, pregnancy complications and congenital defects in the offspring. As mean maternal age is increasing worldwide, there is a pressing need to prevent age-associated infertility and pregnancy complications. The molecular mechanisms underlying female reproductive aging and fibrosis are complex and currently not well understood. We have recently discovered a new mechanistic pathway implicated in aging and fibrosis via sperm associated antigen 17 (SPAG17) signaling.

#### **Methods**

Immunohistochemistry, beta-galactosidase stain, RNA seq, PSR staining, trichrome staining, mouse model

#### **Results**

Our studies revealed different expression levels of *Spag17* mRNA at various gestational ages (D6 to D18), and in the postpartum (2 to 48 h) period in mouse uterine and cervical tissues. Loss of function of this gene promotes accelerated aging in the female reproductive tract accompanied with constitutive activation of profibrotic signaling pathways. Moreover, increased collagen deposition, tightly packed extracellular matrix accumulation and increased stiffness was detected in the uterus and cervix of *Spag17* knockout females compared to same age wild-type females. Importantly, loss of *Spag17* showed reduced litter size and obstructed labor leading to maternal death.

#### **Conclusion**

In conclusion, these results show that SPAG17 is an important regulator of aging and fibrosis and pharmacologic approaches targeting SPAG17 signaling may be a potential mechanism to prevent reproductive aging.

## **Deaquan Nichols, Medicine**

### *Disparities by Surgical Approach for Non-Metastatic Rectal Cancer Based on Race and Ethnicity*

#### **Introduction**

For selected patients, local excision is an appropriate treatment for rectal cancer which allows for organ preservation compared to proctectomy. Our study aims to compare rates of local excision across region, race, income, and other patient specific criteria.

## Methods

Using the National Cancer Database, data were collected for patients with stage I-III rectal cancer who underwent local excision or proctectomy from 2004-2021. Chi-squared and two-sample t-test were used to compare preoperative patient/disease characteristics between local excision and proctectomy groups. Logistic and Cox's proportional hazard regression were respectively used to compare the likelihood of local excision and mortality rate across categories.

## Results

A total of 39,991 patients underwent local excision. Black, Hispanic, and other non-white patients were more likely to undergo local excision than their white counterparts (OR 2.18, 1.30, and 1.47, respectively), even when adjusted for income, education, insurance, rurality, distance from facility, facility region, and comorbidities. Black, Hispanic, and other non-white patients had improved survival after local excision compared to white patients (HR 0.65, 0.58, and 0.50, respectively).

## Conclusion

Minority patients are more likely to undergo local excision and achieve improved overall survival compared to white patients.

## Carson Walker, Human & Molecular Genetics

### *Sacituzumab Govitecan Efficacy Decreases in Triple Negative Breast Cancer Patient Derived Xenografts after Carboplatin Treatment*

## Background

Sacituzumab Govitecan (SG) is an antibody drug conjugate, targeting the epithelial glycoprotein Trop-2, approved for treatment of patients with triple negative breast cancer (TNBC) or estrogen receptor positive (ER+) breast cancer after they had received at least two previous systemic treatments. This study's objectives were to identify biomarkers of SG response using breast cancer patient-derived xenografts (PDXs) and determine if SG efficacy changes when cells become carboplatin resistant (CR).

## Methods

Analysis of transcriptomic and proteomic levels of Trop2 in PDX models consisted of bulk RNAseq, scRNA-seq, tandem mass tag spectrometry, and Immunohistochemistry. SG drug dose curves were performed on cells from 21 different PDXs *ex vivo*, while *in vivo* studies were performed with 7 TNBC PDXs in mouse models at patient relevant doses.

## Results

ER+ PDXs had significantly lower Trop2 RNA ( $p < 0.001$ ) and protein ( $p < 0.001$ ) expression than TNBC PDXs. *Ex vivo*, TNBC cells responded better to SG treatments than ER+ cells ( $p = 0.005$ ). *In vivo*, over 70% of TNBC PDXs tumors were reduced, eradicated, and/or inhibited by SG treatments, resulting in long-term, durable response. *In vivo*, Trop-2 expression alone did not strongly correlate with SG treatment success. CR sublines derived from 2 carboplatin sensitive PDXs were significantly less responsive to SG than their parental PDXs ( $p < 0.001$ ).

### **Conclusions**

Overall, these studies find that SG is highly effective in many TNBC PDX models and should be utilized earlier than carboplatin in treatment protocols, especially in metastatic patients.

## **Dana Kneisley, Pharmacology & Toxicology**

### *Site of $\alpha 3\beta 4$ -nAChR Current Modulation by the Prototoxin lynx1*

#### **Background**

Smoking, maintained by nicotine-seeking behaviors, is the world's leading cause of preventable death.  $\alpha 3\beta 4$  nicotinic acetylcholine receptors (nAChR), found on interpeduncular nucleus (IPN) GABAergic neurons, mediate somatic nicotine withdrawal. The prototoxin lynx1 is highly co-expressed in these neurons and may modulate  $\alpha 3\beta 4$ -nAChR function. This study probes the  $\alpha 3/\alpha 3$  subunit interface, unique to the most sensitive  $\alpha 3\beta 4$ -isoform, to determine the molecular site of  $\alpha 3\beta 4$ -nAChR/lynx1 interactions.

#### **Methods**

Molecular dynamics simulations identified  $\alpha 3\beta 4$ -nAChR residues where lynx1 may interact. These were mutated to alter potential side chain interactions. Two-electrode voltage clamp electrophysiology (TEVC) using *Xenopus* oocytes measured differences in macroscopic ACh-evoked currents between the wild-type (WT) and mutant receptors co-injected with lynx1 mRNA (1-10 ng).

#### **Results**

Eleven of fifteen nAChR mutations tested showed changes in sensitivity to the effects of lynx1 in comparison to WT  $\alpha 3\beta 4$ -nAChRs. This altered sensitivity was greatest at low-to-intermediate doses (1-2ng) of lynx1. Mutating a glycine (G162) to alanine exhibited the largest decreases in sensitivity compared to WT, while changing a valine (V159) or a tyrosine (Y190) to alanine displayed the largest increase. All mutants had reduced macroscopic function compared to WT.

#### **Conclusions**

Lynx1 produces dose-dependent decreases in  $\alpha 3\beta 4$ -nAChR function. Mutations at the putative interaction site show altered lynx1 sensitivity compared to WT-nAChR, confirming the importance of this region for lynx1-nAChR interaction. Increases in lynx1 sensitivity for some mutant receptors, along with reduced function of all mutated receptors, indicates that ACh may bind to, and compete with lynx1 at, the  $\alpha 3/\alpha 3$  site.

## **Jyoti Lodha, Neuroscience**

### *Effects of DREADD Activation of vHip-mPFC Neurons in C57BL/6J Mice following Adolescent Social Isolation Stress and/or Binge Drinking*

#### **Rationale**

Adolescence is characterized by heightened peer-peer interactions and risk-taking behavior. Disruptions to cortical development by adolescent binge ethanol or social isolation (aSI) can lead to attention, social, and cognitive deficits in adulthood. Adolescent development of a monosynaptic connection from the ventral hippocampus (vHip) to the medial prefrontal cortex (mPFC) is critical to social and working memory. This project aims to identify behavioral consequences of aSI and binge drinking.

#### **Methods**

Social stress was modeled by aSI. Adolescent C57BL/6J mice were single (1/cage) or group housed (4/cage) with or without access to 20% ethanol using a drinking in the dark (DID) model. As adults, mice underwent 2-bottle choice intermittent access (2BC-IA) for 3 weeks. In another cohort, aSI males with or without a history of DID were injected with an excitatory (Gq), inhibitory (Gi), or control (mCherry) DREADD in the vHip and a rAAV-Cre virus in the mPFC. As adults, mice were given 3.2 µg/kg Deschloroclozapine (DCZ) 20 minutes before testing. Adults were tested on light-dark box, open field, social preference, and DID.

#### **Results**

A history of aSI increased drinking in mice during both adolescent DID and adult 2-BC intake. aSI mice also showed a modest escalation in adult 2BC-IA. DREADD inhibition of vHip-mPFC neurons impaired social memory and increased adult ethanol intake in animals with a history of aSI, but not ethanol exposure, compared to control mice.

#### **Conclusions**

aSI increases intake in mice during both adolescent and adult drinking. Inhibition of vHip-mPFC neurons inhibits social memory and moderately increases ethanol intake.

## **Diane Ingabire, Pharmacology & Toxicology**

### *Nor-LAAM as a New Therapy for Treating Opioid Use Disorder*

#### **Background**

The prevalence of Opioid Use Disorder (OUD) has escalated to epidemic proportions. As of 2020, OUD affected around 2.7 million individuals aged 12 and above in the United States, as the National Institute on Drug Abuse

(NIDA) reported in 2021. While Medication for OUD has exhibited efficacy in addressing the OUD crisis, many challenges persist. These challenges highlight the need for preclinical investigations to develop novel OUD treatments.

### **Method and Results**

Nor-LAAM microparticles (nor-LAAM-MP) were made of PLGA/PLGA-PEG polymers and formulated using an emulsion solvent evaporation method. A comprehensive characterization of the nor-LAAM microparticles was conducted. This nor-LAAM-MP exhibited sustained drug release around 1 month with minimal burst release (<2% within the initial four hours), suitable for the *in vivo* efficacy study. The efficacy of the nor-LAAM-MP was evaluated through *in vivo* efficacy by subcutaneously administering a single dose of nor-LAAM-MP at a low dose of 20 mg/kg (n=6) and a high dose of 70 mg/kg (n=5) to SD rats with fentanyl dependence, saline was administered as vehicle (n=4). A single subcutaneous high dose of nor-LAAM-MP was observed to diminish fentanyl choices for at least 2 weeks compared to baseline. Furthermore, both doses of nor-LAAM-MP significantly decreased somatic withdrawal signs compared to the vehicle.

### **Conclusion**

These findings underscore the therapeutic potential of nor-LAAM-MP to decrease fentanyl reinforcement, highlighting its promise as a candidate therapeutic for opioid use disorder.

## **Brigitte Lieu, Medicine**

### *Evaluating the Accuracy of ChatGPT as a Resource for Patient Education on Osteosarcoma*

#### **Background**

Patients continually search for information online regarding orthopedic conditions including bone tumors. As artificial intelligence (AI) integrates into healthcare, it is crucial to understand its reliability as a patient information source. This study evaluates the accuracy and comprehensibility of ChatGPT's responses to common patient questions about osteosarcomas.

#### **Methods**

Frequently asked questions regarding osteosarcoma were compiled through a literature review and national society patient FAQ pages. ChatGPT (Version 3.5) was then utilized to answer these questions. Responses were analyzed for accuracy and clarity using the scoring system by Mika et al. and a modified DISCERN score. Readability was assessed using published educational-level indices.

#### **Results**

ChatGPT's responses generally required moderate clarification, with a mean Mika et al. score of 3 (satisfactory but needing clarification) and an average DISCERN score of 39. Readability ranged from a college graduate to a 7th grade level, higher than the recommended level for patient educational materials.

## **Conclusions**

ChatGPT provides a starting point for patient education on osteosarcoma but should not replace professional medical advice. While generally accurate, its responses require further clarification and personalization to a patient's specific circumstances. Limitations of AI include reading level and lack of in-depth patient specific recommendations.

## **Justin Silverman, Pharmacology & Toxicology**

### *Antinociceptive Effects of Morphine and the Kratom Constituent Mitragynine in an Assay of Pain-Depressed Locomotion in Mice*

#### **Background**

Kratom is a tree indigenous to southeast Asia, and kratom products are sometimes consumed with the intent of relieving pain. Mitragynine, which is the primary alkaloid in kratom leaves, acts as a weak agonist at mu opioid receptors (MOR), but the potential of mitragynine to produce clinically relevant analgesia remains unclear. The present study compared effects produced by oral administration of mitragynine and the prototype MOR analgesic morphine in a validated preclinical assay of pain-related behavioral depression.

#### **Methods**

Adult male and female ICR mice were tested in locomotor boxes with two compartments separated by a doorway obstructed by a 1-inch-tall wire-mesh barrier. Photobeams were spaced at 3-cm intervals in each compartment. Before 15-min test sessions, mice were treated with PO morphine, mitragynine, or vehicle ± IP administration of dilute lactic acid as a noxious “pain” stimulus. Locomotion was quantified as Crosses (# crosses between compartments) and Movement (# photobeam breaks). Data were analyzed by ANOVA followed by post hoc tests ( $p < 0.05$ ). Mitragynine was provided by Dr. Chris McCurdy, University of Florida.

#### **Results and Conclusions**

IP acid alone produced a pain-related and concentration-dependent decrease in both Crosses and Movement. Neither morphine (3.2-100 mg/kg) nor mitragynine (10-180 mg/kg) altered locomotion when administered alone. PO morphine (3.2-100 mg/kg) significantly alleviated IP acid-induced depression of both Crosses and Movement, whereas mitragynine (10-100 mg/kg) did not. Dose x Sex interactions were not significant for either drug on any endpoint. These findings do not support the hypothesis that mitragynine produces significant or MOR-mediated analgesia.

## **Natalie Luffman, Human Genetics**

### *The Role of the BET Inhibitor, ARV-825, in Sensitizing Resistant Head and Neck Cancer Cells to Cisplatin*

#### **Background**

Head and neck squamous cell carcinoma (HNSCC) remains challenging to treat despite multimodal therapeutic approaches. Cisplatin, an effective and cost-efficient treatment, is commonly used, but chemoresistance and tumor

relapse limit its efficacy. Understanding the mechanisms of cisplatin resistance and finding compounds to target resistant tumor cells are critical for improving patient outcomes. Although we have demonstrated that ABT-263 (a BCL-2/BCL-X<sub>L</sub> inhibitor) can effectively induce apoptosis in cisplatin-induced senescent HN30 HNSCC cells, it has a high degree of toxicity, limiting its clinical capacity. As overexpression of BRD4, a BET family protein, is associated with poor HNSCC patient prognosis, ARV-825 (a PROTAC BET inhibitor) may be a successful combinatorial treatment.

## **Methods**

We developed a cisplatin-resistant cell line (HN30R) to study resistance mechanisms. We observed the impact of ABT-263 and ARV-825 in eliminating senescent tumor cells after cisplatin treatment using senescence-associated  $\beta$ -galactosidase staining and Annexin-V/PI FACS. We examined the expression of BRD4 and its downstream targets, c-Myc and Survivin, after ARV-825  $\pm$  cisplatin treatment via western blots.

## **Results**

Although ABT-263 was ineffective in sensitizing HN30R cells to cisplatin, ARV-825 promoted apoptosis and delayed proliferative recovery in both HN30 and HN30R cells. The effectiveness of ARV-825 did not appear to depend on the cells entering into senescence, indicating that it was not acting as a conventional senolytic. ARV-825 also successfully inhibited BRD4 and its downstream targets, c-Myc and Survivin, in both cell lines.

## **Conclusions**

These results suggest that ARV-825 could be useful in combination with cisplatin against head and neck cancer.

## **Lauren Moncayo, Pharmacology & Toxicology**

### *DAGL-beta Contributes to Mechanisms Underlying the Development and Reversal of AIPN in Mice*

## **Background**

Alcohol-induced peripheral neuropathy (AIPN) follows chronic alcohol intake. Characterized AIPN mouse models are crucial for the evaluation of novel AIPN targets. I characterized the behavioral, electrophysiological, morphological, and inflammatory aspects of AIPN. I investigated the role of DAGL $\beta$  in AIPN. DAGL $\beta$  produces 2-arachidonoyl-glycerol, a precursor to pro-inflammatory cytokines (PIC). Studies show chronic EtOH (CE) upregulates DAGL $\beta$  and 2AG in mouse brain regions. I hypothesized DAGL $\beta$  contributes to mechanisms of AIPN.

## **Methods**

Mice underwent CE via liquid diet. The impacts of dose and intake duration on pain-related behaviors were characterized. The effects CE on caudal nerve conduction and intra-epidermal nerve fiber (IENF) density were evaluated. Qrt-PCR determined the impact of CE on PIC and DAGL $\beta$  RNA expression in the spinal cord (SC). A dual pharmacological(KT109)/genetic approach evaluated the role of DAGL $\beta$  in AIPN. A similar approach evaluated DAGL $\beta$  in EtOH consumption via 2-bottle choice.



## **Results**

CE induced: sensitivity and deficits in spontaneous behaviors, caudal nerve electrophysiology and IENF density. Intake duration and sex mediated IL6 and IL1 $\beta$  upregulation in the SC. DAGL $\beta$  knockout (KO) attenuated the development of behavioral changes. KT109 reversed sensitivity, and the efficacy did not undergo tolerance. Neither DAGL $\beta$  KO nor KT109 impacted EtOH intake.

## **Conclusion**

PIC and DAGL $\beta$  upregulation suggest neuroinflammation and DAGL $\beta$  plays a role in AIPN. Attenuated AIPN-related behaviors in DAGL $\beta$  KO mice suggests DAGL $\beta$  contributes to AIPN development. The efficacy of KT109 to reverse sensitivity without tolerance development or impact on EtOH intake implicates DAGL $\beta$  as an AIPN target.

## **Ayana Jackson, Medicine**

*Preliminary Evaluation of the Association Between Concussions and Cardiovascular Disease in Military Service Members and Veterans 50 years Old and Older*

## **Background**

Mild Traumatic brain injuries (TBI), also known as concussions, have been one of the most controversial topics in medicine. Mild TBIs are often considered invisible injuries and the lack of objective information to inform patient care and long-term brain health can pose detrimental effects. We seek to examine the effects of concussion history on cardiovascular disease (CVD) in one of the most disproportionately affected populations: Veterans. Long-term cardiovascular effects appear at a disproportionate age later in life.

## **Methods**

TBI history and CVD data of thousands of patients was collected from the ongoing Long-term Impact of Military-relevant Brain Injury Consortium-Chronic Effects of Neurotrauma Consortium (LIMBIC-CENC). Patients under the age of 50 were excluded from this study.

## **Results**

An increase in CVD as well as CVD risk-factors were noted. Risk factors include diabetes mellitus, liver disease, and kidney disease. Increased rates of hypertension, high cholesterol, heart attack and heart disease compared to the general population.

## **Conclusions**

This study provides a starting point for veteran patient education. Proactive medical intervention for prevention of, or delayed presentation, CVD. Ongoing studies are needed to evaluate CVD in members of the military without concussions to the general population before final conclusions as to how these two variables affect the risk of CVD.

## **Raveena Joshi, Medicine**

### *Nerve Tape is an Effective Tool for Small Nerve Repair*

#### **Introduction**

While microsuture neurorrhaphy is the gold standard for repairing digital nerves, functional recovery is often sub-optimal due in part to the technical challenges associated with microsurgery. Nerve Tape (NT) is a novel nerve repair device consisting of opposing Nitinol microhook arrays embedded between laminated sheets of processed small intestine submucosa (SIS). While its safety and efficacy has been validated in nerves >2mm in diameter, we sought to test the effect of the device on small nerves (1-1.5mm diameter) as they are frequently injured.

#### **Hypothesis**

We hypothesize that NT will provide better regeneration and muscle strength recovery as compared to sutures.

#### **Methods**

24 Sprague-Dawley rats underwent sciatic nerve transection and repair with either Nerve Tape, n=12; or microsutures (9-0), n=12. At three months, outcome measures included muscle mass and girth, twitch and tetanic muscle contraction force, and nerve histomorphology. Walking track analysis was used to calculate Sciatic Function Index (SFI) pre-operatively, post-operative day one, and at three months.

#### **Results**

At three months post repair, Nerve Tape integrity was maintained for all subjects. No statistical differences were observed in any outcomes following NT versus microsuture repairs. Axon counts were similar in both suture and nerve tape groups. However, g-ratio was significantly higher in NT group as compared to microsuture group.

#### **Summary**

Based on our findings, Nerve Tape appears to offer a similar level of efficacy as conventional microsuturing when applied to small diameter nerve repair.

## **Radina Lilova, Neuroscience**

### *Regional Astrocyte Changes Following Diffuse Traumatic Brain Injury and Buprenorphine Administration in Rats*

#### **Background**

Secondary sequelae from traumatic brain injury (TBI) can result in glial alterations. Our previous studies showed regional morphological astrocyte changes following central fluid percussion injury (cFPI) and buprenorphine (bup) administration, however, what these morphological changes indicate remains enigmatic. This study aimed to investigate the influence of bup on astrocyte protein expression post-cFPI.

## Methods

At 4w post-cFPI and saline or bup treatment, cortical, hippocampal, and thalamic tissue from adult male rats was assessed for protein levels of the intermediate filament, GFAP, the volume reducing channel, SWELL1, and the ion channel associated with astrocyte swelling, TRPM4.

## Results

Using multi-factor analyses across injury, region, and treatment we found regional, injury-dependent differences in all three proteins. There was a trend toward increased GFAP levels following cFPI compared to sham. There were interactions among injury, region, and treatment in which bup reduced GFAP in the cortex and hippocampus following cFPI, but not the thalamus or in sham animals. Significant regional differences in both SWELL1 and TRPM4 were observed. There was a significant interaction between region and treatment and a trend toward interactions among region, injury, and treatment for SWELL1, in which TBI animals treated with bup had lower cortical but higher thalamic SWELL1. An interaction among region, injury, and treatment was seen for TRPM4 where TBI animals treated with bup had lower cortical TRPM4.

## Conclusion

Differences in astrocyte markers across brain regions following cFPI and bup suggest unique cellular responses that may provide insight into function.

This work was funded by NINDS grants R01NS096143.

## Maya Gaines-Smith, Neuroscience

### *Stereoselective Effects of MDMA on Mouse Frontal Cortex Structural Plasticity via 5-HT<sub>2A</sub>R*

Serotonergic drugs are gaining popularity as a potential therapeutic for mental health pathologies, showing promising potential in treating individuals with major depressive disorder (MDD) and treatment resistant post-traumatic stress disorder (PTSD) after as little as one dose. Upon completing phase 3 human trials, 3,4-methylenedioxymethamphetamine (MDMA) showed a reduction in both PTSD and MDD symptoms in participants, however the complete mechanism of its success is still not completely understood. This project aims to further elucidate the therapeutic mechanism of MDMA, providing both *in vitro* and *in vivo* data supporting the drugs proposed mechanism of action. This research proposes that the therapeutic action of MDMA is mediated at least in part by its interaction at the serotonin 2A receptor (5-HT<sub>2A</sub>R). *In vitro*, competitive radioligand binding of MDMA isomers against [<sup>3</sup>H]ketanserin at the 5-HT<sub>2A</sub>R was conducted, followed by intracellular Ca<sup>2+</sup> quantification to determine 5-HT<sub>2A</sub>R agonism. *In vivo*, 5-HT<sub>2A</sub>R psychedelic potential via 5-HT<sub>2A</sub>R was measured using head twitch response (HTR) in mice. It was found that while the R isomer of MDMA was better at displacing [<sup>3</sup>H]ketanserin, the S isomer showed partial agonist activity, and was more effective at inducing HTR across sexes, with a more potent response seen in female mice. Additional experiments are currently being conducted to test whether R and S isomers differently affect frontal cortex dendritic spine density, as well as the role of 5-HT<sub>2A</sub>R signaling using knockout mice. Our preliminary data suggests that dendritic spine data will be stratified according to this trend.

## **Emily Zboril, Biochemistry & Molecular Biology**

### ***Assessment of New Generation Endocrine Therapy as Effective Treatments for PDX Models of ESR1-MUTANT ER+ Breast Cancer***

Estrogen receptor (ER) signaling is the main driver of tumorigenesis in ER+ breast cancers by inducing proliferation and survival through genomic and non-genomic means. Therefore inhibition of ER signaling has been a mainstay of treatment for decades. While primary ER+ breast cancer has a relatively good initial prognosis, ~30% of patients will develop treatment-refractory recurrence or metastasis. Although advances in treatment approaches have prolonged average progression free survival, metastatic breast cancer remains an incurable disease. In addition, up to 30% of advanced or metastatic tumors will acquire an activating mutation to ESR1, the gene which encodes ER. These mutations often make tumor cells less responsive to ER-targeting compounds. New generation endocrine therapies such as Elacestrant and Lasofoxifene are approved, or seeking approval, for the treatment of ER+, ESR1-mutant advanced or metastatic breast cancer. While targeted treatment for ESR1-mutant disease is a necessary advance in breast cancer therapeutic development, not all ESR1 mutations are equivalent. The central hypothesis of this study is that mutant alleles differentially affect the efficacy of specific endocrine therapies. To evaluate this, we observed changes to ER expression and downstream transcriptional alterations following treatment with Elacestrant and Lasofoxifene in two ESR1 mutant (Y537S and D538G) cell lines. Although Elacestrant has been shown to degrade the estrogen receptor in wild type ER-expressing breast cancer models, both Elacestrant and Lasofoxifene significantly upregulate ER expression in Y537S mutant cells, suggesting that Elacestrant may act as a selective estrogen receptor modulator (SERM) in this context. Because SERMs often display tissue specificity, we sought to determine if any common markers of ER modulation were present in tissues such as the uterus, bone, or in Y537S-mutant breast cancer models themselves. However, we found no evidence to support the conclusion that Elacestrant is capable of SERM activity. Ongoing studies include evaluating the physiological significance of Elacestrant induced ER-upregulation, as this may contribute to a unique mechanism of action. We are also currently evaluating whether this effect results in any therapeutic vulnerability which may be leveraged clinically as a targeted therapy for patients with Y537S-mutant ER+ disease.

## **Suhas Rao Velichala, Medicine**

### ***Risk Factors and Incidence of 30 Day Readmission Following Outpatient TKA***

#### **Background**

Reflecting advancements in surgical techniques and postoperative care, total knee arthroplasty (TKA) is being performed increasingly as an outpatient procedure. This study aims to provide a comprehensive evaluation of 30-day readmissions after outpatient TKA and identify risk factors for readmission in the first 30 postoperative days.

## Methods

Utilizing the National Surgical Quality Improvement Program (NSQIP) database, this study retrospectively analyzed data from patients who underwent outpatient TKA between 2012 and 2021. Adverse events and unplanned readmissions were identified. For each readmission, the timing of and reason for readmission was recorded. Statistical analysis involved multivariate logistic regression to identify patient risk factors for readmission.

## Results

This study examined 31,347 patients undergoing outpatient TKA from 2012 to 2021. Following surgery, 1.86% of cases reported an unplanned readmission within 30-days. Multivariate analysis demonstrated that age, body mass index, operative time, congestive heart failure, chronic obstructive pulmonary disease, bleeding disorders, hypertension, and partially dependent functional status significantly increased the risk of 30-day readmission. Reasons unrelated to surgical site contributed the most to readmission at 68.31% while reasons related to surgical site made up 27.30% followed by knee related complaints (4.40%).

## Conclusion

Our analysis reveals a low readmission risk (1.86%) after outpatient TKA. Readmission rates were found to decrease over the observed time period despite a dramatic increase in outpatient cases. The most common reason for 30-day readmission was Organ/Space SSI. Identified risk factors for readmission highlight areas for targeted mitigation to enhance patient outcomes.

## Belle Buzzi, Neuroscience

### *The Effect of Psilocybin on Nicotine Dependence Behaviors in Preclinical Models*

#### Introduction

Smoking remains a leading cause of preventable death in the US, with current pharmacotherapies having low efficacy. Psilocybin has been recently proposed as a potential therapeutic agent for numerous neuropsychiatric disorders, including for smoking dependence. Our study uses a mouse model to study the effect of psilocybin on nicotine dependence behaviors.

#### Methods

Young adult mice were implanted subcutaneously with mini-pumps containing nicotine, with a flow rate of 24 mg/kg/day for 14 days. 1hr following mini-pump removal, mice were injected intraperitoneally with psilocybin (1 mg/kg) and assessed the following day for nicotine withdrawal signs. A separate cohort of serotonin (5-HT)<sub>2A</sub>R knockout(KO) mice were tested in the same paradigm to determine the necessity of the receptor, thought to be responsible for the “hallucinogenic” effects of psychedelics. In a separate cohort, mice were tested for nicotine conditioned place preference (CPP) via 3 days of drug conditioning in a three-chamber box in the CPP test. Following the last nicotine conditioning day, mice were injected with psilocybin (1 mg/kg) and tested for nicotine preference in a drug free state the following day.

## Results

Psilocybin sex dependently reversed nicotine withdrawal signs in mice. This effect was lost in the 5-HT2ARKO mice, establishing this receptor as a potential mechanism of this attenuation. Psilocybin decreased the expression of nicotine preference and reinstatement in mice in the CPP paradigm.

## Conclusions

These studies suggest that classical psychedelics like psilocybin, and the 5-HT2AR, may be a feasible target for smoking cessation.

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## Gabriella Silva, Pharmacology & Toxicology

### *A Zinc Finger Transcription Factor in the Nucleus Accumbens Regulates Cocaine-Induced Transcription and Behaviors in a Cell Type Specific Manner*

#### Background

ZFP189 is a transcription factor (TF) that regulates the reinforcing effects of cocaine within the nucleus accumbens (NAc), but the direct function is unknown. To interrogate the function and gene targets of ZFP189, we reprogrammed the endogenous ZFP189<sup>WT</sup> by replacing the repressive domain with an enhanced transcriptional activation domain (ZFP189<sup>VPR</sup>) or by removing the functional moiety (ZFP189<sup>NFD</sup>). Synthetic ZFP189 TFs exert divergent transcriptional regulation at a *luciferase* target gene, *in vitro*. Upon packaging these ZFP189 TF constructs in herpes viral vectors and delivering to mouse NAc, ZFP189<sup>VPR</sup> affects only cocaine behaviors. After performing RNA sequencing on these tissues, we see mice with ZFP189<sup>VPR</sup> intra-NAc and treated with cocaine experience significant transcriptional upregulation, but the cell types involved in this response is unclear.

#### Methods

We performed single nuclei RNA sequencing on infected NAc tissues of cocaine exposed mice. We next investigated the NAc cell type specific contribution of our ZFP189 variants to cocaine-induced locomotor behavior. Lastly, we investigated the consequences of the synthetic ZFP189 TFs on dendritic spine density and morphology in differing NAc cell types.

#### Results

ZFP189<sup>VPR</sup> within *Drd1*+ MSNs produce an inflammatory response not seen in ZFP189<sup>WT</sup> in *Drd2*+ MSNs. Delivering ZFP189<sup>VPR</sup> to *Drd1*+ MSNs and ZFP189<sup>WT</sup> to *Drd2*+ MSNs led to a similar cocaine-induced increase in locomotive behavior and increase in mature spine formation.

#### Conclusions

This work links the MSN-specific function of a drug-induced TF in governing lasting drug-related transcriptional neuroadaptations and behaviors.

## **Michelle Taylor, Neuroscience**

### *ApoE4 Exacerbates TBI-Induced TNFR1 Activity to Promote AD Pathophysiologies*

#### **Background**

Apolipoprotein E4 (ApoE4) and traumatic brain injury (TBI) are two well established risk factors for developing Alzheimer's disease (AD), but how they may act synergistically to increase an individual's likelihood of developing AD remain unknown. Both ApoE4 and TBI increase neuroinflammation, specifically the proinflammatory cytokine tumor necrosis factor (TNF). Soluble TNF preferentially binds to TNFR1, furthering neuroinflammation by increasing NF-KB activity. Lipoprotein receptor-related protein 1 (LRP1), a receptor for apoE, reduces neuroinflammation by internalizing TNFR1, preventing its downstream signaling. However, when apoE is misfolded by the ApoE4 allele, LRP1's ability to remove TNFR1 from the membrane may be impaired, thus furthering TBI-induced TNFR1 signaling to accelerate AD pathophysiologies.

#### **Methods**

C57BL6 and humanized ApoE4 mice underwent either sham or TBI (CCI model) and were survived up to 7 days, undergoing the novel object recognition test (NORT) 3dpi. At 12 hours or 7 dpi, the ipsilateral hippocampus was collected and processed for Western blotting.

#### **Results**

Preliminary data shows that ApoE4 mice have increased Shc\*, TNFR1\* and NF-KB\*\* expression as early as 12 hours following TBI (cf. WT levels), suggesting an increase in LRP1 and TNFR1 activity, which ultimately leads to increased amyloid precursor protein (APP)\* levels. While Shc\* and NF-KB\* levels have reduced to baseline levels by 7 DPI in WT mice, ApoE4 sustains the expression of these proteins, leading to increased amyloidosis\* and cognitive deficits (NORT).

#### **Conclusions**

These results suggest that ApoE4 sustains TBI-induced TNFR1 activity through an LRP1- mediated mechanism to accelerate and exacerbate AD pathophysiologies. (n=3-5; \*= $p < 0.05$ , \*\*= $p < 0.01$ ).

## **Alexandra Gonsiowski, Biochemistry—Cell & Molecular Biology**

### *S1P Receptor 1 on Glioma-Associated Astrocytes Regulates Tumor Growth and Progression*

Glioblastoma multiforme (GBM) is a deadly primary brain tumor with no effective treatment. While it has been shown that GBM's microenvironment promotes angiogenesis, GBM cell proliferation, and immune suppression, the mechanisms by which tumor-associated reactive astrocytes affect these processes remain elusive. Recently, STAT3 activation has been reported in GBM-associated astrocytes; however, molecules driving this activation are not known. Sphingosine 1-phosphate (S1P) is a bioactive signaling molecule that promotes the growth of many

cancers, including GBM. S1P signals through sphingosine 1-phosphate receptors (S1PR1-5) on cells' membrane. Since S1PR1 is highly expressed in astrocytes and known to drive STAT3 activation in other cell types, we examined the effect of its deletion from astrocytes on glioma growth and progression. We used a new syngeneic KMWT1 glioma model, in wild-type and S1PR1<sup>D<sup>As</sup>t</sup> (S1PR1<sup>FLOX/FLOX;GFAP-CRE</sup>) mice. Tumor growth was measured overtime using an in vitro imaging system, and tissues were collected two weeks post-injection. Tumor growth was decreased in S1PR1<sup>D<sup>As</sup>t</sup> mice compared to wild-type mice. Immunofluorescence staining showed a significantly decreased numbers of myeloid cells in the tumor microenvironment and core of the tumor in S1PR1<sup>D<sup>As</sup>t</sup> mice. Additionally, gliomas in S1PR1<sup>D<sup>As</sup>t</sup> mice had decreased vascularization. These results show that astrocytic S1PR1 is critical for glioma tumor growth, promoting vascularization, and increasing the recruitment of myeloid cells.

## **Amala Nayak, Medicine**

### *FESS Decreases the Risk of Cardiovascular Events in an OSA Population: A TriNetX Database Study*

#### **Background**

It is well-documented that obstructive sleep apnea (OSA) patients are at high risk for developing cardiovascular disease. The current recommended treatment for OSA is continuous positive airway pressure (CPAP). This study aimed to investigate the effects of functional endoscopic sinus surgery (FESS) on incidence of cardiovascular diseases among patients with obstructive sleep apnea (OSA) and comorbid chronic rhinosinusitis (CRS) through utilization of a large-scale database.

#### **Methods**

We queried the TriNetX Research Network, a global federated health research network providing access to electronic health record data from over 120 million patients, to identify OSA patients with concomitant diagnosis of CRS. Propensity score matching was utilized to match patients with OSA and CRS who underwent FESS to those who did not, allowing us to explore the 90-day incidence of new-onset atrial fibrillation/flutter (AFib), myocardial infarction (MI), and cerebrovascular accident (CVA) between these groups. Patients were propensity score matched for age, sex, race, and presence of nasal polyps.

#### **Results**

After propensity matching for age, sex, race, and presence of nasal polyps, each cohort was comprised of 23,895 patients. Odds of experiencing new-onset MI (OR 1.522, 95% CI 1.156-2.004, p=0.0026), CVA (OR 1.417, 95% CI 1.12-1.794, p=0.0036), and AFib (OR 1.639, 95% CI 1.278-2.102, p<0.0001) were all significantly higher in the non-surgical cohort.

#### **Conclusion**

In OSA patients with comorbid CRS, undergoing FESS decreased the odds of developing new-onset adverse cardiac events including MI, CVA, and AFib.



## Jessica Maltman, Neuroscience

### *Assessing the Necessity of ERK Signaling in Hallucinogenic and Therapeutic Effects of LSD*

#### **Background**

The psychedelic field is extremely interested in parsing out the signaling mechanisms responsible for the hallucinogenic vs therapeutic effects of classical psychedelics, such as lysergic acid diethylamide (LSD), which are all agonists of the serotonin 2A receptor (5-HT<sub>2A</sub>R). Our lab has previously shown that 1) LSD, but not lisuride (a non-hallucinogenic 5-HT<sub>2A</sub>R agonist), increased early growth response protein 1 & 2 (*EGRI*, *EGR2*) expression, suggesting that *EGR* expression may be associated with hallucinogenic properties of the LSD and 2) the effects of LSD on *EGRI* and *EGR2* were attenuated by the ERK inhibitor SL327, indicating that this downstream signaling pathway of 5-HT<sub>2A</sub>R may be responsible for hallucinations. This project aimed to assess whether inhibition of ERK signaling does in fact attenuate the hallucinogenic effects of LSD measured via the head twitch response (HTR).

#### **Methods**

Mice (n=10) were pretreated with either vehicle or SL327 (50 mg/kg, i.p) prior to LSD administration (.2 mg/kg, i.p), and were assayed for the HTR for a 15-minute baseline, the 45-minute pretreatment time, and 90 minutes after LSD administration. After allowing several weeks for drug washout, the mice were also assayed for locomotor activity 45 minutes after vehicle or SL327 administration to ensure this was not responsible for the HTR results.

#### **Results**

SL327 significantly attenuated LSD's HTR without affecting locomotor activity.

#### **Conclusions**

These results suggest that ERK signaling is necessary for the hallucinogenic effects of LSD, which may inform the design of biased agonists to harness the therapeutic, but not hallucinogenic, properties of psychedelics.

## Aashish Batheja, Medicine

### *Assessing the Efficacy of Regenerative Interventions in Pediatrics with Avascular Necrosis of the Femoral Head and Secondary Disease: Systematic Review*

#### **Background**

Pediatric avascular necrosis (AVN) of the femoral head (FH), notably in sickle cell disease (SCD) or Legg-Calvé-Perthes disease (LCPD) patients, is often treated with core decompression (CD) + bone marrow aspirate concentrate (BMAC). However, tailored surgical approaches, considering age and severity, have shown greater efficacy than traditional methods.

## **Methods**

Utilizing peer-reviewed studies addressing the treatment of pediatric AVN of the femoral head (FH), this study analyzed the outcomes and efficacy of a variety of regenerative interventions. Relevant articles were identified using specific keywords and analyzed for inclusion. Out of the hundreds screened, 20 articles were selected for review. Systematic Reviews, case reports, and studies prior to 2016 were excluded.

## **Results**

CD + BMAC showed no signs of enhanced improvement compared to CD alone at stages 3 and 4 of the disease. It also poses a risk of short-term relief instead of long-term correction. However, it does prove to be more effective than alternative options, such as bone marrow transplant, autografts, and stem cell implantation in early-stage treatment.

## **Conclusions**

This study assesses the efficacy of conservative surgical approaches in treating pediatrics with AVN of FH alongside a secondary disease. Findings indicate a negative correlation between the effectiveness of CD +BMAC and the patient's age or AVN stage. Consequently, for skeletally mature individuals or those diagnosed at stage 3 or beyond, alternative therapeutic strategies can be considered.

## **Ayana Jackson, Medicine**

### *Preliminary Evaluation of the Association Between Concussions and Cardiovascular Disease in Military Service Members and Veterans 50 years Old and Older*

## **Background**

Mild Traumatic brain injuries (TBI), also known as concussions, have been one of the most controversial topics in medicine. Mild TBIs are often considered invisible injuries and the lack of objective information to inform patient care and long-term brain health can pose detrimental effects. We seek to examine the effects of concussion history on cardiovascular disease (CVD) in one of the most disproportionately affected populations: Veterans. Long-term cardiovascular effects appear at a disproportionate age later in life.

## **Methods**

TBI history and CVD data of thousands of patients was collected from the ongoing Long-term Impact of Military-relevant Brain Injury Consortium-Chronic Effects of Neurotrauma Consortium (LIMBIC-CENC). Patients under the age of 50 were excluded from this study.

## **Results**

An increase in CVD as well as CVD risk-factors were noted. Risk factors include diabetes mellitus, liver disease, and kidney disease. Increased rates of hypertension, high cholesterol, heart attack and heart disease compared to the general population.

## **Conclusions**

This study provides a starting point for veteran patient education. Proactive medical intervention for prevention of, or delayed presentation, CVD. Ongoing studies are needed to evaluate CVD in members of the military without concussions to the general population before final conclusions as to how these two variables affect the risk of CVD.

## **Barika Mirza, Medicine**

### *Opioid Use in Patients with Rheumatoid Arthritis (RA) and Depression*

#### **Background**

Chronic pain often accompanies depression. Additionally, up to 40% of RA patients use opioids for pain management. Given limited research on the interplay of RA, depression, and opioid use, this study aimed to find potential synergies of RA and depression diagnoses on outpatient opioid use.

#### **Methods**

A non-systematic literature review in PsycInfo, PubMed, and Embase identified populations with overlap in RA, depression, and opioid use. A SlicerDicer query identified the prevalence of RA, depression, and outpatient opioid use in a one year period. Opioid use among patients with RA, depression, or both were compared using odds ratio and regression analyses.

#### **Results**

Only seven articles addressed opioid use in patients with concomitant RA and depression. SlicerDicer yielded 59,222 patients with outpatient opioid use. The odds ratio for RA among patients with both depression and outpatient opioid use was 1.79. Regression analyses showed an increasing trend of overall outpatient opioid use ( $R^2=0.87$ ,  $p<0.05$ ), but decreasing trends among patients with both depression and RA ( $R^2=0.71$ ,  $p<0.05$ ) and all patients with depression ( $R^2=0.41$ ,  $p<0.05$ ).

#### **Conclusions**

The results suggest synergism between an RA diagnosis and a depression diagnosis on outpatient opioid use, but outpatient opioid use among patients with depression may be decreasing. Limitations include using EHR data, which excludes non-prescription opioids, and time period. While RA and depression may be linked, it is difficult to quantify the extent and significance. Further research with larger datasets may reveal deeper insight.

## **Ge Vick Safarians, Medicine**

### *3D Hydrogel System to Elucidate the HA Concentration-Dependence of Glioblastoma Invasiveness and the CD44-Ezrin Axis*

#### **Background**

A limited understanding of the Hyaluronan (HA)-CD44-Ezrin signaling axis' role in modulating glioblastoma (GBM) cell invasion has impeded the ability to develop therapeutics targeting the cancer. In response, we engineered a mechanochemically tunable, 3D hydrogel system to study how changes in local HA concentrations could affect GBM cell migration propensity via CD44-Ezrin signaling.

### **Methods**

Patient-derived gliomaspheres (GSs) were encapsulated in hydrogels with 0.10%, 0.25%, 0.50%, and 0.75% (w/v) HA. Following six days of culture, we quantified GS invasiveness using phase-contrast images. CD44-Ezrin colocalization in GS cells was assessed by immunocytochemical staining. In separate experiments, we studied changes in GS invasiveness in response to Ezrin inhibitor, NSC668394.

### **Results**

A biphasic relationship occurred between HA concentration and GS invasiveness such that optimal migratory activity occurred in 0.25% and 0.50% (w/v) HA hydrogels. While greater CD44-Ezrin colocalization occurred in GSs residing within higher 0.25%-0.75% (w/v) compared to lower 0.10% (w/v) HA environments, Ezrin inhibition decreased GS invasiveness in higher HA hydrogels but increased invasion in lower HA environments where limited migration originally occurred.

### **Conclusions**

We engineered a biomimetic hydrogel system with theranostic applicability to characterize GBM invasive phenotypes and assess therapeutic response of tumor samples. Through effecting changes in HA concentration along the physiologically-relevant range of 0.10%-0.75% (w/v), we quantified patient-specific GBM invasiveness and clarified the dual nature of the Ezrin in modulating GBM invasion within the context of higher and lower HA microenvironments.

## **Radina Lilova, Neuroscience**

### *Regional Astrocyte Changes Following Diffuse Traumatic Brain Injury and Buprenorphine Administration in Rats*

#### **Background**

Secondary sequelae from traumatic brain injury (TBI) can result in glial alterations. Our previous studies showed regional morphological astrocyte changes following central fluid percussion injury (cFPI) and buprenorphine (bup) administration, however, what these morphological changes indicate remains enigmatic. This study aimed to investigate the influence of bup on astrocyte protein expression post-cFPI.

#### **Methods**

At 4w post-cFPI and saline or bup treatment, cortical, hippocampal, and thalamic tissue from adult male rats was assessed for protein levels of the intermediate filament, GFAP, the volume reducing channel, SWELL1, and the ion channel associated with astrocyte swelling, TRPM4.

## Results

Using multi-factor analyses across injury, region, and treatment we found regional, injury-dependent differences in all three proteins. There was a trend toward increased GFAP levels following cFPI compared to sham. There were interactions among injury, region, and treatment in which bup reduced GFAP in the cortex and hippocampus following cFPI, but not the thalamus or in sham animals. Significant regional differences in both SWELL1 and TRPM4 were observed. There was a significant interaction between region and treatment and a trend toward interactions among region, injury, and treatment for SWELL1, in which TBI animals treated with bup had lower cortical but higher thalamic SWELL1. An interaction among region, injury, and treatment was seen for TRPM4 where TBI animals treated with bup had lower cortical TRPM4.

## Conclusion

Differences in astrocyte markers across brain regions following cFPI and bup suggest unique cellular responses that may provide insight into function.

This work was funded by NINDS grants R01NS096143.

## Peter Hoang, Pharmacology & Toxicology

### *Exploration of a CB1R Allosteric Modulator in a Mouse Model of Cannabinoid Dependence*

#### Background

In 2022, Cannabis Use Disorder (CUD) affected 19 million people in the United States. There are currently no FDA-approved medications to treat CUD. Some of the strategies studied to ameliorate CUD were shown to have dependence and unwanted side effects. Positive allosteric modulators (PAMs) of the cannabinoid 1 (CB1) receptor show promise to fulfill this need. This study is to explore whether novel CB1 PAMs, PTDP-15 or PTDP-131, will attenuate withdrawal signs in cannabinoid-dependent mice with minimal cannabimimetic side effects and dependency.

#### Methods

Male and female C57BL/6J mice were administered high doses of PTDP-15 and PTDP-131, then tested in the tetrad assay, an in vivo assay used to infer cannabimimetic activity. Next, male and female ICR mice received THC 2x/day for 5.5 days. On day 6, mice were administered CB1 antagonist rimonabant after their last injection of THC to precipitate withdrawal. The occurrence of somatic signs, i.e. paw tremors and head shakes, was scored for the following hour.

#### Results

PTDP-15 and PTDP-131 did not produce cannabimimetic side effects in the tetrad assay. Rimonabant precipitated a large magnitude of somatic signs in mice repeatedly treated with THC with a significant difference in somatic signs for the THC+Rim group. Female mice exhibited more paw flutters than male mice.

#### Conclusions

Ongoing studies are assessing whether PTDP-15 and -131 have dependence liability and will attenuate THC-precipitated withdrawal. Ultimately, these studies will provide insight on whether CB1 PAMs have promise as a pharmacological strategy to treat CUD without undesirable side effects.

## **Divya Shan, Medicine**

### *A Retrospective Study Assessing Recurrence Rates of Excised Keloids Treated with Radiation*

#### **Background**

Keloids, aberrant fibroproliferative scars, pose significant challenges due to their high propensity for recurrence following treatment interventions.<sup>1,2,3</sup> While surgical excision alone can have high recurrence rates as high as 80%, adjunctive therapies like radiation can be utilized in patients with persistent or refractory keloids.<sup>4,5</sup> We aim to evaluate recurrence rates of excised keloids treated with radiation therapy, as well as patient and clinical factors impacting these rates.

#### **Methods**

A retrospective review was performed of patients with excised keloids who underwent radiation treatment at VCU Radiation Oncology during 2010-2021 (n=22 keloids). The second phase of the study (ongoing) includes phone call follow-up with patients who did not receive follow-up after their procedure to collect two data variables (1) if the keloid returned and (2) the date when the keloid returned.

#### **Results**

Preliminary data analysis revealed that a majority of patients underwent excision through the plastic surgery department (77.3%), initiating radiation therapy post-operative day 1 (86.4%) with a median number of 3 sessions and average total radiation dose of 18.77 Gy. Of the 50% of patients who had follow-up after their procedure, 40.9% of patients had keloid recurrence. Chi-square analysis showed no association between recurrence and median household income (p=0.395).

#### **Conclusion**

The preliminary results demonstrate a keloid recurrence rate of 40.9% after surgical excision and radiation therapy, which was not associated with factors such as median household income. This study highlights the benefits of combination surgical and radiation treatment, which yields lower recurrence rates compared to surgery alone.<sup>4</sup>

# **School of Pharmacy**

**Nadia Ahmed, Pharmaceutical Engineering**

## *Mass spectrometry-based Proteomics Analysis of Macrophage Extracellular Traps*

### **Purpose**

Macrophages play an important role in the immune system including pathogen clearance, wound healing, cancer, obesity, and inflammation. Their primary function involves detection and phagocytosis of different pathogens and secretion of both pro-inflammatory and antimicrobial mediators for initiating specific defense mechanisms (adaptive immunity) by recruiting other immune cells such as lymphocytes. The mechanism of phagocytosis takes in by scavenger receptors, Fc $\gamma$  Receptors (Fc $\gamma$ Rs), and Complement Receptors (CRs) which interact with ligands inherent to the surface of pathogens.<sup>1</sup> An emerging defensive mechanism of macrophage against pathogens is mediated by macrophage extracellular traps (METs) which are complex milieu released following exposure to microbes, increased intracellular calcium, TNF- $\alpha$ , IFN- $\gamma$ , extracellular DNA, and oxidative stress. METs are composed of DNA strands decorated with chromatin binding proteins and granule proteins released from macrophage which can entrap and kill various microbes by a process called ETosis.<sup>2</sup> The studies have focused on characterizing the content of the METs under different physiological conditions, macrophage polarization, and disease phenotypes but significant gaps in our understanding remain. The overall goal of this research project is to close the technical gaps in quantitative proteomics to enable high-resolution characterization of METs under different stimuli conditions and polarization states.

### **Methods and Results**

THP-1 cell line has been used to generate different macrophage polarization states ( $M_0$ ,  $M_1$ ,  $M_2$ ) which have been characterized using polymerase chain reaction (PCR) and enzyme linked immunosorbent assay (ELISA). These polarized macrophages have been treated with neutrophil elastase (NE) to induce METs formation. METs have been quantified as a function of different concentrations of NE and duration of treatment. METs have been visualized using fluorescent microscopy. After enrichment METs composition will be studied using quantitative proteomic analysis technique based on mass spectrometry.

### **Conclusion**

Our aim is to establish a comprehensive resource of MET-associated proteins from THP-1 cells and further develop an enrichment method for LC-MS/MS proteomics analysis of METs derived from primary macrophages in patients. This will help to elucidate potential implications of MET formation in vivo with their contributions to immune defense and pathology.

**Purnajai Srivijay Saravanan Vanaja, Pharmaceutical Sciences**

## *Development of a Sensitive Chromatographic Assay to Examine the Intestinal Stability of Quercetin and Isoquercitrin for Potential Therapy in Myotonic Dystrophy Type 1*

## Background

Myotonic dystrophy type 1 (DM1) involves a toxic CTG repeat expansion in the DMPK gene, leading to splicing problems [1]. Quercetin inhibits CTG transcription selectively but has low bioavailability, limiting its use [2]. Glycosylated derivatives such as isoquercitrin and EMIQ, with improved bioavailability, are being explored as treatments [3]. The aim is to develop a sensitive quercetin assay which would facilitate the development of these glycosylated derivatives as an effective therapy for DM1.

## Methods

An HPLC-fluorescence method was partially validated for quercetin and isoquercitrin. Metabolic stability was assessed by studying quercetin and isoquercitrin glucuronidation with hepatic and intestinal enzymes (HLS9 and HIS9 fractions), using UDPGA as the cofactor. A mass balance experiment with  $\beta$ -glucuronidase, and methylation using S-adenosyl methionine, were conducted.

## Results

Quercetin and isoquercitrin showed good accuracy (98.9-101.8% and 96.2-105.5%, respectively) and precision (0.13-3.04% and 0.25-3.42% CV, respectively) with the HPLC-fluorescence method. Extensive quercetin glucuronidation was observed, with near-complete recovery in  $\beta$ -glucuronidase experiment. Isorhamnetin was formed by methylation at a slower rate. Isoquercitrin was stable in HLS9 fraction but released quercetin by cleaving the attached glucoside when HIS9 fraction was used.

## Conclusions

The chromatographic assays developed could provide a useful analytical tool for studying quercetin's absorption and disposition pathways. Findings suggest presystemic metabolism as a factor for quercetin's limited bioavailability. Although isoquercitrin exhibited resistance to hepatic hydrolysis, it was susceptible to intestinal enzymes. These insights will guide a strategic development of EMIQ as a potential therapy for DM1.

## Asma AlTerawi, Pharmaceutics

### *Development of a PLX Liposomal Formulation using a Continuous Manufacturing Approach and Design of Experiments (DOE)*

#### Purpose

PLX-3397 (*PLX*) is a macrophage-targeting therapy with potential application in the treatment of solid tumors. Our objective is to develop clinically translatable liposomal PLX (*L-PLX*) suspension formulation using a continuous manufacturing approach for use in nebulizing dosage forms.

#### Methods

L-PLX will be prepared using a scale-independent microfluidic approach. L-PLX's critical quality attributes (CQAs) will be characterized in terms of their hydrodynamic diameter (*HD*), polydispersity index (*PDI*) and zeta potential ( $\zeta$ ) using light scattering, as well as the drug (*PLX*) encapsulation efficiency (EE%) and Drug Loading (DLwt.%) using HPLC. Experimental analysis/design will be performed with JMP. In this study, we will investigate the following critical materials attributes (*CMAs*): PLX (1 and 3 mg/mL) and lipid (10 and 15 mg/mL)



concentration in ethanol; drug:lipid (1:24 and 1:11) molar and DPPC:CHO (2:1 and 2.5:1) weight ratio; and lipid type (DSPC and DPPC). The critical process parameters (CPPs) that will be investigated include: total flow rate (12 and 15mL/min) and temperature (25 and 65°C), at a mixing ratio of 3:1.

## Results

A L-PLX formulation with desirable TPP was achieved with 1 and 15mg/mL of PLX and lipids; 1:11 drug:lipid; 2.5:1 DPPC:CHO; 12mL/min at 65°C. CQAs of this formulation include a HD<200 nm (84±8nm), homogeneous dispersion PDI<0.2 (0.08±0.05), high encapsulation efficiency >80% (85±2%) and suitable D.L.(5.3±0.3%).

## Conclusions

An L-PLX formulation with suitable TPP was found. In our next steps we will perform an optimal DOE to find an optimum formulation by probing the whole parameter space of relevant CMAs and CPPs in an efficient way.

## Yasir Alsherhry, Pharmaceuticals

### *Enhancing mRNA Delivery to Tumor-Associated Macrophages via Lipid Nanoparticles for Breast Cancer Immunotherapy*

Cancer poses a global health challenge, driving the quest for innovative therapies. Messenger ribonucleic acid (mRNA) lipid nanoparticles (LNPs) are a promising strategy in cancer immunotherapy. However, a major obstacle lies in efficiently transfecting immune cells like macrophages and dendritic cells (DCs) with LNPs<sup>1-3</sup>. This study seeks to improve cancer immunotherapy by optimizing mRNA-LNP formulations. Therefore, we systematically evaluated three components of LNPs, namely ionizable lipids, phospholipids, and sterols, and fine-tuned the components and their molar ratios. A comprehensive screening process was conducted to determine the efficiency of LNPs, involving in vitro experiments on macrophages and DCs, as well as in vivo assessments.

Among ionizable lipids assessed in different cell lines (RAW264.7 and DC2.4), SM-102 significantly enhanced the transfection efficiency in macrophages and DCs. Subsequently, we evaluated these LNPs in an in vivo setting. We quantified the bioluminescence of the popliteal lymph node after administering LNPs loaded with luciferase mRNA (1ug/mouse) via subcutaneous paw injection. The results demonstrated a significant increase in luciferase expression when using SM-102 and ALC-0315 lipids. To validate this finding, we conducted a T cell response study, which revealed an increased percentage of CD8+ T cells with SM-102-based LNPs compared to other formulations. Having identified SM-102 as a potent ionizable lipid, we proceeded to evaluate three phospholipids in vitro. The results indicated a significant enhancement in transfection efficiency with DOPE lipids compared to DSPC. Consequently, we selected DOPE as the phospholipid for subsequent screening. Lastly, we explored different types of sterols with varying molar ratios in macrophages and DC cells. Our findings unveiled a notable improvement in mRNA delivery, particularly in DCs, when the molar ratio of  $\beta$ -sitosterol was increased to 19.5%, while concurrently decreasing the molar ratio of cholesterol to 19% within the same formulation. It is noteworthy that the addition of  $\beta$ -sitosterol alone led to reduced transfection efficiency in DCs but resulted in a significant enhancement in macrophages. Lastly, we evaluated the top four formulations, and the results demonstrated a significant increase when  $\beta$ -sitosterol was added to the formulation with cholesterol, at molar ratios of 19.5% and 19%, respectively.

Overall, altering lipid composition and their molar ratios profoundly impact mRNA-LNP transfection. The optimized formulations, comprising SM-102, DOPE, and cholesterol with or without  $\beta$ -sitosterol, outperformed the alternatives. These refined formulations hold promise for clinical applications, potentially enhancing passive therapeutic agent delivery into macrophages and DCs, offering promising prospects for advancing cancer immunotherapy.

## **Lamya Alghanim, Medicinal Chemistry**

### *Development of Aromatic Aldehydes with Amide Substitution as Potential Sickle Cell Disease Therapeutic Agents*

#### **Background**

Aromatic aldehydes have become promising therapeutic agents for sickle cell disease. They modify sickle hemoglobin (HbS) to increase its affinity for oxygen, resulting in inhibition of HbS polymerization and red blood cells (RBCs) sickling. Our objective was to develop metabolically stable amide-substituted aromatic aldehydes that prevent RBCs sickling by increasing HbS oxygen affinity and destabilize the polymer, leading to enhanced antisickling activity.

#### **Methods**

Amide-substituted analogues of the previously reported antisickling leads VZHE-039 and PP14 were synthesized, and investigated for their in vitro ability to modify Hb, increase Hb oxygen affinity, inhibit RBCs sickling, without cytotoxic effects. The structure of LA-2 in complex with Hb was determined, while LA-1 was studied in rats for their in vivo activities.

#### **Results**

Several of the compounds modified Hb, inhibited RBCs sickling, partitioned into RBCs, and showed no cytotoxic effects. LA -2 bound at the  $\alpha$ -cleft of Hb to make Schiff-base interaction with  $\alpha$ Val1 amine, hydrogen-bond and hydrophobic interactions with the protein, and water-mediated hydrogen-bond interactions with the  $\alpha$ F-helix residues. Unexpectedly, the amide moiety metabolized into carboxylic acid upon oral administration to rats.

#### **Conclusions**

Most of the compounds showed significant sickling inhibition under hypoxia and anoxia conditions, the former due to increasing HbS oxygen affinity and the later due to interaction with the  $\alpha$ F-helix as demonstrated by the crystal structure of LA-2. The compounds showed relatively high RBCs partitioning and no cytotoxic effect, which bodes well for their overall safety. Nonetheless, the propensity to metabolize in vivo may pose potential toxicity problems.

## **Matthew Fernandez, Pharmaceuticals**

### *Macrophage-Targeting Immunotherapy Enhances Chemotherapy Response for Primary and Metastatic Triple-Negative Breast Cancer*

#### **Background**

Triple-negative breast cancer (TNBC) is a highly aggressive breast cancer subtype that lacks targeted treatments. While immune checkpoint blockade leads to significant benefits in TNBC when combined with chemotherapy, recurrence and metastasis remain major challenges. We aim to address this by targeting tumor-associated macrophages (TAMs). TAMs are the most abundant immune infiltrate in the TNBC tumor microenvironment (TME) and are associated with poor outcomes. Furthermore, anti-inflammatory M2-like TAMs are associated with worse overall survival (OS) and metastasis free survival (MFS) in TNBC.

### **Methods**

We selected pexidartnib (PLX) as immunotherapy and gemcitabine (GEM) as chemotherapy. We employed a 4T1/BALB/c immunocompetent mouse model. Mice were injected with 100,000 cells, and then exposed to daily administrations of PLX, and weekly administrations of GEM. Tumor growth was recorded, and the TME was analyzed ex-vivo. For the metastatic model, mice were inoculated with 100,000 cells and exposed to treatments as outlined above. Mice underwent survival surgery to remove the primary tumor and then received adjuvant therapy. MFS and OS were tracked.

### **Results**

PLX+GEM led to the greatest depletion of total and M2-like TAMs in a primary TNBC model, while also leading to the greatest reduction in tumor burden. In a survival surgery model, PLX+GEM again depleted total and M2-like TAMs, while significantly prolonging MFS and OS.

### **Conclusion**

Combining macrophage-targeting immunotherapy with chemotherapy leads to priming of the TME towards an immunogenic phenotype. This priming reduces tumor burden, while prolonging MFS and OS.

## **Aimalohi Okpeku, Pharmacoeconomic & Outcomes Science**

*Evaluating the Economic and Clinical Value of Empagliflozin versus Glimperide for Preventing Drug-induced Hypoglycemia in Elderly Patients with Type 2 Diabetes: Insights from a U.S. Payer's Perspective*

### **Background**

Type 2 Diabetes Mellitus (T2DM) significantly impacts the elderly, leading to high healthcare costs, largely due to hypoglycemic events. Current guidelines advocate for individualized treatments to reduce these risks, emphasizing the importance of cost-effective pharmacologic interventions.

### **Methods**

This study conducted a cost-effectiveness analysis comparing empagliflozin and glimepiride in preventing drug-induced hypoglycemia in older adults with T2DM from a US payer's perspective. Utilizing a decision tree model, the analysis incorporated data from clinical trials and real-world evidence to evaluate hypoglycemic event probabilities and healthcare costs, focusing on the cost per hypoglycemic event avoided as the primary outcome.

### **Results**

Empagliflozin proved to be more cost-effective than glimepiride, reducing both the risk and severity of hypoglycemic events, thereby decreasing overall healthcare costs despite its higher acquisition cost. Sensitivity analyses confirmed these findings under various scenarios.

### **Conclusion**

Empagliflozin offers a more economically viable alternative to glimepiride for the prevention of hypoglycemia in older adults with T2DM, leading to better health outcomes and lower total healthcare expenditures. This suggests a need for revising current treatment practices to optimize patient quality of life and healthcare spending. Further comparative and longitudinal studies are recommended to support these conclusions.

## **Ola AlAzzeh, Pharmaceutical Sciences—Pharmacotherapy**

### *Impact of Epigenetic Aging on Hepatic Expression of Drug Metabolism and Transport Genes in an Aged Mouse Model*

#### **Background**

Our lab previously conducted an exploratory genome-wide analysis of epigenetic aging in mouse liver via application of reduced representation bisulfite sequencing (RRBS), to identify drug metabolism and transport genes dysregulated in aging. Our goal in the current study is to validate and further investigate two of the top genes in this analysis, the cytochrome P450 2D9 gene (*Cyp2d9*) and the ATP-binding cassette transporter C2 gene (*Abcc2*).

#### **Methods**

High resolution-melt analysis (HRM) of bisulfite converted DNA was utilized to examine DNA methylation levels at *Cyp2d9* in liver genomic DNA obtained from male mice aged 4 months and 24 months (n=6 per group). Targeted gene expression analysis of *Cyp2d9* and *Abcc2* were run using standard TaqMan gene expression reagents. A *p*-value below 0.05 was used to indicate a significant difference between the two age groups.

#### **Results**

Our replication sample showed significant *Cyp2d9* hypermethylation with age with a mean (SD) of 49.7% (10.7) in 24mo mice compared to 4mo mice with 38.6% (10.9). This 11.1% increase in methylation replicated our original finding of a 12.5% increase from RRBS. Liver expression of *Cyp2d9* significantly decreased from 4 months to 24 months (p-value=0.002) Furthermore, *Cyp2d9* methylation showed a significant inverse correlation with the expression levels (p=0.007, R2=0.53). *Abcc2* showed a large decrease (36.4%) in DNA methylation levels with age, whereas the change in gene expression among the aged and young group was not significant (p-value = 0.685). *Abcc2* hypomethylation with age was not associated with gene expression (p=0.57, R2=0.033).

#### **Conclusion**

Our findings support that epigenetic variation with age could be an important contributor to changes in drug metabolism in older adults.

## Dickson Donu, Medicinal Chemistry

### *Targeting Plasmodium Falciparum Sir2 for the Development of Novel Antimalarials*

#### **Background**

*Plasmodium falciparum* (*Pf*) causes the most severe form of malaria. In 2023, the WHO reported over 600,000 malaria deaths globally. Drug resistance to existing antimalarials is widespread, prompting the need for novel agents against new targets of the parasite to support the combination-therapy approaches promoted by the WHO. In this study, we target *PfSir2*, an enzyme *Pf* utilizes in antigenic variation, a mechanism that facilitates its evasion of the host immune system, leading to persistent infection.

#### **Methods**

The enzymatic activity of *PfSir2* was evaluated using HPLC and western blot assays. The modulation of *PfSir2* activity by endogenous biomolecules was further investigated. To identify potential *PfSir2* inhibitors, a focused library of known human sirtuin modulators was screened for their activity against *PfSir2* using the aforementioned assays.

#### **Results**

The catalytic efficiency of *PfSir2* for a peptide substrate or the whole histone substrate was enhanced between 2-6-fold in the presence of dsDNA. Interestingly, myristic acid demonstrated differential regulation of the two distinct activities of *PfSir2*: it activated the deacetylase activity, but inhibited the defatty-acylase activity. Compound screening led to the identification of two potential *PfSir2* inhibitors with activities against both deacetylation and defatty-acylation.

#### **Conclusions**

In addition to endogenous biomolecules, *PfSir2* activity can be regulated by synthetic compounds. Here, 2 inhibitors of *PfSir2* were discovered, which provides us with a novel chemical scaffold for further optimization to develop more potent and selective inhibitors of *PfSir2*.

## Federica Carnamucio, Chemistry

### *Metal/Gemcitabine Liposomal Formulations for the Treatment of Lung Cancers*

#### **Background**

Gemcitabine (GMT) is a chemotherapeutic agent widely used to treat different solid tumors, including the lungs. With the aim of improving its pharmacokinetic profile, various GMT liposomal formulations have been proposed, however characterized by low drug loading values. The aim of this study is to develop GMT liposomal formulations by exploiting specific interactions between the biocompatible divalent metal cations  $Mn^{2+}$ ,  $Zn^{2+}$  and  $Ca^{2+}$  and GMT as the driving force to improve GMT loading for the treatment of lung cancers.

## Methods

The liposomes were prepared by active loading using thin film hydration-extrusion method. The hydrodynamic diameter (HD), polydispersity index (PDI), zeta potential ( $\zeta$ ), and loading characterization of the Metal/GMT liposomes (L-M/GMT) were determined by Light Scattering and HPLC analysis. The *in vitro* release profiles of the three formulations were studied under physiological conditions (pH=7.4 and t=37°C) and results were compared to free GMT. The *in vitro* cytotoxicity effects of GMT and L-M/GMT were assessed on K7M2-WT cells.

## Results

The speciation studies' results showed that t=45°C and pH=7.4 were suitable for the formulations to achieve the highest formation percentages of metal-GMT species. L-M/GMT showed suitable quality attributes (HD<200 nm, PDI<0.2) and a longer stability over time under refrigeration. L-M/GMT allow to further control the GMT release rate. *In vitro* cytotoxicity assays on K7M2-WT cells results were comparable to free GMT.

## Conclusions

We demonstrated that the metal GMT complexation is a potential strategy to improve the drug loading and stability and to enhance the ability to further control the GMT release rate.

## Dalia Al Saeedy, Pharmacotherapy & Outcomes Science

### *Dysregulation of Gene Expression in a Rotenone Rat Model of Parkinson's Disease*

## Background

Parkinson's Disease (PD) risk is 30% genetic, leaving 70% attributed to environmental factors. Among these factors, pesticides like Rotenone have been linked to higher PD risk. Our study investigates gene expression dysregulation in a Rotenone-induced rat model of PD, aiming to identify potential targets for epigenetic therapy.

## Methods

Male Lewis middle-aged (12-14 months) rats were used. The experimental group received daily Rotenone injections (3 mg/kg) for nine days, and the control group received vehicle (98% Miglyol 812 N, and 2% DMSO). Post-treatment, PD symptoms were evaluated using the bar test before sacrificing the rats for striatal RNA extraction and sequencing. Data analysis included alignment to the Rn6 rat genome, differential expression analysis, and pathway investigation with a 5% false discovery rate.

## Results

Rotenone significantly increased PD-like symptoms. RNA sequencing identified 345 differentially expressed genes, with notable downregulation of Dopa decarboxylase (*Ddc*), essential in dopamine synthesis. Circadian rhythm genes such as *Arntl* and *Per3* also showed significant dysregulation, correlating with PD-associated sleep disturbances.

## Conclusions

Chronic Rotenone exposure in rats induced PD-like behaviors and significant striatal gene expression changes. The downregulation of *Ddc* and alterations in circadian rhythm genes highlight potential molecular pathways affected by Rotenone, emphasizing the environmental impact on gene expression in PD.

## Raneem Aldaqqa, Pharmaceutics

### *Designing mRNA Lipid Nanoparticles for Tumor Associated Macrophages: Towards Immunotherapies for the Treatment of Osteosarcoma Lung Metastases*

## Background

Tumor associated macrophages (TAMs) are prevalent in Osteosarcoma Lung Metastasis (OSLM), making up to 50% of tumor volume. The abundance of TAMs phenotype, either supportive (M2-like) or inhibitory (M1-like) to tumor growth<sup>1</sup> can be influenced by levels of interferon gamma IFN- $\gamma$ <sup>2</sup>.

We investigate the optimization of mRNA lipid nanoparticles (LNPs) to enhance the expression of proteins in macrophages and other tumor microenvironment (TME) cells, aiming to activate macrophages towards an antitumorigenic state. Additionally, we assess the tolerability and translation efficiency of these LNPs in lung tissue in vivo, a crucial step toward evaluating their potential in OSLM treatment.

## Methods

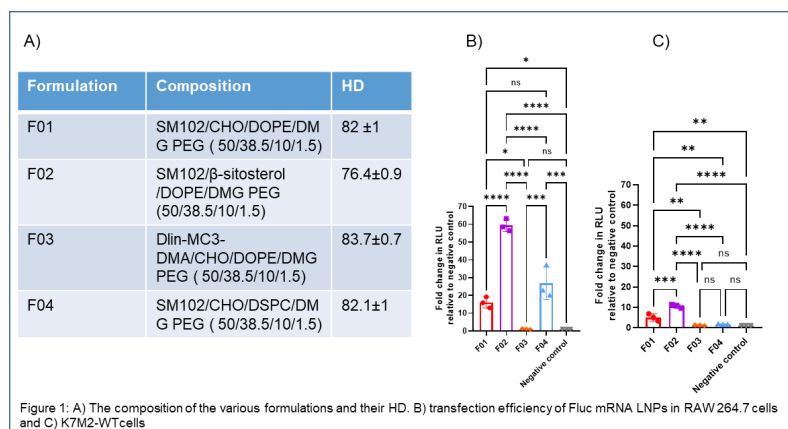
LNPs encoding Firefly Luciferase (FLuc) mRNA were formulated via ethanol injection method. Physical attributes were analyzed and encapsulation efficiency (EE%) determined. *In vitro* transfection studies were performed in murine macrophage (RAW 264.7)<sup>3</sup>, OS cells (K7M2-WT)<sup>4</sup>, and fibroblasts (NIH-3T3). *In vivo* tolerability and translation efficiency were evaluated in BALB/c mice via pulmonary administration (P.A.) of FLuc-mRNA LNPs.

## Results

Formulations met the desired quality target product profile. *In vitro*, F02 exhibited superior transfection efficiency compared to baseline and positive control (F04). *In vivo*, F02 LNPs were well-tolerated up to 5  $\mu\text{g}/\text{dose}$  and demonstrated successful translation of FLuc protein in the thoracic area and lungs.

## Conclusion

Optimized mRNA LNPs formulation can effectively transfect macrophages, OS cells and fibroblasts in OSLM TME. potentially shifting TAMs towards an anti-tumorigenic state. Moreover, these LNPs exhibit good tolerability and transfection efficacy in lung tissue in vivo, supporting their potential as a localized treatment strategy for OSLM.



## Sagun Poudel, Pharmaceuticals

### Six Months Effective Treatment of Age-Related Macular Degeneration Using Fenofibrate Microparticles

#### Background

Macular Degeneration Fenofibrate, a classical PPAR $\alpha$  agonist, has been formulated into microparticles (MP), to achieve controlled and sustained release. The purpose of this study was to evaluate the therapeutic potential of a new fenofibrate-loaded microparticles (Feno-MP) in a murine model of age-related macular degeneration (AMD).

#### Method

Feno-MP (30  $\mu$ g feno) and blank microparticles (Blank-MP) (125  $\mu$ g MP) in 1  $\mu$ L aqueous suspension were administered via intravitreal injection into very low-density lipoprotein receptor gene knockout (Vldlr  $-/-$ ) mice at 2 months of age. At 6 months post-injection, retinal function was evaluated using Electroretinography (ERG), Peanut agglutinin lectin staining of cone photoreceptors was conducted on flat-mounted retinas. Additionally, neovascular lesions were assessed through fundus fluorescein angiography and isolectin staining.

#### Result

Feno-MP treatment prevented the decline of cone ERG response in Vldlr  $-/-$  mice (n =5, p < 0.01). The photopic a-wave amplitudes in the Feno-MP group were 16.28%,30.87% and 20.34% higher than those of the Blank-MP group at 1,3- and 5-months post-injection, respectively. In addition, the decreased density of cone photoreceptors in both the central and peripheral retinas were alleviated by Feno-MP treatment (n = 5, p< 0.05). Feno-MP treated mice exhibited significantly fewer retinal leakage spots and decreased leakage spot area relative to the Blank-MP



(n = 4, p<0.05) as shown by FFA. With isolectin-stained flat-mounted RPE/choroid and retina, the number of subretinal neovascularization (SRNV) was decreased from 15.2 ( $\pm$ 0.41) per eye in the Blank-MP group to 10.1 ( $\pm$ 1.47) in the Feno-MP group (n = 5, p<0.01), and the number of intraretinal neovascularization (IRNV) was significantly decreased from 25.6 ( $\pm$ 2.29) per eye in the Blank-MP group to 15.2 ( $\pm$ 1.24) per eye in the Feno-MP group (n = 5, p<0.01). Additionally, the areas of SRNV and IRNV lesions were decreased in Feno-MP treated Vldlr -/- mice compared with the Blank-MP Vldlr -/- mice accordingly (n = 5, p<0.05).

### **Conclusion**

Intravitreal injection of Feno-MP protected retinal photoreceptor cells, ameliorated vascular leakage and subretinal neovascularization in Vldlr -/- mice, suggesting their therapeutic potential for AMD.

## **Ehsan Kaffash, Pharmaceutics**

### *PPAR $\alpha$ Agonist Eyedrop for Treating Corneal Wound Healing*

#### **Background**

Fenofibrate, a peroxisome proliferator-activated receptor  $\alpha$  (PPAR $\alpha$ ) agonist, has been used clinically for the treatment of dyslipidemia for over 30 years. The role of PPAR $\alpha$  in mitigating oxidation, inflammation and angiogenesis has previously been established. Nitrogen mustard (NM) is a potent vesicating chemical warfare agent that can cause severe corneal injuries. This study aims to validate PPAR $\alpha$  as a druggable target for NM-induced corneal injury and optimize fenofibrate microemulsion (Feno ME) eyedrops formulation to assess their efficacy.

#### **Methods**

Sprague Dawley rats were subjected to NM-injury in the cornea. A stable Feno ME formulation was optimized and the safety profile of the eyedrops was evaluated. Injured corneas were treated with Feno ME, Placebo ME and saline eyedrops (3 $\times$  day). Routine clinical observations and evaluations were performed.

#### **Results**

The optimized stable Feno ME formulation that was developed had a droplet size of approximately 20 nm, a PDI value under 0.1, a near-neutral zeta potential, an osmolarity of 457 mOsmol/kg, and a drug loading capacity of above 95%. Safety evaluations demonstrated no signs of toxicity or irritation. Efficacy studies revealed that Feno ME eyedrops significantly inhibited corneal ulceration, neovascularization, and opacity over a duration of two weeks.

#### **Conclusion**

Feno ME eyedrops could serve as a promising treatment option with potential for easy translational application in the treatment of corneal injuries induced by vesicants and diabetic wounds.

## Surendra Poudel, Pharmaceutics

### *In Vivo Efficacy of Tobramycin EEG Dry Powder Aerosol in Bioluminescent Pseudomonas Aeruginosa Induced Lung Infection Model*

#### **Background**

Inhaled antibiotics such as Tobramycin (Tobi) are effective in treating bacterial lung infections with localized drug delivery and reduced systemic exposure compared to intravenous administration. This study evaluates the efficacy of Tobramycin dry powder aerosol (Tobi EEG), prepared with excipient enhanced growth technology (EEG), in a *P. aeruginosa*-induced lung infection model.

#### **Methods**

Tobi EEG powder containing tobramycin, mannitol, l-leucine, and poloxamer 188 was prepared into micrometer-sized particles with spray drying. Lung infection in rats was induced intratracheally with  $2 \times 10^6$  CFU of *P. aeruginosa* (PA01::p16Slux) embedded in 80  $\mu$ l agar beads. Rat Air-jet Dry Powder Insufflator (Rat AJ DPI) was used to aerosolize 5 mg (1X/day) of Tobi EEG or Tobi® Podhaler for treatment. Luminescence and colony count in harvested lungs were used to determine treatment efficacy.

#### **Results**

Tobi EEG and Tobi® Podhaler, with median volume diameters of  $0.99 \pm 0.01$   $\mu$ m and  $1.77 \pm 0.01$   $\mu$ m, respectively, exhibited similar device emptying ( $68.1 \pm 3\%$  and  $69.6 \pm 3\%$  emitted dose via Rat AJ DPI). Rats inoculated with *P. aeruginosa* showed a higher luminescent signal on day 1 along with weight loss. The luminance of the lungs (day 5) for Tobi EEG and Tobi® Podhaler was significantly lower by 2.5- and 2.25-fold compared to no treatment group, respectively.

#### **Conclusions**

A novel Tobi EEG, micrometer-sized, spray-dried powdered was successfully aerosolized into *P. aeruginosa* lung infection using Rat AJ DPI. Tobi EEG showed comparable effectiveness to Tobi® Podhaler in significantly reducing *P. aeruginosa* in a rat lung infection model.

# **School of Population Health**

**Farnese Murielle Edimo Motto, School & Behavioral Sciences**

*Building Bridges: Exploring Group Dynamics in and Oral Health Community Advisory Board*

## **Background**

This mixed method study utilized a community-based participatory research approach to evaluate group dynamics within a virtual community advisory board (CAB) aimed at addressing the oral health needs of refugee and immigrant communities in the Greater Richmond Area.

## **Methods**

The evaluation used a mixed methods concurrent convergence parallel triangulation design, where CAB members completed a survey and semi-structured interview that evaluated key dimensions of group dynamics (e.g. decision-making, communication). The survey responses were tabulated and reported using descriptive statistics. Interviews were audio-recorded, transcribed verbatim and analyzed using deductive thematic content analysis. Findings were subsequently converged and merged for interpretation.

## **Results**

All invited CAB members (N=7) completed the survey and semi-structured interview. Participants expressed comfort in voicing opinions. Survey indicated 85.7% felt other group members listened to each other's perspectives even if they might disagree. The facilitator was identified as a key contributor in fostering open communication and collaboration. All indicated the amount of trust in the group increased throughout the initial 6 months. While decisions were consensus-based, 71.4% were very satisfied with the process. Minimal conflict reported, but 28.6% were somewhat satisfied with how the CAB dealt with problems that arose.

## **Conclusions**

Ongoing evaluation of group dynamics is integral to fostering partnership processes that promote the long-term sustainability of CABs. Findings underscore the importance of intentionally implementing CAB processes that de-center researchers and aim to redistribute power to refugee and immigrant community members in an effort to collectively mobilize towards oral health justice.

**Tolulope Kolawole, Social & Behavioral Sciences**

*Prevalence and Knowledge of the Effects of Substance Use among Secondary School Students in Lagos State, Nigeria*

## **Background**

The World Health Organization defines substance use as harmful or hazardous use of psychoactive substances including alcohol and illicit drugs. There is an increased rate of substance use among youths and adolescents. The aim of this study was to determine the prevalence and the knowledge of effects of substance use among secondary school students in Lagos State, Nigeria.

## **Methodology**

The study was a descriptive, cross-sectional study with 800 participants selected from eight different secondary schools using multi-stage sampling method. The instrument for data collection was amended WHO students' drug-use questionnaire. Data was analyzed using Epi Info 7 software. Chi squared test was used to test for association. The level of significance was  $p < 0.05$ .

## **Results**

The prevalence of addictive substance use among the participants was 6.9% (current users only). About 13.9% of the participants had a history of drug use. Apart from alcohol consumption, the addictive drug most frequently used by the participants was Tramadol (52.7%) followed by Marijuana (36.4%) and Shisha (29.1%). Almost all the participants (98.1%) were aware of addictive substance use. 88.7% of the participants were able to identify symptoms of addictive substance use: short term complications (79.1%) and long-term complications (61.1%). Factors associated with the use of addictive substances in this study were age, gender, religion, family size and highest educational level of the mother.

## **Conclusion**

This study has shown the need for increased awareness of the effects of substance use among secondary school students in Lagos state, Nigeria through a holistic approach involving all stakeholders.

## **Stacie Lefeavers, Social & Behavioral Sciences**

### *From Red Flags to Freedom: A Human Trafficking Medical Education Pilot Study*

## **Background**

Up to 88% of trafficked people are seen in a clinical setting while they are in a human trafficking situation and are unidentified. In 2023, less than 10% of medical schools in the United States required training on this topic. This study pilots an educational intervention with an aim to educate the next generation of physicians by emphasizing the introduction of this topic during the first years of medical school.

## **Methods**

An online, self-directed educational intervention comprised a cohort of medical students ( $n=27$ ). Participants were instructed to take a pre-survey, then proceed to a 1-1.5 hour online self-directed human trafficking curriculum consisting of videos, reading, multiple choice knowledge check questions, and interactive patient scenarios. A post survey was administered directly after the training.

## **Results**

78% of participating students had never received training on human trafficking prior to this study. A t-test demonstrated a significant difference between the pre and post survey in the perception of the participants' self-efficacy pertaining to their role in trauma informed care ( $p < 0.001$ ). Additionally, there was significant difference in the attitudinal score of the residents' role in trauma informed care ( $p < 0.001$ ).

## **Conclusions**

The majority of participants had never received training on human trafficking, consistent with the findings of previous studies. Post-intervention, student participants reported greater self-efficacy in delivering trauma-informed care. This preliminary study demonstrates the need for further training for medical students.

## **Oyintoun-emi Ozobokeme, Healthcare Policy & Research**

### *Educational Awareness of Skin Bleaching and Lightening Practices among Non-Whites in Diaspora (United States): A Comprehensive Review*

## **Background**

Skin bleaching and lightening practices among non-White populations in the diaspora have gained increasing attention in recent years. This review explores the educational awareness surrounding these practices, including the associated perceptions, attitudes, intentions, and behaviors. Based on the potential health risks and socio-cultural implications of skin bleaching and lightening, understanding the educational context and influencing factors is important.

## **Method**

A systematic search was conducted on PubMed using a structured keyword strategy. Three sets of keywords were employed: (1) "skin bleaching" OR "skin lightening" AND "awareness" OR "knowledge" OR "education," (2) "skin bleaching" OR "skin lightening" AND "perceptions" OR "attitudes," and (3) "skin bleaching" OR "skin lightening" AND "intentions" OR "use" OR "practice. 27 articles met the inclusion criteria, focusing on skin bleaching and lightening practices among the target populations, and containing relevant information on awareness, perceptions, attitudes, intentions, knowledge, education, or practices related to skin bleaching or lightening.

## **Results**

Various levels of awareness, knowledge, attitudes, perceptions, intentions, and practices were found. The literature showed relationships between sociocultural factors, media influence, and historical contexts in shaping individuals' decisions regarding skin bleaching and lightning. Educational gaps were identified, highlighting the need for targeted interventions and policy implementations to promote healthier choices and discourage harmful practices.

## **Conclusions**

This review emphasizes the significance of educational awareness in addressing these practices and their associated health risks and also reveals a critical need for culturally sensitive education and awareness programs that consider the sociocultural contexts, perceptions, and attitudes surrounding skin bleaching and lightening.

## **Jeancarlo Siles, Public Health**

### *School Connectedness as a Protective Factor for Suicidal Thoughts and Behaviors*

As suicide prevention continues to be incorporated into public health interventions, it is important to review and test solutions that foster protective effects for youth at risk. According to recent estimates, suicide rates for adolescent youth continue to increase (CDC, 2023). Utilizing data from the 2021 National Youth Risk Behavioral Survey, school connectedness was measured in a singular item for the first time. This study intends to conduct a prevalence analysis on school connectedness and its relationship with five measures of suicidal thoughts and behaviors (STB). The five measures included poor mental health due to Covid-19, feelings of sadness or hopelessness for two weeks or more, seriously considered a suicide attempt, made a plan to attempt suicide, and previously attempted suicide. Demographic groups were also compared in the assessment for school connectedness and measures of STB. It was hypothesized that higher levels of school connectedness would be negatively associated with measures of STB. Results confirmed that overall, school connectedness is associated with lower levels of reported poor mental health, suicidal ideation, and suicide attempts. This assessment provides the first exploration of school connectedness as a protective factor for suicide prevention among youth. Some limitations include the nature of a cross-sectional design, inability to prove causality, and the definition of school connectedness.

## **Nixon Arauz, Social and Behavioral Sciences**

### *Racial Disparities in HPV Vaccine Uptake Among Adult Black and white Latinx Cisgender Men in the United States: Behavioral Risk Factors Surveillance System 2014-2022*

#### **Background**

Latinx individuals bear a disproportionate burden of human papillomavirus (HPV)-related cancers. However, research on HPV vaccine uptake often overlooks potential racial differences within this population. This study aims to fill this gap by investigating HPV vaccination factors among Latinx adults, focusing on racial disparities.

#### **Methods**

Using data from the 2014-2022 Behavioral Risk Factors Surveillance System, this study examined HPV vaccine uptake among Black or white Latinx cisgender men aged 18-34 years-old who reported receiving three vaccine doses. Logistic regressions assessed racial disparities in HPV vaccine uptake among Black and white Latinx cisgender men, adjusting for complex survey design.

#### **Results**

Overall, among Latinx individuals, 6.8% (N=718) completed the HPV vaccine series, with 91.40% being white Latinx and 8.60% Black Latinx. Weighted multivariate logistic regression analysis revealed significant odds for Black Latinx men (AOR: 0.408, 95% CI: 0.180-0.928) compared to white Latinx counterparts, indicating their 0.408 times lower likelihood of completing HPV vaccination. Additionally, older men are 0.295 times less likely than younger men to complete the HPV vaccine (AOR: 0.295, 95% CI: 0.168-0.517). Conversely, men who reported not being married/partnered (AOR: 2.065, 95% CI: 1.128-3.782) are 2.065 times more likely than their married/partnered counterparts to complete the HPV vaccine series. Similar outcomes were observed in Models 3 and 4.

#### **Conclusion**

Further research is needed to understand the health experiences of Black Latinx individuals in the United States. This study underscores the importance of examining HPV uptake in this population to prevent associated chronic diseases.

## **School of Education**

**Joyce Robinson, Educational Psychology**

*Restorative Educational Justice: Exploring the Costs of Education Debts for Black Men*

This systematic literature review will determine: (1) what previous research shows about Black men's educational attainment and associations will affect economics that may affect their current or future marital or paternal availability. (2) to what extent does Black men's educational attainment, financial well-being, and marital and paternal availability have an impact on Black women and children.

### **Introduction**

Though African Americans have endured wealth-building disadvantages for centuries, Black male youth and men have been more disadvantaged in their likelihood of secondary and postsecondary completion (Taylor et al., 2018) and gaining economic empowerment (Kearney, 2023; Reeves, 2022). This education achievement gap between Black boys (Ladson-Billings, 2006) and men (Kearny, 2023 and Reeves, 2022) is the greatest and leads to weak economic standing that impacts marriageability to Black women (Cohen & Pipin, 2018). Further, Black men report delays in or the decision not to marry for financial reasons while Black women cite education and economics as desired markers of marriageability (Chapman, 2006).

### **Methods**

The review proposes to incorporate seven major milestones: 1) Define research questions, 2) Develop the research protocol, 3) Conduct the review, 4) Scan for eligibility, 5) Codify full text articles, 6) Synthesize data, 7) Discussion. Currently, this research is undergoing Step 3.

### **Results & Discussion**

The goal of this proposal is to utilize this examination to inform and conduct future research and gain a comprehensive understanding of previous interventions and novel interventions that could be beneficial.

## **Rima Boukhzam Fayad, Curriculum, Culture and Change (CCC)**

### *Visual Art Integration in Mathematics: Providing Equity and Optimizing the Teaching and Learning Process in the Context of VA State Standards of Learning and WIDA Framework for Multilingual Learners*

#### **Background**

Math is a subject affected by equity and social justice issues. College acceptance and enrollment in STEM degrees may be inaccessible to Multilingual Learners (MLs) who are inadequately supplied with the right strategies to access the content of their math courses in secondary schools.

#### **Methods**

A qualitative content and discourse analysis study designed to explore the standards of learning, knowledge, and skills established by the VDOE for both math and visual art at the middle school level. Then, assess the alignment of the VDOE standards of learning with the WIDA standards, which often emphasize the incorporation of MLs' background knowledge, cultural assets, talents, and abilities in the learning process.

#### **Results**

Research suggests that art helps students engage in subject matter more effectively than typical instructional methods (Stewart et al., 2019). Meanwhile, the growing population of MLs needs educational support, advocacy, and creative learning engagements to complement their talents and cultural capital (Yosso, 2016; Baker, 2019; Grapin et al., 2023). This combination has presented an objective that should be appreciated and explored.

## **Jacqueline Hopkins, Curriculum, Culture and Change (CCC)**

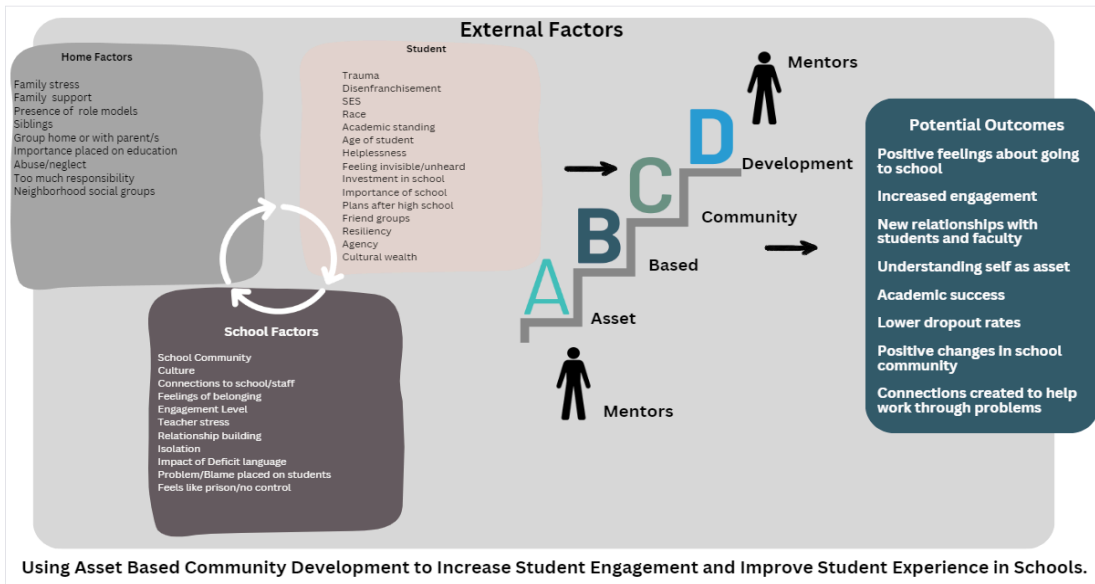
### *Using Asset- Community-Based Model in Schools to Increase Engagement and Prevent Adolescent Alienation*

#### **Background**

The history of public education in the United States shows that it has created a system that is not designed for all students (Farrington, 2020). As a result, many students with marginalized identities based on factors such as culture, race, ability, and socioeconomic status feel alienated and disengaged (Henry et al., 2012). Using an asset-based community development (ABCD) model could complement culturally relevant pedagogies and other approaches and create realistic, practical solutions to school disengagement and alienation.

#### **Conceptual Framework**





## Methods

This qualitative study focuses on an ABCD program that was launched in two local schools. Interviews were conducted, and secondary data from student surveys were analyzed to understand the following research questions:

- RQ1:** What is the perceived impact of an ABCD model program on students' feelings of belonging in school?
- RQ2:** How does an ABCD model program impact students' perceived level of engagement in school and class activities?
- RQ3:** What is the perceived impact of an ABCD model on students' academic self-confidence?
- RQ4:** How does the context of each case influence the perceived impacts of the ABCD model on student experience in school?

## Preliminary Results

The study is currently underway; however, preliminary results indicate that the ABCD program has increased students' willingness to attend school, engagement in social and academic activities, and their sense of connection to students and staff.

## Conclusion

The study is ongoing and not yet complete; some of the preliminary results are above. More data will be presented at the symposium.

## **Kristine Herakovich-Curtis, Educational Leadership**

### *Safe Schools: A Descriptive Study Examining How to Prevent Peer-to-Peer Sexual Misconduct in K-12 Schools*

#### **Background**

In response to a problem of practice presented by the non-profit Stop Sexual Assault in Schools (SSAIS), this study examines what training and resources K-12 Title IX Coordinators and school administrators need to prevent and effectively address peer-to-peer sexual harassment and assault. Grounded in Bryk's Improvement Science (Bryk, et al., 2018; Hinnant-Crawford, 2020), we partnered with SSAIS to address a real-world dilemma. Through the theoretical lens of the Social-Ecological Framework, a descriptive study was conducted using quantitative and qualitative methodologies to study changes needed to reduce peer-to-peer sexual misconduct in schools (Guy-Evans, 2023).

#### **Methods**

Data was collected through focus group interviews and a Nearpod® questionnaire with a national sample. Relying upon the Social-Ecological Framework, which assists researchers in understanding the experiences and outcomes of sexual violence, data was coded with descriptive statistical methods and analyzed by constant comparison (Richards et al., 2021).

#### **Results**

Findings revealed that Title IX Coordinators and school administrators are challenged by Title IX training and laws, which were designed for adult sexual allegations. Leaders reported they are taxed with adapting training to meet their K-12 needs and balancing federal law, while responding to the needs of students and families.

#### **Conclusions**

Our findings offer recommendations for SSAIS to develop K-12 case scenario professional learning, develop resources to support schools in sharing policy and law with staff, students, and families, and opportunities to influence Title IX federal law for our youth. We also make recommendations regarding the efficacy of student-led sexual assault clubs in school settings.

## **Cammie Justus-Smith, Research, Assessment, and Evaluation**

### *Deschooling Pedagogy: Experiences of Conventional Educators Turned Self-Directed Education Advocates*

#### **Background**

This research draws upon Ivan Illich's work *Deschooling Society* (1971) to create a framework for exploring the experiences of teachers who left conventional education to work within Self-Directed Education (SDE) environments. SDE environments are specific learning communities that offer the following optimizing conditions: an acceptance that learning and development is the child's responsibility; extensive time to play and

pursue personal interests; opportunity to play with tools of the culture; access to a variety of helpful adults whose goal is to facilitate learning and not evaluate it; free age mixing among all students; and immersion in a consistent, supportive community.

### **Methods**

Through semi-structured interviews, I gathered qualitative data from 11 former teachers. I used thematic analysis to find areas where interviewees' experiences aligned with and diverged from Illich's understanding of deschooling and the meanings participants placed upon their experiences.

### **Results**

Study participants highlighted the struggles inherent within institutionalization, theoretical and ethical reasons for leaving conventional education spaces, and the acts of resistance that ultimately led to personal transformation. Interviewees' experiences highlight ways that conventional education spaces, with the implicit curriculum of hierarchy and inequality, are ripe for abuses of power and succeed in the stripping of agency for teachers and students.

### **Conclusions**

Participant narratives revealed a philosophical evolution that prompted a transition into SDE environments. These interviews also illustrated a divergence from individuals who burn out and leave education, instead becoming change agents who challenge the educational community to examine and revolutionize teaching pedagogy and praxis.

## **Brandi Daniels, Educational Leadership**

*A Path Toward Healing: Parent and Caregiver Perspectives on the Work of Restorative Practices  
Richmond at Martin Luther King Middle School*

### **Background**

To address how key stakeholders experience restorative practices (RP), Restorative Practices Richmond (RPR) submitted a request for assistance (RFA) to Virginia Commonwealth University. This single case study responds to the RFA by examining how parents, caregivers, and community partners perceive school discipline and restorative practices and how this understanding supports restorative practices at Martin Luther King Middle School (MLK MS). Through the lens of the Social Justice Framework, this single case study approach was used to explore the challenges and needs of parents, caregivers, and community partners engaging with the restorative practice (RPR) program.

### **Methods**

The doctoral team conducted a qualitative study, complete with semi-structured interviews, field/observation notes and a neighborhood corridor crawl. The Semantic Thematic Analysis (TA) approach allowed the team to identify recurring themes and patterns within the dataset, providing valuable insights into the underlying meaning of the data.

## **Results**

The themes that emerged included the following: parents and caregivers lack sufficient knowledge about what RP is, how it is implemented at the school, and how it will benefit their child; communication channels need to be expanded to increase awareness and participation in RP; and this key stakeholder group wants relationships and connections strengthened with the school as well as perceived biases dismantled. The results of the study show that if the information was presented to study participants in a culturally appropriate manner, if they were invited to take part in the RPR programming, and if barriers to RP access were recognized and removed, they would support the RPR program.

## **Conclusion**

Our team's work supported RPR in finding ways to increase buy-in from parents, caregivers, and community partners and move towards providing a whole school restorative practices model for this community of stakeholders.

## **Oscar Keys, Art Education**

### *Exposing the Camera: The Pedagogical Possibilities of Critical Camera-Based Arts Curriculum*

## **Background**

Cameras are a ubiquitous part of our everyday lives, especially in education, found in students' smartphones and state-of-the-art surveillance systems. This research project emerged from an iterative redesign of the Photography for Art Education course, addressing the complicated history of the camera as a tool for creative expression and social control.

While the camera is often used as a tool to address social issues through methods like documentary; this criticality is rarely turned towards the tool itself. This study draws on photographer and theorist Allan Sekula (1986), who observed how easier access to photography became both an act of democratization (for the People) and institutionalization (by the State), and articulates this tension between our desire to be *seen* and our fear of being *watched*.

## **Methods**

The author employs autoethnography (Ellis et al., 2011) to critically examine how his pedagogical shifted over time. These reflections are supported through additional analysis of course materials, personal artifacts, student interviews, and historical research on camera-based instruction in art education and other disciplines. A reflexive thematic analysis (Braun & Clark, 2021) is used to identify themes across student artworks, written reflections, and video interviews and structure the analysis.

## **Results**

Organized through three main units of the course — Body, Truth, and Power — each section provides an overview of the themes that emerged in students' projects and pedagogical reflections.

## **Conclusions**

The aim of this study is to provide an in-depth analysis of how the camera offers critical pedagogical possibilities beyond learning to capture and interpret images.

## **Bailey Bontrager, Educational Psychology**

### *Aligning Practice with Theory: A Review to Determine Teacher Noticing Interventions that Align with Luna et al.'s (2023) Conceptual Framework*

#### **Background**

Van Es and Sherin (2021) presented their *teacher noticing* (TN) framework, systematizing how teachers determine what to pay attention to, interpret what they observe, and make decisions about subsequent instructional moves. Paris (2012) presented culturally sustaining pedagogy (CSP) – an alternative to culturally responsive/relevant pedagogies – which values “our multiethnic and multilingual present and future” pluralistic societies (p. 95). Luna et al.'s (2023) conceptual framework aligns the theoretical foundations of TN and CSP. They applied the framework to a TN intervention, demonstrating how teachers learned to notice students' learning while leveraging students' cultural knowledge and experiences.

#### **Methods**

The present review searched databases relevant to teaching and teacher development, as well as psychological constructs (e.g., ERIC, APA PsychInfo). Search strings captured the intersection of teacher preparation/development and TN (e.g., “teacher\*” or “professional development” AND “noticing”). Included articles will be analyzed to determine if/where alignment occurs between the intervention and Luna et al.'s (2023) framework.

#### **Results**

Initial analysis revealed some studies demonstrate an intentional attempt to support teacher noticing as it relates to equity and students' identities (e.g., Graham & McDuffie, 2023; Jackson et al., 2023), while others present a teacher-focused approach of skill development.

#### **Conclusions**

The current review is the first to investigate TN intervention components to a degree that assists in determining whether the intervention aligns with Luna et al.'s (2023) framework. Identifying alignment is essential to provide guidance regarding which interventions support teachers' development of TN and CSP skills, thereby supporting teachers as they foster meaningful student learning.

## **Lindai Xie, Counselor Education & Supervision**

### *Posttraumatic Growth of Undergraduate Students with Sexual Violence Experiences*

## **Background**

Literature has explored the relationship between adverse childhood experiences and victimization in adulthood, suggesting that integrating mindfulness activities into the treatment for survivors of sexual violence could be beneficial (Ports, et al., 2016). This study investigates the relationship between posttraumatic growth (PTG), adverse childhood experiences (ACES), anxiety, and mindful attention awareness scale (MAAS) among 233 college students who experienced traumatized sexual violence.

## **Methods**

After cleaning the data, a confirmatory factor analysis (CFA) and structural equation modeling (SEM) were conducted. The purpose of CFA is to evaluate model fit, and the SEM was performed to examine the mediator role of mindful attention awareness and anxiety. Mplus Editor and Mplus Diagrammer (both are in Version 1.8.10(1)) were used to conduct these analyses.

## **Results**

Results showed that MAAS significantly mediates the relationship between ACES and anxiety of sexual violence victims. Moreover, anxiety mediates the relationship between their ACES and PTG. This study further examines how MAAS separately affects the five factors of PTG and each factor's relationships with ACES and anxiety, which indicates MAAS's mediating and suppressing roles among ACES, anxiety, and factor 3 (personal growth) of PTG.

## **Conclusion**

Based on the results, mental health professionals could consider using mindfulness activities while assisting sexual violence survivors in reducing anxiety. In addition, increasing anxiety and traumatized experiences to improve PTG is a painful way, safer and more gentle strategies need to be discussed. Findings provide implications for institutions and mental health professionals on how to better support sexual violence victims.

## **Tiyacca Simms-Jones, Educational Leadership, Policy and Justice**

### *Black Docs Matter: Mentoring and Advising of Black Women Persisting to Doctorate Degrees*

#### **Background**

In 2021, Black students earned about 2400 doctorate degrees, with Black women making up 64% of doctorate holders (Kang & Falkenheim, 2022). Black women doctoral candidates face an academic environment where they are often doubly hindered by gender and race.

While the terms of advising and mentoring are used interchangeably, they are different (Jones & Wilder, 2013). Advising for doctoral students has a supervision component encompassing the programmatic support doctoral to meet departmental milestones (Jones & Wilder, 2013). Formal mentoring is established by the student's department and is characterized by shared research interests and similar goals with predictive outcomes that are important for doctoral students striving to gain a foothold in academia. Informal mentoring is organic and may happen outside the student's field of study but with members of their culture or similar pathways (Sinanan, 2016).

## **Methods**

This narrative literature review ascertains the relationship between advising, formal and informal mentoring on the success of Black female doctoral students. Peer-reviewed journals from feminist theory, higher education, advising, and psychology are included, and 20-35 were used to complete the review.

## **Results**

This review resulted in a compilation of successful strategies involving advising and mentoring that meet Black female doctoral students' developmental and programmatic needs. These noted and empirically successful strategies address systemic and institutional barriers to African American women persisting to doctoral degree completion.

## **Conclusion**

Findings provide administration with strategies for implementing a long-term strategic plan and new theories for recruiting, supporting, and sponsoring Black women's voices in academia.

## **Tanya Wineland, Educational Psychology**

### *Academic Advising as Cultural Brokering: A Qualitative Echo of Advisor Voices Through the Pandemic*

#### **Background**

Once the COVID-19 global pandemic began, undergraduate academic advisors became *everything* to their institutions, validating the advising profession as a guiding force in post-secondary operations. As students seek out academic advising to reconcile coursework with significant life changes and learning loss amid a now-receding pandemic, it is critical to understand how the advising role continues to be shaped by the experience. Introducing academic advising as a form of *cultural brokering*, “the act of bridging...reducing conflict or producing change” (Jezewski, 1990, p. 497), may create new inroads for advisors and students to make.

#### **Methods**

This preliminary study qualitatively explored areas of the academic advisor's developing role in institutional contexts. Purposeful sampling was used to select interview participants who advised students at VCU before and through the pandemic. 60-minute interviews were conducted via Zoom and in person over a month in the fall of 2023. VCU advisors' perceptions of student interactions, culture, privilege, and power encountered in academic advising were questioned. Deductive and inductive coding were used.

#### **Results**

Findings point to advisors forging relationships with students who have opted for transactions. As time passes, students are being reintroduced to the idea of academic advising.

#### **Conclusions**

As institutions increasingly rely on advisors to drive degree outcomes, academic advising has never been more crucial. By introducing academic advising as a form of cultural brokering, a powerful tool for bridging gaps and fostering change, a future can be envisioned where advisors and students forge new, meaningful connections.

# College of Humanities & Sciences

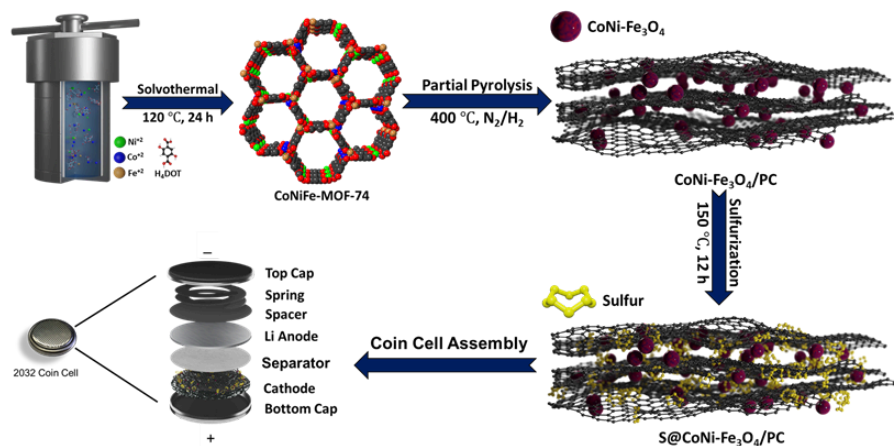
Mahmoud Kaid, Chemistry

## Advanced Nanostructured Cathodes for High Energy Density and Long-Life Lithium-Sulfur Batteries

### Background

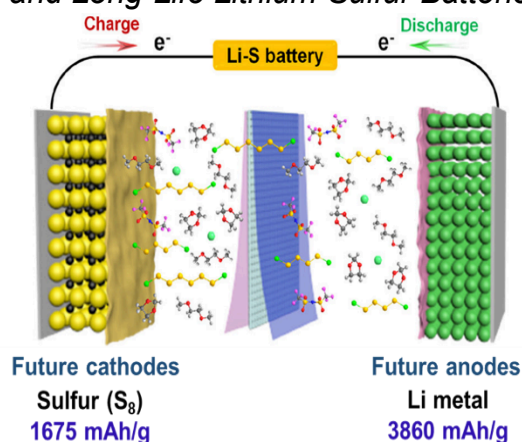
Lithium-sulfur batteries hold great promise as next-generation high-energy-density batteries. However, their performance has been limited by low cycling stability and sulfur utilization. Herein, we demonstrate that a selective reduction of the multivariate metal-organic framework, MTV-MOF-74 (Co, Ni, and Fe), transforms the framework into a porous carbon decorated with bimetallic CoNi alloy and Fe<sub>3</sub>O<sub>4</sub> nanoparticles capable of entrapping soluble lithium polysulfides while synergistically facilitating their rapid conversion into Li<sub>2</sub>S.

**Methods. Fabrication of S@CoNiFe<sub>3</sub>O<sub>4</sub>/PC Cathode:**

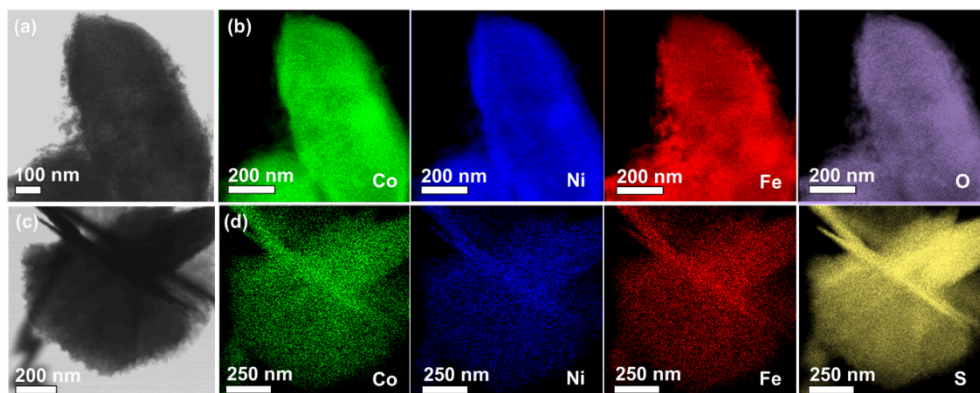


**Scheme 1.** Schematic representation of CoNiFe-MOF-74 synthesis and its thermal transformation into S@CoNiFe<sub>3</sub>O<sub>4</sub>/PC cathode.

**TEM and EDS images**

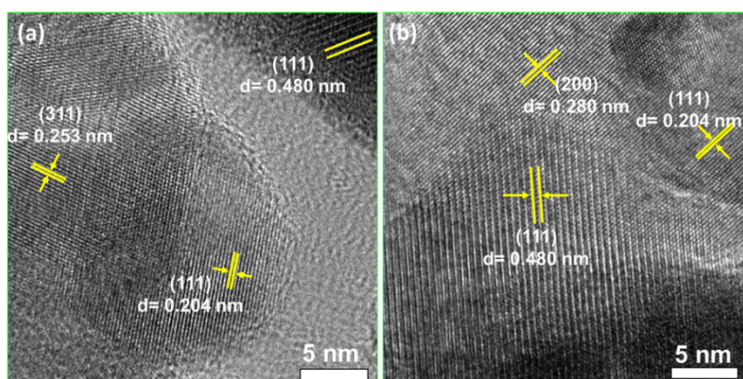






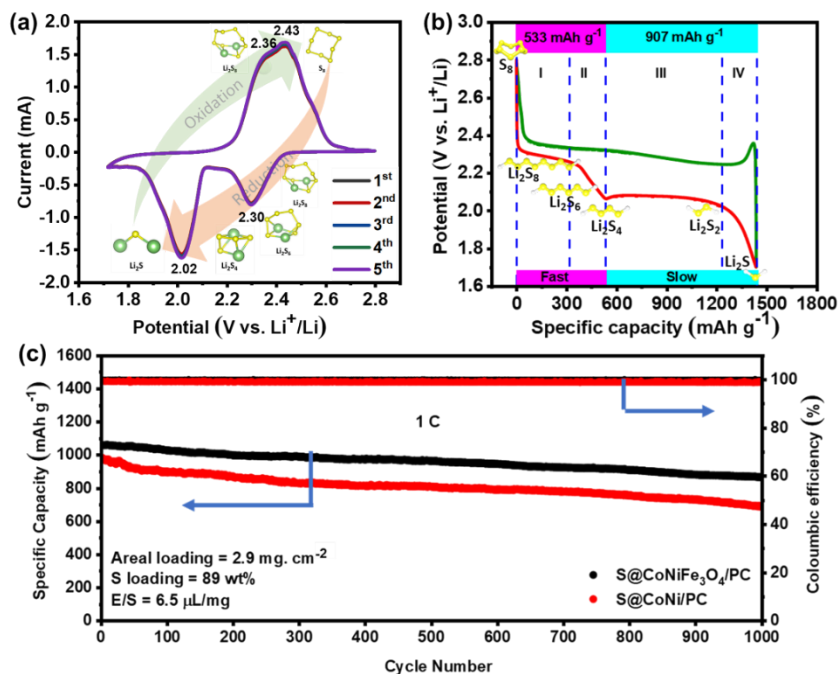
**Figure 1.** TEM images and the corresponding energy-dispersive X-ray spectrometry mapping of (a,b)  $\text{CoNiFe}_3\text{O}_4/\text{PC}$  and (c,d)  $\text{S}@\text{CoNiFe}_3\text{O}_4/\text{PC}$ .

### High Resolution-TEM



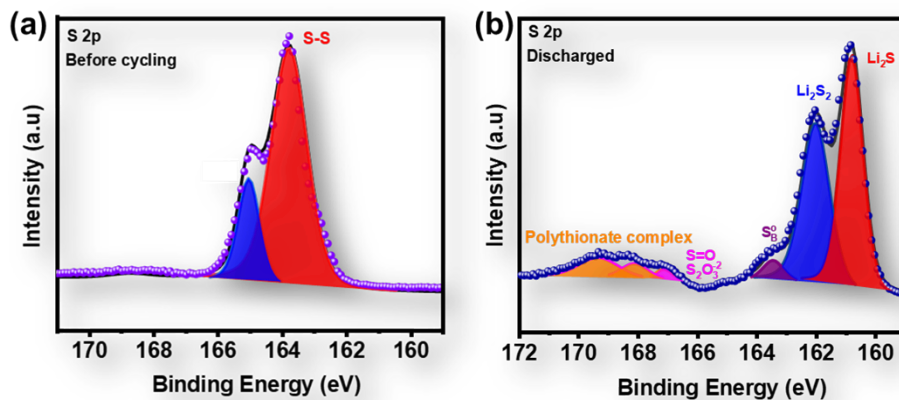
**Figure 2.** HR-TEM of (a)  $\text{CoNiFe}_3\text{O}_4/\text{PC}$  and (b)  $\text{S}@\text{CoNiFe}_3\text{O}_4/\text{PC}$ .

### Electrochemical performance



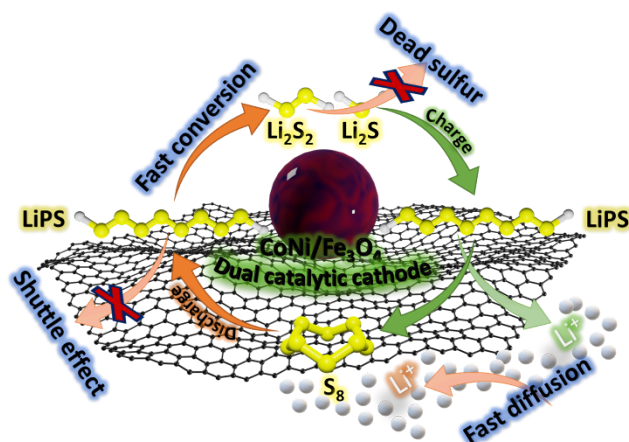
**Figure 3.** (a) Cyclic voltammetry, (b) Charge-discharge profiles, and (c) long-term stability curves of Li-S battery with S@CoNiFe<sub>3</sub>O<sub>4</sub>/PC cathode.

### High-resolution XPS of S-cathode



**Figure 4.** High-resolution XPS of S@CoNiFe<sub>3</sub>O<sub>4</sub>/PC cathode (a) before cycling and (b) fully discharged after 100 cycles GCD.

### Mechanism Overview



**Figure 5.** The schematic mechanism of CoNi-Fe<sub>3</sub>O<sub>4</sub> catalyzed polysulfide conversion in rechargeable LSBs.

### Conclusion and Future Perspective

- Our Design of electrocatalyst hosts simultaneously achieves **diffusion, adsorption, and fast catalytic conversion of polysulfides**, which make them uniquely suited for addressing the shortcomings of sulfur cathodes in practical Li-S batteries.
- The highest priority for future perspectives on developing high energy-density LSBs are design of smart cathodic electrocatalyst hosts with:
- **Interconnected and highly porous materials.**
- **High adsorption and catalytic activity.**
- **Good conductivity.**

### Abigail Adade, Clinical Psychology

*Does Stigma Influence Intentions to Seek Mental Health Care? A Study among Young Adults Attending University in Ghana*

#### Background

Stigma, a pervasive public health concern, significantly impacts individuals' lives, particularly in mental health. How stigma influences Ghanaian students' mental health-seeking behavior is unclear. In this cross-sectional study, we investigated the interplay between self-stigma, social stigma, and intentions to seek counseling services, along with attitudes toward seeking mental health services and attitudes toward seeking professional psychological help.

#### Method

Data was collected from 440 students at two tertiary institutions in Ghana. The instruments employed were standardized questionnaires, including the Barriers to Access Care Evaluation Scale, Intention to Seek Counseling Inventory, Inventory of Attitudes Toward Seeking Mental Health Services, Self-Stigma of Seeking Help, and Stigma Scale for Receiving Social Support.

### **Results**

Preliminary results revealed a significant negative relationship between self-stigma and attitudes toward seeking mental health services and attitudes toward seeking professional psychological help. However, self-stigma did not have any significant associations with intentions to seek counseling services. Furthermore, social stigma showed an inverse relation with attitudes toward seeking mental health services, while no significant associations were found with intentions to seek counseling services or attitudes toward seeking professional psychological help.

### **Conclusion**

These results shed light on the complex dynamics of stigma in the context of mental health services, contributing valuable insights for future research and intervention strategies.

## **Tijana Simovic, Rehabilitation and Movement Science**

### *Regular Users of Electronic Cigarettes Exhibit Reduced Cardiorespiratory Fitness*

#### **Background**

Electronic cigarettes (e-cigs) are popular tobacco products advertised as safer alternatives for combustible cigarettes despite preliminary data suggesting a negative effect of e-cigs use on cardiovascular profile. Cardiorespiratory fitness, a marker of cardiovascular health, is diminished in traditional tobacco users. The effect of regular e-cig usage on cardiorespiratory fitness is currently unknown. Thus, the purpose of this study was to investigate the impact of regular e-cig use on cardiorespiratory fitness in healthy young adults.

#### **Methods**

Nineteen regular e-cig users (ECU; age: 23±3 yr; e-cigs usage 4±2 yr.) and sixteen demographically matched, never users (NU; age: 23±3 yr.) participated in this study. Cardiorespiratory fitness was measured by peak oxygen consumption ( $VO_{2peak}$ ) via respiratory gas exchange analyzer during a cardiopulmonary exercise test. The peripheral oxygen extraction ratio ( $O_2ER$ ), an indicator of skeletal muscle  $O_2$  utilization, was evaluated as a difference between arterial and venous oxygen saturation during rest and exercise.

#### **Results**

Chronic e-cig users exhibited significantly lower  $VO_{2peak}$  (ECU vs. NU; 28.2±4.7 vs. 32.3±5.5 ml/kg/min;  $p=0.025$ ) and percent predicted (ECU vs. NU; 77±15 vs. 91±16 % predicted;  $p=0.015$ ) when compared to never users. No differences were observed during resting  $O_2ER$  between the groups, at peak exercise,  $O_2ER$  was significantly lower in ECU than in NU (51±11, vs. 61±10 %;  $p=0.025$ ).

#### **Conclusions**

For the first time, we have identified significantly reduced cardiorespiratory fitness and skeletal muscle oxygen utilization in young, apparently healthy, regular e-cig users. Results from our study imply a negative effect of chronic e-cig use on cardiovascular health.

## **Phillip Glass, Nanoscience**

### *Integration of Tactile Sensors and Variable Resonance Frequency Flexible Tactile Actuators in an Event-Cue Feedback Loop*

#### **Background**

This study presents a groundbreaking approach to restoring somatosensory feedback loops disrupted in conditions such as neuropathy and prosthetic use. Leveraging advanced manufacturing techniques and cutting-edge materials, a novel sensing-actuation platform is developed.

#### **Methods**

The platform integrates carbon nanotube (CNT) sensors with custom, soft tactile actuators to create wearable flexible electronics capable of delivering precise and responsive feedback. The CNT sensors exhibit exceptional conductivity and flexibility, enabling accurate detection of pressure changes. These sensors are seamlessly integrated with flexible tactile actuators, featuring 3D printed bodies with customizable cantilevers to achieve a wide range of potential driving frequencies.

#### **Results**

The study demonstrates the fabrication of three functional event-cue feedback devices: a prosthetic, sole, and glove. These devices utilize CNT sensors to detect pressure variations and transmit signals to flexible actuators, eliciting vibrotactile cues on healthy skin areas. The deployment of these innovative devices holds promise for stimulating peripheral nerves, enhancing prosthetic functionality, and improving grip control and tactile sensation in individuals with limited nervous system function.

#### **Conclusions**

This work signifies a significant advancement in wearable flexible electronics, paving the way for transformative applications in healthcare and beyond.

## **Wuwei Li, Biochemistry**

### *Controlled Release of Nitric Oxide from S-nitrosothiol-Based Liquid Formulations and Polymeric Devices*

Nitric oxide (NO) plays an essential role in various physiological functions, including cardiovascular regulation, immunity, and neurotransmission. The challenge of harnessing NO's therapeutic potential lies in the controlled delivery of this gaseous molecule. S-nitrosothiols (RSNOs), capable of spontaneously releasing NO, present a promising avenue for the exogenous delivery of NO. However, their application is hindered by the unpredictable kinetics of NO release. This research addresses these limitations by presenting three interconnected projects

aimed at achieving safe, effective, and sustained NO release from RSNOs suitable for diverse biomedical applications.

The initial project introduces a novel one-step 3D printing strategy for fabricating NO-releasing silicone medical devices. These devices incorporate RSNO-loaded polymers with a drug-free surface coating, enabling sustained NO emission. The embedded RSNO crystals within the silicone matrix provide durable antibacterial properties. This approach bypasses conventional drug dissolution processes and the need for thermal or UV curing, presenting a unique method for customizing drug-eluting devices.

The subsequent study focuses on aqueous RSNO formulations designed as catheter lock solutions to prevent catheter-associated infections. It emphasizes the significant role of buffer systems in stabilizing pH-sensitive NO donors and illustrates how specific cyclodextrins can markedly extend the stability and NO release duration of RSNOs from days to weeks. These findings highlight the potential for long-term infection control in clinical environments.

Lastly, the development of a straightforward, light-controlled NO generator is described. This device operates without requiring NO<sub>2</sub> filters or complex feedback systems, relying solely on controlled photon exposure. Such a design significantly reduces the costs associated with NO inhalation therapy, offering a viable solution for resource-limited settings.

## **Brandon Daul, Physics- Nanoscience and Nanotechnology**

### *Magnetic Reactive Origami-Inspired Cassette for Tools to Investigate Spatial Temporal 3D Cellular Migration*

#### **Background**

Three-dimensional (3D) cell culture platforms represent a promising avenue for overcoming the limitations of traditional two-dimensional models, as they offer enhanced insights into cellular behavior within complex microenvironments. Origami-inspired cassettes have emerged as a promising 3D culture technique, as they allow for precise control over scaffold and culture system geometry.

#### **Methods**

In this study, we investigate 3D cell migration using a magnetic reactive origami-inspired cassette. By strategically seeding cancer cells (A549), healthy cells (NIH/3T3), and extracellular matrix (ECM) within the cassette we showcase our design's superiority and environmental effects in facilitating cellular migration.

#### **Results**

By analyzing scaffold configurations and the critical role of ECM hydrogel concentration, we establish precise guidelines for optimal and efficient cellular migration. Our findings highlight the importance of considering cell-specific responses and environmental factors in tailoring future designs. Furthermore, our study demonstrates the adaptability of our proposed approach to various cell types, offering a potential game-changer for creating intricate *in-vitro* multicell culture systems.

#### **Conclusions**

Overall, our study not only contributes valuable insights to the field of 3D cellular migration but also paves the way for innovative *in-vitro* culture systems, signaling a paradigm shift in our approach to studying cellular interactions in a 3D context. The exploration of vertical migration involving A549 and NIH/3T3 cells highlights the pivotal role of gravity in dictating cellular movement within the 3D scaffold, essential for designing effective 3D culture systems aligned with natural cellular behaviors.

## **Morgan Jackson, Applied Mathematics**

### *Characterizing Probabilities of Outbreaks of Dengue in Central Argentina using a Temperature-Dependent Stochastic Model*

#### **Introduction**

Dengue virus (DENV) causes over 390 million infections and around 40,000 deaths worldwide each year. DENV is primarily transmitted by the mosquito *Aedes aegypti*, and both the life cycle of these mosquitoes and dengue transmission are significantly impacted by temperature. In the temperate region of Central Argentina, where dengue outbreaks first began in 2009, outbreaks of dengue can only occur due to new introductions of DENV from other regions. Due to the relationships between temperature and dengue, the risk of outbreak changes throughout the year.

#### **Experimentation**

We develop a stochastic model including temperature-dependent mosquito life history traits and transmission-related parameters. We calculate the next-generation matrix to estimate the temperature dependent reproduction number ( $R_0$ ). We fit the model to climate and dengue case data collected in Córdoba, Argentina from the 2016 outbreak. We numerically solve the model and calculate epidemiologically relevant metrics.

#### **Results**

We characterize how the timing of introduction of an infected person from endemic countries affects the probability of autochthonous transmission. We also characterize the percent of introductions that lead to large outbreaks. For outbreaks that occur, we also calculate length of outbreak, timing and magnitude of peak number of cases, and total number of persons infected throughout the outbreak. We also investigate how climate change may affect these outbreak statistics.

#### **Conclusion**

We discuss these results in the context of improving mosquito population and dengue epidemiological models and improving methods to include seasonal temperature in mechanistic-stochastic models.

## **Lara LoBrutto, Counseling Psychology**

### *Evaluating the Role of Interoceptive Awareness in Insomnia and Across the Sleep Health Spectrum*

#### **Background**

Interoceptive awareness, characterized by a non-judgmental and trusting attitude towards body sensations, is an understudied construct that is implicated in sleep and health outcomes. Interoceptive awareness is cultivated via contemplative and mindfulness-based practices. Given that it may be utilized to reduce pre-sleep arousal, which is a key mechanism in insomnia, interoceptive awareness is posited to be a protective factor for sleep health.

#### **Methods**

A cross-sectional study was conducted among undergraduate university students ( $n=420$ ) in the Mid-Atlantic region of the United States to assess the association between interoceptive awareness and sleep outcomes. Participants received a survey link and completed a 45-minute online questionnaire via REDCap. Measures included the Multidimensional Assessment of Interoceptive Awareness-2 (MAIA-2), Pittsburgh Sleep Quality Index, Pre-sleep Arousal Scale, RU-SATED, Insomnia Severity Index, and the Mindful Attention Awareness Scale (MAAS). Data were analyzed using hierarchical linear and logistic regressions.

#### **Results**

Interoceptive awareness predicted pre-sleep arousal, sleep health, sleep quality, and insomnia. The ‘not distracting’ factor, in particular, emerged as the strongest interoceptive predictor. When adjusting for covariates such as mood, not distracting significantly predicted pre-sleep arousal ( $b^*=-0.13$ ,  $p<.001$ ) and sleep duration ( $b^*=0.14$ ,  $p=.01$ ). This indicated that not engaging in maladaptive distraction from pain and discomfort was associated with lower levels of disruptive heightened cognitive and physiological states before sleep and longer total sleep times. Interoceptive awareness explained global sleep and sleep health above and beyond mindfulness.

#### **Conclusions**

Findings suggest that specific training in interoceptive capacities could be a valuable complement to interventions for sleep health and insomnia.



# **College of Health Professions**

## **Shruti Sampath, Rehabilitation and Clinical Mental Health Counseling**

### *Parents of Children with Medical Complexity: Personal Perspectives of the Impact of Toxic Stress and Medical Trauma*

#### **Background**

Parents of children with medical complexity experience medical trauma on a consistent basis as their children are frequently in and out of hospital care, need lifesaving interventions, and sustain chronic illness. This level of sustained emotional upset is likely to cause toxic stress in this group of parent caregivers. The term “toxic stress” refers to a set of biological changes that occur at internal and external physical levels (e.g., molecular, cellular, and behavioral) when there is sustained or significant adversity without mitigating social/emotional buffers (Shonkoff & Garner, 2012).

A more thorough understanding of parent caregivers’ experiences will assist medical providers in both assessment of parent wellbeing and more adequate delivery of trauma informed care in healthcare settings. In order to better understand the experiences of such parents and the impact on their parenting journeys, the primary specific aim of this study is to explore the lived experience of parent caregivers of medically complex children.

#### **Methods**

The Complex Care Clinic at Children’s Hospital of Richmond currently enrolls over 200 enrolled families who will be the target population. A diverse sample of parents will be recruited including representation from different racial and cultural backgrounds. Parents of children with a wide range of medical diagnoses will be included. Focus groups with parents of children (N=20) with complex medical conditions will be held (Bradbury-Jones et al., 2009).

#### **Results**

Results of the study will highlight the lived experiences of parents and inform clinicians as to how to serve this population more effectively.

#### **Conclusions**

This project will be leveraged as a starting point in understanding the experiences of parent caregivers with medically complex children related to the impact of toxic stress and medical trauma on the health and wellbeing of their families.

## **Kristin MacDonald, Health Services Organization and Research**

### *The Effects of Experienced Compassion at Work on Nursing Home Certified Nursing Assistants' Well-Being and Turnover Intentions*

#### **Background**

Post-pandemic healthcare workforce recovery remains challenging, and is slowest among long-term care workers and health care aides. Could experienced compassion at work – both demonstrating and receiving compassion – alleviate caregiver burnout? This study aims to test whether (1) nursing home (NH) certified nursing assistants' (CNAs') experienced compassion at work increases meaningfulness of work, psychological vitality, and resilience (well-being measures), and (2) NH CNAs' experienced compassion at work decreases turnover intentions as mediated by well-being.

#### **Methods**

This is a prospective, observational, longitudinal, survey-based study with data collected at three timepoints (T1, T2, T3) separated by six weeks using convenience sampling of Kansas and Virginia NHs. CNAs received gift cards with additional laddered incentives for longitudinal participation. CNAs completed surveys at each timepoint. NH administrators completed organizational characteristics surveys at T1. Response rate at T1 was 50%. Retention by T3 was 30% (n=71 CNAs). The hypothesized model was tested using path analyses after validating scale reliability.

#### **Results**

Experienced compassion at work positively affects well-being constructs. Well-being decreases CNAs' intentions to leave their jobs and the field. Meaningfulness of work mediates the effect of experienced compassion at work on turnover intentions. Analyses are ongoing to understand direct and indirect effect sizes more completely.

#### **Conclusions**

This study adds to theory by examining compassion through a multi-theoretical perspective and empirically tests newly conceptualized relationships. If benefits of experienced compassion are demonstrated among NH CNAs, a sub-category of caregivers with exceptionally high demands and low resources, similar outcomes may be seen among other healthcare workers.

## **Brianna Young, Rehabilitation and Mental Health Counseling**

### *Factor Analysis of the Therapeutic Working Alliance*

#### **Background**

It has been well documented that the therapeutic working alliance is the single most predictive factor of outcomes in mental health counseling. Bordin (1979) broke this concept down into three elements: emotional bond, agreement on tasks, and agreement on goals. Further research has demonstrated that confidence in the therapist and confidence in treatment are underlying factors contributing to the working alliance.

## **Methods**

Researchers conducted a literature review of relevant studies related to the therapeutic working alliance. Working off previous factor analyses, they propose a framework for conceptualizing the working alliance into therapist factors and client factors.

## **Results**

This presentation proposes a model for the elements of the therapeutic working alliance that helps to operationalize this critical concept for use in the therapeutic environment. These factors, combined with the nuance and complexity of individual client factors, contribute to successful outcomes in therapy.

## **Conclusion**

The therapeutic working alliance can be conceptualized as a combination of emotional bond, agreement on goals, and agreement on tasks. These concepts can be further analyzed through the lens of theoretical orientation and problem-solving steps combined with unique client factors and applied for successful outcomes in therapy.

## **Sofia Eskola, Rehabilitation and Mental Health Counseling**

### *Developing a Career Plan for Intercollegiate Student-Athletes*

## **Background**

Being a student-athlete comes with many benefits that can result in future opportunities. However, many student-athletes endure emotional, physical, and mental health challenges. They are required to adhere to rigorous schedules with their sports (i.e., practice, traveling) in addition to maintaining their academics (i.e., attending class, study hall). This complex schedule creates challenges for student-athletes in fully preparing for their post-sport profession during their time in their undergraduate program. This also gives them little time to enjoy leisurely activities and maintain sport/academic/life balance. The Success Wheel is a model for student-athletes to enhance their career development during their busy undergraduate experience, which includes the following: setting priorities, relationship building, using resources, interacting with mentors, developing time management skills, developing organizational skills, maintaining motivation, working towards school/sport balance, engaging in networking, having a career focus: micro and macro. This presentation will focus on the benefits of comprehensive vocational evaluation in helping student-athletes develop a career plan and address these success factors while participating in college athletics and achieve success post-graduation.

## **Methods**

This project utilized a comprehensive literature review.

## **Results**

This project provides an in-depth discussion of the factors that impact the success of student-athletes, and the potential benefit of utilizing a comprehensive vocational evaluation to improve not only their career focus, but to also provide focus to the other factors of success.

## **Conclusions**

Engaging student-athletes in a comprehensive vocational evaluation can potentially positively impact their academic outcomes, professional preparation, and quality of life.

## **Stephen Friedrichs, Medical Laboratory Sciences**

### *Cerebrospinal Fluid Ergosterol as a Screening Test for Primary Amoebic Meningoencephalitis*

## **Background**

*Naegleria fowleri* is a pathogenic free-living amoeba that causes a deadly form of meningitis referred to as primary amoebic meningoencephalitis (PAM). Clinical methods for detecting *N. fowleri* are limited and delays in treatment can be attributed to an initial misdiagnosis of bacterial meningitis. This prompted investigation into developing a method to screen cerebrospinal fluid (CSF) for ergosterol, an integral component of the cell membrane of amoeba and fungi.

## **Methods**

The VCU HS clinical pathology immunology/microbiology laboratory provided 200 residual deidentified patient CSF specimens for the study. These specimens were screened for ergosterol using a novel methodology and LC-MS/MS platform.

## **Results**

Ergosterol was found to remain stable in CSF at various temperatures and could be reliably measured at a concentration range of 1.0 – 500 ng/mL. Ergosterol measured in the supernatant of *N. fowleri* cells incubated in CSF produced an *in vitro* limit of detection (LOD) of 1000 cells/mL. A quantifiable concentration of ergosterol was not detected in any of the patient CSF specimens that were screened. However, a signal at the retention time of ergosterol, but below the method limit of detection, was observed in one of the patient specimens. It was confirmed post-screening that this specimen was clinically positive for fungal meningitis. The two CSF specimens that were confirmed to be clinically positive for bacterial meningitis were negative for ergosterol.

## **Conclusions**

With consideration of the method LOD, this study supports the hypothesis that ergosterol does have potential as a screening analyte for amoebic and fungal meningitis.

## **Megahan Farkas, Occupational Therapy**

### *Social Isolation and Loneliness in the Geriatric Population*

## **Objective**

Determine the current percentage of older adults experiencing social isolation and loneliness, as well as contributing factors. In addition, explore the risks of social isolation and loneliness on older adult health and quality of life.

### **Methods**

Perform a literature review of current research topic with search terms including social isolation, loneliness, older adult loneliness, risk of loneliness and social isolation, interventions for social isolation. From this literature review, develop a survey that will be presented through the Virginia Memory Project Registry to obtain data on the topic.

### **Results**

The National Health and Aging Trends Study found that 24% of community dwelling adults aged 65 or older, approximately 7.7 million people, were socially isolated prior to the COVID-19 Pandemic. This percentage has continued to rise, resulting in an increase in premature death and being more susceptible to stroke, developing heart disease, anxiety, depression, dementia, and being at higher risk to viruses and serious illness. In addition, through the social isolation and loneliness survey conducted, approximately 21% of older adults report feeling isolated from others, contributing to perceived loneliness and approximately 20% of older adults report they do not participate in a social activity at least once a week.

### **Conclusion**

Older adults who are facing social isolation and loneliness are at a significantly higher risk of premature death and adverse health effects which reduce quality of life. Therefore, there is a significant need to prioritize efforts in addressing social isolation and loneliness in the geriatric population.

## **Tanu Bhargava, Rehabilitation and Movement Science**

### *Exploring Factors that Influence Prosthetic Attention in Upper and Lower Limb Prosthesis Users*

#### **Background**

Prosthetic limbs often lack the innate control and sensory feedback capabilities of natural limbs, requiring more cognitive effort or attention during motor tasks. While a conceptual model of prosthetic attention exists for lower limb (LL) users, its applicability to upper limb (UL) remains unclear. This study aimed to explore how LL and UL users experience prosthetic attention, and explore factors that influence the existing model.

#### **Methods**

Twenty five UL users and thirty LL users with at or above wrist or ankle-level limb loss participated. Focus groups (FG), guided by open-ended questions, delved into user's lived experiences with prosthetic attention. Qualitative analysis identified situations and activities requiring attention to the prosthesis.

#### **Results**

Findings from 11 FGs were attention-driving stimuli, individual factors (modifiable and unmodifiable) that influence attention, and consequences of paying attention to the prosthesis for both LL and UL users. LL users

cited terrain and space constraints, while UL users mentioned type of tasks (fine or gross motor, unimanual or bimanual) as reasons for attention. Both groups noted modifiable individual factors like self-image and self-efficacy, alongside unmodifiable demographic factors such as level of limb loss. LL group prioritized fall prevention as a desired result of attention, whereas UL group emphasized avoiding damaging objects or spilling.

### **Conclusion**

The initial framework seems applicable to both UL and LL groups, revealing similarities in individual factors affecting prosthetic attention. However, differences emerged regarding attention stimuli and outcomes. Understanding heightened cognitive demands can aid clinicians in devising targeted rehabilitation plans to enhance prosthetic utilization.

## **Marjan Habib, Rehabilitation and Mental Health Counseling**

### *Eldest Daughter's Identity Formation: Emotional Parentification and Cultural Expectations*

#### **Background**

This presentation utilizes a case study to explore the eldest daughter phenomenon, focusing on emotional parentification and cultural expectations. Khafi et al. (2014) note ethnic disparities in cultural values and ecological challenges moderate parentification rates. European American families prioritize independence, whereas many minority groups emphasize interdependence, role flexibility, and responsibility (Harrison et al., 1990). This creates cultural strain for minority eldest daughters immersed in both Euro-American and traditional cultures. Despite existing literature, gaps persist regarding eldest daughters' experiences across cultures. This case study aims to amplify their narratives.

#### **Methods**

A fictional case study was chosen for its ability to capture detailed experiences and key themes contributing to a broadened understanding of the eldest daughter's role in bi-cultural, Black households.

#### **Results**

Key themes emerged including Michelle's perceived responsibilities both physically and emotionally, navigation of relational supports and challenges, and strengths in leadership, caretaking, and academic drive. Potentially unhealthy manifestations include neglect of well-being and emotional outbursts.

#### **Conclusion**

Michelle's narrative broadens understanding of eldest daughters' roles. Acknowledging research ambiguity within the realm of family dynamic research, our hope is to continue highlighting the untold experiences of bi-cultural eldest daughters.

# **School of Social Work**

## **Samuel Ochinang, Social Work**

### *Exploring Suicidality in Relation to Impulsivity among College Students*

#### **Background**

Suicide is the third leading cause of death in the United States for ages 15-24, following unintentional injury and homicide, and the second leading cause of death among college students. Research indicates that impulsivity is believed to play a role in the progression from suicidal thoughts to suicidal behaviors, and therefore distinguish suicidal ideation and suicide behavior. This study aims to replicate these findings using an ideation-to-action framework among a diverse college student sample across five facets of impulsivity.

#### **Methods**

This study analyzed a cross-sectional sample of college students from the Spit for Science dataset. Bivariate analyses were conducted for demographic data and suicidality, depression, and facets of impulsivity using subscales of the UPPS-P (negative urgency, lack of perseverance, lack of premeditation, sensation seeking, and positive urgency). Respondents were grouped into three categories: no suicidality, suicidal ideation only, and suicide attempt. Analyses of variance compared group means on impulsivity, with additional analyses using race as a moderator.

#### **Results**

Initial results show no significant differences between suicidal ideation and suicide attempt groups in impulsivity, even when considering race. Negative urgency was higher in both groups compared to those with no suicidality. Both sensation seeking and positive urgency were notably higher in the suicide attempt group compared to those without suicidality.

#### **Conclusion**

Impulsivity facets in this sample did not significantly differentiate the suicide attempt group from the suicidal ideation group as originally hypothesized.

## **Rose Miola, Social Work**

### *Exploring the Role of Critical Consciousness on Complex Trauma among Adopted Adults*

#### **Background**

Adopted adults are at high risk of experiencing complex trauma symptoms. A common element of trauma is powerlessness and self blame. Critical consciousness of larger systems of oppression may mitigate individual powerlessness and shame, and inspire purposeful collective action. However little empirical evidence has

explored the effects of critical consciousness on reducing complex trauma symptoms. This study explored the relationship between critical consciousness and complex trauma symptoms among a racially diverse sample of U.S. adult adoptees.

### **Methods**

Data were analyzed from a national cross-sectional online survey of 467 adult adoptees. The survey included measures of complex trauma symptoms, stressful life events, and critical consciousness (reflection, motivation, action). Descriptives and hierarchical regression were conducted.

### **Results**

Demographics, age of adoption, adult stressful life events, and critical consciousness subscales explained 29.5% of complex trauma symptoms among participants [ $R^2=.295$ , ( $F(12,367)=12.78$ ,  $p<.001$ )]. Higher critical motivation predicted lower trauma symptoms ( $\beta=-0.15$ ,  $p<.05$ ); higher critical action predicted higher trauma symptoms ( $\beta=.17$ ,  $p<.001$ ), controlling for other variables.

### **Conclusions**

Results demonstrate that critical motivation provides adult adoptees a sense of purpose and empowerment, and ultimately supports the healing and reduction of trauma, while critical action could predict more symptoms. Further study of critical consciousness is needed but preliminary findings can inform adoption centers, clinical services, and support groups to consider critical education as a novel way to address trauma in adoptees.

## **Kade Goldin, Social Work**

### *Community Connectedness for Non-Binary People*

#### **Background**

This study aims to better understand predictors of community connectedness for non-binary individuals. While ample research exists on mental health concerns or negative outcomes for trans and non-binary people, this study aims to shift the narrative towards positive connection. Additionally, there is a gap in literature focusing specifically on non-binary people regarding support and community connection.

#### **Methods**

Linear regression analysis was utilized to determine the effect of varying types of social support (IV) and shared identity (IV) on community connectedness (DV). To determine the IV's, a brief literature review was conducted of articles that addressed areas of social support for trans and non-binary people (Dowers et al., 2020; Thorne et al., 2020; Weinhardt et al., 2019). This study then utilized only non-binary individuals' data from the 2016-2018 TransPop National Survey.

#### **Results**

The regression model was able to explain 87.5% of the variance in community connectedness for non-binary individuals. The overall model is statistically significant ( $F=80.18$ ,  $p<.001$ ) and is useful to understanding



community connectedness. Results also indicated statistical significance among shared gender identity ( $B=.247^{***}$ ), belonging ( $B=.384^{***}$ ), and social support from friends ( $B=.073^{**}$ ).

\*  $p<.05$ , \*\* $p<.01$ , \*\*\* $p<.001$

## **Conclusion**

It is essential that research shifts the paradigm to focus on strengths-based, positive outcomes for trans and non-binary people. This study outlines several statistically significant findings that provide insight into community connectedness for non-binary people. Findings can help inform community building and areas of social support for non-binary people.

## **Lindsay Cunningham & Lilly Hettrick, Social Work**

*Assessing the Impact of Race, Ethnicity, and English-Speaking Status on Traffic Stop Outcomes in Virginia*

### **Background**

This study investigates whether traffic stops by police are associated with individual race and ethnicity background or English-speaking status. Recent research indicates both a discrepancy in how often African American and Hispanic individuals experience threats of force compared to their White counterparts and a sizable gap in policing knowledge among non-native English speakers. These findings have the potential to manifest in the coercion and exploitation of non-native speakers by police.

### **Methods**

We will investigate the following research question: Does the likelihood of a police stop differ based on the race, ethnicity, and/or English-speaking status (ESS) of the individual stopped in Virginia? We will use data obtained from the Virginia Community Policing Act Data Collection (VCPADC), publicly available in the Virginia Open Data Portal. The sample includes all 396,740 police stops throughout Virginia in 2022. Three outcomes of police stops are measured: (1) person searches, (2) vehicle searches, and (3) physical force used by officers.

### **Results**

A descriptive analysis indicates that the majority of individuals stopped in 2022 were White (56.5%) or African American (36.1%). Additionally, 54,646 individuals (13.8%) were identified by police as Hispanic or Latino. The researchers will perform further statistical analysis using SPSS software to conduct chi-square tests to test all hypotheses.

### **Conclusions**

This study unveils patterns of traffic stops in Virginia, particularly disparities based on race/ethnicity and ESS. We aim to disseminate our findings to policymakers throughout Virginia to inform policy creation and reform law enforcement practices.

# **Wilder School**

## **Katy Miller, Urban and Regional Planning**

### *Urban Green Equity and Resilience Project (UGERP): Preliminary Social Network Map of Richmond's Green Spaces*

#### **Background**

In Richmond, urban greening is critical to address multiple issues affecting resilience: heat stress, flooding, pollution, food insecurity, etc. GIs are multifunctional, so a tree canopy project to reduce UHI can be linked to another targeting food insecurity via community gardens, or to one designing GI to manage urban flooding, etc. But the panoply of actors developing, managing and using GIs has resulted in a complex and ambiguous network of disconnected projects siloed within their own social networks.

#### **Methods**

We conducted content analysis to identify all governmental/private/civic actors and GI projects, identifying their (1) roles and (2) partners on these projects. We are converting this data into a network map showing the Actors (nodes) and Interactions (connections between nodes). Content analysis included a review of websites of ~185 actors, and ~50 research documents on Richmond's climate challenges and GI application and management. Our deliverable will be an interactive, open-access network map on KUMU (<https://kumu.io/>).

#### **Results**

We have already identified 886 GI projects from 165 actors, with data on roles and partnerships. Once this data is mapped on KUMU, it will depict the following information visually: (1) actors with the most projects, (2) interaction densities between actors, (3) interaction types, (4) "clusters" of actors working together, silo-ed actors, "bridging" actors who link "clusters". We will also be able to calculate the "central" actors in the network.

#### **Conclusions**

This study is a first-time application of Social Network Analysis for a critical (and universally applied) urban intervention.

## **Cameron Hart, Public Policy & Administration**

### *Racial Disparities in the Wealth Gap*

#### **Background**

The widening wealth gap, especially pronounced among lower-class families and people of color, is a persistent issue. Historical analysis reveals stark disparities, with Black Americans facing significant obstacles in building generational wealth, exacerbated by discriminatory practices like redlining in neighborhoods like Jackson Ward. “In 1870, the Black-White wealth gap was 23 to 1 (McKay, 2022).” I focus on Jackson Ward, situated in Richmond's historically Black area, examining data to highlight the impact of discriminatory practices. To compare effects, I'll contrast this with "The Fan," a primarily White neighborhood.

#### **Methods**

I utilized qualitative and quantitative methods to collect data from long-term Black and White residents in Richmond and their homes. Simple sampling provided transparent data when analyzing financial history, such as using secondary data analysis from Mapping Inequality, and Zillow will test my hypothesis on redlining's impact on Black wealth.

#### **Results**

I uncovered economic disparities between two houses in distinct neighborhoods. Despite sharing similar architectural styles and floor layouts, the home in Jackson Ward is undervalued by nearly \$100,000 compared to its counterpart. The redlining data database sheds light on the historical context, revealing how segregated neighborhoods were graded and influenced properties' perceived value. This grading disparity elucidates why the home in "The Fan" commands a higher value and enjoys greater marketability.

#### **Conclusion**

Redlining in Jackson Ward was the independent variable, impacting the race-based wealth gap divide. Results solidified my hypothesis on the persistence of the wealth gap due to racial discrimination and legislative redlining.

## **Amidu Kalokoh, Public Policy & Administration**

### *Money Laundering and Terrorists Financing Risks and Democratic Governance: A Global Correlational Analysis*

#### **Background**

Money laundering (ML) and terrorism undermine national and international economies, peace, and security. The estimated value of global ML is between \$800 billion and \$ 2 trillion, about 2 – 5 % of the global gross domestic product (Sarigul, 2013); ISIS-related deaths in Africa alone were nearly 5,000 in 2020 (US Department of State, 2021). This study examines the association between money laundering/terrorist financing risks (hereafter, money laundering risks) and democratic governance across 117 countries.

## **Methods**

A cross-sectional design uses a quantitative approach to examine the association between ML risks and democratic governance for 2020, the peak year of the global crisis in COVID-19. The data derives from the annual ratings of 117 countries from the Basel Index on ML/TF risks, the Economic Intelligence Unit (Democracy Index), the Global Initiative against Transnational Organized Crimes (Criminality Index), and the Institute for Economics and Peace Index.

## **Findings**

A multiple linear regression model found a statistically significant negative association between democratic governance and ML risks ( $B = -0.354, t = -7.454, p = <.001$ ) and a significant positive association between criminality and ML risks ( $B = 0.242, t = 2.692, p = .008$ ).

## **Conclusion**

The results suggest deepening democratic governance as a critical measure in combating money laundering and terrorism. Increasing criminality encourages thriving ML and terrorist financing activities. Democratic principles of transparency, accountability, and the rule of law are foundations upon which efficient state institutions, like anti-money laundering regimes, develop, which ensure normative compliance with legal and institutional processes.

## **Ari Galbraith, Criminal Justice**

### *An Examination of Adverse Childhood Experiences and Drug Overdoses among School of Incarcerated Individuals*

#### **Background**

Adverse childhood experiences (ACEs) are traumatic events that take place during childhood. These traumatic events often include emotional, physical, or sexual abuse that is often inflicted by one or both parents/parental figures. This study explores parental substance abuse as a potential additional ACE. Parental drug use can appear as using illicit substances, intentional or unintentional overdose, or as a coping mechanism. Some parents have also provided substances for their child(ren), and go as far as to show them how to administer them, whether that be by injection or snorting (DeLisi et al., 2019).

#### **Methods**

This study uses a cross-sectional sample of incarcerated persons in a local jail to examine the impact of ACEs, drug use, and drug overdose.

#### **Results**

Descriptive statistics on a variety of key variables will be presented.

#### **Conclusion**

Implications and policy recommendations discussed.

## **School of the Arts**

**Ashley Botkin, Art History**

*Reorienting the “Periphery” : Art et Liberté and the École de Dakar, and Radical Acts of Decolonizing Picasso*

Traditional art history describes art movements as moving chronologically through time, each evolving from the previous movement, and emanating from a center (Europe) to the periphery (Majority World). The École de Dakar, born from Senegalese President Léopold Senghor’s desire for a national art movement, and the artist group Art et Liberté, created by Egyptian artists to oppose the rise of fascism and to support ‘degenerate’ art, are significant participants in the modern art movement, but they are often discussed as an addendum to European modern art. This essay will reorient the study of two particular movements under the umbrella of modern art - Primitivism and Surrealism - away from Europe and toward the “periphery,” in this case, Dakar and Cairo. In order to disrupt the canon and its idolization of European artists, this essay will analyze the ways in which the École de Dakar and Art et Liberté removed Picasso from his position within a larger colonial machine and utilized him for their own artistic and philosophical goals.

Through these two case studies, this essay will identify the means by which and the motivations for each group interacted with Picasso by analyzing the sociopolitical context and philosophies that each group held. This essay will largely rely on postcolonial and decolonial theory to achieve what I term an iconoclastic art history - one that seeks to dethrone and disrupt idolized European artists by studying them from alternate perspectives.

## **VCU Life Sciences**

**Briana Loftus, Environmental Studies**

*Migratory Bird Vulnerability to Window Collisions*

**Background**

Bird collisions with windows are a significant threat to avian populations worldwide. Studies suggest neotropical migratory species face a particularly high risk (Loss et al. 2014). This vulnerability may be due to factors like unfamiliar landscapes and nocturnal migration patterns.

### **Methods**

To investigate this phenomenon, we compared collision rates of resident and migratory birds at a university campus during the fall migration period over a three-year span (2020-2023).

### **Results**

Our analysis revealed a significantly higher rate of window collisions among migratory birds compared to resident species. This finding highlights the specific vulnerability of migratory birds to window strikes.

### **Conclusion**

This research underscores the importance of considering migratory behavior when developing conservation strategies. Our findings can inform targeted initiatives, such as adjusting "lights out" programs to coincide with peak migration seasons. By elucidating the link between migration and window collision risk, this study contributes to safeguarding vulnerable bird populations in urban environments.

## **Mariam Topchyan, Bioinformatics**

### *Investigating Genome Evolution Through Reduction in Heritable Endosymbiotic Bacteria*

#### **Background**

Genome reduction is a common mode of evolution that has played a fundamental role in diversification across all kingdoms of life, and is key to the evolution of heritable bacteria found in insects. However, the reduction process may leave behind gene fragments and non-functional elements that may still be interpreted as intact genes, limiting accurate genome annotation. Motivated by five highly reduced genomes of endosymbiotic bacteria in the genus *Enterobacter*, this study will investigate the role fragmented genes may play in false gene discovery.

#### **Methods**

Predicted protein sequences of five bacterial endosymbiont genomes were clustered into orthologous groups along with sequences from 48 closely-related bacterial genomes. Genes that were not assigned to a group were subsequently compared to the NCBI nr database.

#### **Preliminary Results**

A relatively large percent (up to 56.3%) of the predicted genes from each endosymbiont failed to cluster into any orthologous group. Of each set of unassigned genes, the majority (ranging from 85.7% to 97.9%) also

failed to return any significant hits within the nr database. Preliminary *in silico* simulations of genome reduction provided evidence that gene fragments may be recognized as intact “genes” using common annotation pipelines.

## **Conclusions**

My results highlight potential problems of gene discovery within genomes undergoing gene inactivation and genome reduction. Future *in silico* simulations based on empirical data will be performed to further investigate the impact of fragmented genes, as well as different stages of genome reduction, on false gene discovery.

# **School of Business**

## **Sonika Singhal, Information Systems**

### *Beyond Information Disclosure: Factors Affecting Intent to Disclose Personal Health Information*

In today's data-driven society, personal information disclosure is one of the top concerns. Particularly in the healthcare industry, the intent to disclose Personal Information is of highest importance. The purpose of this study is to identify factors and how these factors affect the Personal Information Disclosure Intent. Based on the privacy calculus theory, this study examines the perceived benefit over perceived risk of sharing information and considers different factors that cause privacy concerns and trust, and how a user decides whether to share health information or not.

## **Introduction**

Concern over the possible disclosure of personal information has skyrocketed alongside the widespread adoption of digital technologies. These days, gaining access to healthcare services often requires disclosing personal information. There may be reasons besides a willingness to share that motivate the intention to disclose personal information.

There has to be a shift in how healthcare is organized so that more people are involved and people feel safe disclosing their personal information. In addition, health records contain information that is typically more sensitive than credit card numbers or email addresses. To what degree people feel comfortable disclosing sensitive health information is affected by the environment in which such information is shared (Bansal et al., 2015).

The current study attempts to build a model that integrates the privacy calculus theory with privacy concern and trust factors to examine the individual intent. The integrated model can provide a holistic view of individuals' Personal Information Disclosure Intent. Specifically, we address the following three research questions:

RQ1: What factors are majorly responsible for the disclosure of personal information?

RQ2: How privacy concern and trust affect the disclosure of personal information?

RQ3: Does perceived benefits really outweigh the perceived risks while disclosing the personal information?