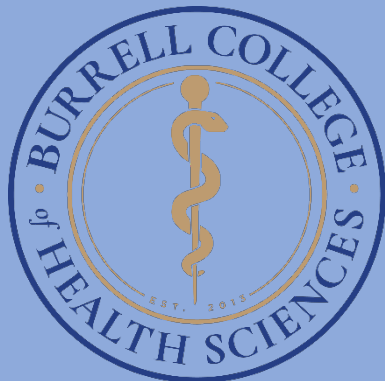


MEDICAL STUDENT RESEARCH DAY
PROGRAM AND ABSTRACT BOOK
SEPTEMBER 12, 2026



Burrell College of Health Sciences
Office of Research and Sponsored Programs

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President's Welcome Address



It is my privilege to welcome you to the Burrell College of Health Science's 2026 Medical Student Research Day (MSRD)!

Thank you to our participants and visitors for attending the College's premiere student research event. This is the ninth year that the College has hosted this event and I could not be prouder of the students and faculty who have put forth so much effort to make this day possible. Medical Student Research Day is an immensely important day for our students. Not only does MRSD provide our students the opportunity to gain experience that will give them a competitive edge when applying for future residency programs, it also promotes the research and scholarly efforts of the College on a national scale.

I am pleased to see such an impressive turnout of student abstract submissions by our medical students. The research studies presented have significance because of their potential for translation to Osteopathic Medicine. I would like to take a moment to recognize the efforts of our faculty and staff members of the Burrell College Office of Research and Sponsored Programs. Without our research mentors and the dedication of the staff of the Research Office, none of this would be possible. The Burrell College research community is a rising force, already making significant contributions to advancing knowledge in basic, clinical, and applied biomedical research.

It is my hope that you will engage with our student researchers and their mentors to learn both about their current projects and the ongoing investigative endeavors at Burrell College.

John L. Hummer, MHA
President & Co-Founder
Burrell College of Health Sciences

Dean's Welcome Address



William Pieratt, DO, FACP
Dean and Chief Academic Officer
Burrell College of Health Sciences

It gives me great pleasure to recognize the many students who traded their summer break for an opportunity to further their own education in the field of research. This year's Summer Research Program encompasses investigations in population health, infectious disease prevention, human physiology, anatomy, pathology and clinical medicine—a testimony to the varied interests of our students and their faculty mentors.

I am encouraged to see those interested in becoming the next generation of physician-scientists helping advance our medical knowledge for the benefit of our profession and our patients. Please join me in appreciating their enthusiasm to share the skills and knowledge they have gained from this experience.

Keynote Speaker – Karen Florio, DO



Dr. Karen L. Florio, DO, MPH, is an Associate Professor of Obstetrics and Gynecology at the University of Missouri, where she serves as Director of the Cardio-Obstetrics Program, Vice Chair for Patient Safety and Quality, and Director of the Maternal-Fetal Medicine Fellowship. She is a maternal-fetal medicine specialist whose clinical practice and research focus on hypertensive disorders of pregnancy, cardiovascular disease in pregnancy, maternal mortality, and implementation science. Dr. Florio has developed multidisciplinary cardio-obstetrics programs and statewide quality improvement initiatives designed to improve maternal outcomes through collaboration, systems redesign, and evidence-based care. Her research spans implementation science, health equity, maternal mortality, and cardiovascular disease in pregnancy, and she serves as a national leader in advancing innovative models of maternal care. She is the Co-Principal Investigator of the NIH-funded HOPE (Heart Outcomes in Pregnancy Expectations) study, the first large U.S. prospective multicenter study evaluating cardiovascular outcomes through one year postpartum in pregnant people with cardiovascular disease. As both a physician and a survivor of severe preeclampsia, Dr. Florio has transformed her personal experience into a career dedicated to improving maternal health. Her work bridges patient care, research, quality improvement, and advocacy, with the goal of translating scientific discoveries into better outcomes for mothers and families.

Schedule Overview

Saturday, September 12, 2026	
7:00 AM – 7:45 AM	Coffee/Pastries Cub's Den
7:45 AM – 8:00 AM	Welcome Remarks <i>Scott Cyrus, DO, Chair, Clinical Medicine</i> <i>Thomas P. Eiting, PhD, Director of Student Research</i> Room 158
8:00 AM – 9:00 AM	Keynote Address – Karen Florio, DO, University of Missouri <i>“From Maternal Mortality to HOPE: Building a Cardio Obstetrics Movement.”</i> Room 158
9:00 AM – 11:00 AM	Poster Presentations <i>Student authors present their posters.</i> Foyer/Hallway/Rooms 152/153, 155/156
11:00 AM – 12:00 PM	Oral Presentations <i>Student oral presentations.</i> Room 158
12:00 PM – 12:45 PM	Lunch (<i>All attendees</i>) Cub's Den/Patio
12:45 PM -1:00 PM	Award Ceremony and Closing Remarks Room 158

Schedule in Detail

Welcome Remarks. 7:45 – 8:00 am, Room 158

Scott Cyrus, D.O.

Chair, Dept. Clinical Medicine, Burrell College of Health Sciences

Thomas P. Eiting, Ph.D.

Director of Student Research, Burrell College of Health Sciences

Keynote Address. 8:00 – 9:00 am, Room 158

From Maternal Mortality to HOPE: Building a Cardio Obstetrics Movement

Karen Florio, DO

University of Missouri

Poster Presentations. 9:00 – 11:00 am, Foyer/Hallway/Rooms 152/152, 155/156

P1. Morphometric Analysis of the Capuchin C1 Vertebra Across Ontogeny

AnneMarie Derouin, Robert Storbakken

Mentor: Taylor Polvadore, Ph.D.

P2. Enamel thickness and root/crown areas of deciduous premolar and incisors in tufted and untufted capuchins

Amber Alvarado, Amy Malacalza

Mentor: Taylor Polvadore, Ph.D.

P3. Ontogenetic Trajectories of C2 Morphology in Tufted and Untufted Capuchins: Evidence for Divergent Developmental Patterns

Joy Lin, Joseph Sheridan

Mentor: Taylor Polvadore, Ph.D.

P4. Ontogenetic Variation in Third Cervical Vertebral Shape in Tufted and Untufted Capuchins

John Hejl, Kimberly Lopez

Mentor: Taylor Polvadore, Ph.D.

P5. Computational Fluid Dynamics Comparison of Virtual Surgical Techniques for Concha Bullosa: Crushing, Medial Laminectomy, and Lateral Laminectomy

Janice Yi

Mentor: Thomas P. Eiting, Ph.D.

P6. Agility estimations of Eocene carnivorous mammals using inner ear reconstructions and body mass estimates

Michelle Anyanwu, Charlotte Poulson Mason, Bilal Uddin, Mohamad Cheikhali

Mentor: Spencer Mattingly, Ph.D.

P7. Characterizing Reproductive Stages in Bats: Optimization of Cytological Staining Methods

Nhu Bui

Mentor: Teri Orr, Ph.D.

P8. Stress Sensitivity in Different Regions of the Brain: Implications for Epilepsy

Camila Atencio, Miles Davis, Margarita Soltero Gutierrez, Jalin Haskins, Macy Mehdioun, Nathan Smole

Mentor: Kristin Gosselink, Ph.D.

P9. Evaluation of Stress-Induced HYPE Expression in the Brain

Margarita Soltero Gutierrez*, Nathan Smole*, Macy Mehdioun*, Jalin Haskins*, Miles Davis*, Camila Atencio

*Equal contribution

Mentor: Kristin Gosselink, Ph.D.

P10. Biogenic Thiazolidines as Potential Mitochondrial-Protective Metabolites: Initial Evaluation of Cytotoxicity and Cellular Metabolic Effects in HeLa Cells

Jacqueline Tranmai, Ashlee Kim, Ryan Deming, Micah Tang,

Mentors: Alex Gasparian, Ph.D., Steven Karpowicz, Ph.D.

P11. Evaluating Cervical Cancer Biomarkers Ki-67 and p16 and Their Relationship to hrHPV Infection

Stella Curtis, Rithika Treasa John, Shannon Lee, Julia Taki

Mentors: Debra E. Bramblett, Ph.D., Chris Hague, Ph.D.

P12. Concentration-Dependent Effects of Common Local Anesthetics on In Vitro HeLa Cell Wound Healing and Cytotoxic Disruption of Monolayer Integrity.

Brandon Stucken, Ari Barskiy, Gabriel Marquardt, Joshua Ramirez, Emily Waddle

Mentor: Christopher Hague, Ph.D.

P13. Sustained UPI Peptide Release from Embedded Microparticles to Enhance Vascular Graft Endothelialization

Sunita George, Cyrah Pinnock, Shirin Changizi, Malsha Nanayakkara, Leah Degard-Edmond, Lauren Hill, Sajae Willis, Chen Hong

Mentor: Chris Bashur, Ph.D.

P14. Opportunistic Coronary Artery Calcium Scoring on Low-Dose CT Lung Cancer Screening: A Literature Review

Adam Schomer

Mentor: Kunal Mitra, Ph.D.

P15. Explainable AI for Multiclass Brain Tumor Classification

Shrivatsa Sundarraj, Sharukh Khan, Wenxi Liu, Michael Trimboli, Matthew Newmarch

Mentor: Xianqi Li, Ph.D.

P16. Comparative Efficacy of Platelet-Rich Plasma, Mesenchymal Stem Cell Therapy, and Extracorporeal Shockwave Therapy in Tendon and Ligament Repair: A Mechanistic Review and Weighted Matrix Analysis

Hamza Nawaz

Mentor: Kunal Mitra, Ph.D.

P17. Predictive Biomarkers for Immune Checkpoint Inhibitor Therapy: Current Evidence and Future Directions

Dimpal Kasabwala and Merit Mikhael

Mentor: Alexander Gasparian, Ph.D.

P18. Prevalence of Abdominopelvic Bleeding in Abdominal Trauma Patients With & Without Anticoagulant/Antiplatelet Use

David Denisov, Ali Raja, Mireya Arreguin, Peter Maniuos, Braxon Maida

Research Mentors: Robert M. Rodriguez, MD, Ali Raja, MD, Malkeet Gupta, MD, William R. Mower, MD, Ph.D.

P19. Development and Characterization of 4D Shape Memory Polymer Hydrogel Scaffolds with Nanosilica Coating for Tendon and Ligament Tissue Engineering

Karen Ngantcha

Mentors: Vipul Kishore, Ph.D., Diya Pillai Babu

P20. COVID-19 Vaccination Refusal Among Cancer Survivors in China

Leon Zhao

Mentor: Jagdish Khubchandani, Ph.D.

P21. Proposal of Association Between Loss of Smell and Cardiovascular Disease: A Meta-analysis

Mantas Sliesoraitis, Filiberto Lopez, Janice Yi

Mentor: Jagdish Khubchandani, Ph.D.

P22. MRSA Colonization Among Medical and Nursing Populations: A Literature Review

Naisargi Pathak, Melisa Camurlu, Ashwinder Parmar

Mentor: Debra E. Bramblett, Ph.D.

P23. *Coccidioides* Seroprevalence in the Las Cruces Population

Mariana Castaneda, Charisse Dumlao, Aaron Jeanloz, Fernanda Pardo, and Brian Tonthat

Mentor: Michael Woods, Ph.D.

P24. Physicians as Public Health Advocates in the United States: Practices, Training, and Call for Action

Jessica Te, Julius Hubby

Mentor: Jagdish Khubchandani, Ph.D.

P25. Intellectual Humility Among Medical Students

Adaeze Chukwudebe

Mentor: Mary Lacaze, M.D.

P26. Clinicians Face Misinformation Without Training: A Review of Exposure and Perceptions

Vivian Leung, Rebecca Ayiku

Mentor: Jagdish Khubchandani, Ph.D.

P27. Gender Concordance in Healthcare: A Systematic Review of Patient Preferences and Outcomes Associated With Physician Gender

Andrea Anchondo, Delaram Doorandish

Mentor: Jagdish Khubchandani, Ph.D.

P28. A Scoping Review of Leader Fairness in Sport Research

Sufyan Siddiqui and Verzhin Vicky Shagrikyan

Mentor: Katherine E. Hirsch-Agnew, Ph.D.

P29. Gender Representation on Medical School Websites: A Longitudinal Content Analysis of Institutional Websites, 2015–2025

Simran Dhillon, Uchenna Odu, Ashley Sanderson

Mentor: Timothy Ketelaar, Ph.D.

P30. Understanding the Relationship Between Imagery, Body Image, and Body Checking

Luiza Zaccaria Bertolini, Isabella Astorga

Mentor: Katherine Hirsch-Agnew, Ph.D.

P31. Exploring preferences for formal and informal athlete leadership: Perspectives of intercollegiate athletes and coaches

Katherine Miller and Leyn Alatrach

Mentor: Katherine Hirsch-Agnew, Ph.D.

P32. Gender Representation in Super Bowl Advertising: A Longitudinal Content Analysis of Super Bowl Commercials (2013 to 2025)

Oanes Mahmood, Braxon Maida

Mentor: Timothy Ketelaar, Ph.D.

P33. “How Much is Too Much?": Assessing Ideal Teammate Interaction in Intercollegiate Sport

Anshu Dandu

Mentor: Katherine Hirsch-Agnew, Ph.D.

P34. Case-Based Learning for Abetalipoproteinemia

Alexander Salas

Mentor: Wendy Innis, Ph.D.

Oral Presentations. 11:00 am – 12:00 pm, Room 158

11:00 – 11:20 am

O1. Comparative Evaluation of DLP and Extrusion-Based 3D Bioprinting for Modeling Vascularization and Pulmonary Fibrosis in Cellular Constructs

Lucas Betancourt

Mentors: Sampada Koirala, MS, Brian Billings, MS, Kunal Mitra, PhD

11:20 – 11:40 am

O2. Insertion of an Internal Joint Stabilizer Through a Posterolateral Approach for the Management of Complex Elbow Instability

Nikalus Skipp, Ana Love, Jazzlyn Gonzalez

Mentors: Miguel A. Pirela-Cruz, MD, Deana Mercer, MD

11:40 am – 12:00 pm

O3. Reversible Bilateral Amantadine-Associated Corneal Edema With Residual Endothelial Changes One Year After Discontinuing Medication

Shrishti Jain

Mentor: Parul Deshpande, M.S., D.N.B

Lunch. 12:00 – 12:45 pm, Cubs Den/Patio/Room 158

Please grab a plate and join your friends for lunch in the 2nd floor reception area, or anywhere else you like. Our award ceremony will begin promptly at 12:45 pm.

Award Ceremony. 12:45 – 1:00 pm, Room 158

Thomas P. Eiting, Ph.D.

Director of Student Research, Burrell College of Osteopathic Medicine

Abstracts – Poster Presentations

P1. Morphometric Analysis of the Capuchin C1 Vertebra Across Ontogeny

AnneMarie Derouin, Robert Storbakken

Mentor: Taylor Polvadore, Ph.D.

Objective: Geometric morphometric analysis of primate craniodental features has been performed using computed tomography (CT) imaging to obtain comparative data among species with different dietary habits. The analyses preceding this sub-project have focused on populations of tufted (*Sapajus* spp.) and untufted (*Cebus* spp.) capuchins to catalogue differences in morphology in the mandible, dentition, and masticatory muscles. Tufted capuchins prefer a more rigorous diet of mechanically challenging foods with hard shells and tough fibers, while untufteds enjoy a more relaxed diet. This project intends to add to the body of morphologic data by examining the cervical vertebra across ontogeny, and discussing the potential postural implications of different dietary behaviors throughout their development. (Our team focused on the C1 vertebra while two other groups have worked concurrently to perform the same examination of C2 and C3.)

Methods: Computed tomography data was provided for 36 tufted and 22 untufted capuchins and grouped into developmental stages defined by dental eruption (infants up to dpm3; juveniles dpm4; subadults up to M2; Adults M3). These groups are consistent with past analyses and define benchmarks in changes of dietary patterns over the species' lifespan. The CT data provided was then uploaded into a 3D slicer program that allowed us to plot the major landmarks of the C1 vertebra. Landmarks were placed on the ventral arches, dorsal arches, and transverse processes of each sample, and semilandmarks were plotted around the edges of the superior and inferior articular facets. Once each vertebra sample was mapped, the data was imported into R Studio to perform a Generalized Procrustes Analysis (GPA) relative to each samples grouping.

Results: To display relative vertebral shape difference graphically, two variables were used as Principal Components (PC) that best represented dimensional differences. Trends in vertebral dimensions were then evaluated in comparison of the developmental stages within each species and then comparatively between the two. To avoid redundancy trends are stated and discussed in the conclusion.

Conclusion: There was no significance between tufted adults and juveniles (indicated graphically by group overlap). Additionally, there was no significance between tufted infants and subadults. This coupled with the high variability seen in the juvenile group is likely indicative of the higher rate of morphological development during this phase of life. The untufted infants and juveniles are clustered together, while the adults and subadults are closer together. This may indicate developmental variability based on suckling practices during infancy as compared to different postural behaviors in adulthood.

The tufted capuchins had more variability in their groupings due to the larger sample size in every age group of the tufted capuchins. There is a slight overlap in the infant figure perhaps indicating similar suckling posture in both tufted and untufted capuchins during

infancy, though beyond infancy the morphologic divergence is consistent.

Overall, our data indicates consistency within each species' morphological development, and represents distinct, ontogenetic postural changes related to diverging dietary behaviors of capuchin species.



P2. Enamel thickness and root/crown areas of deciduous premolar and incisors in tufted and untufted capuchins

Amber Alvarado, Amy Malacalza

Mentor: Taylor Polvadore, Ph.D.

Objective: Capuchin monkeys are New World primates that are divided into two genera: tufted capuchins (*Sapajus*) and untufted capuchins (*Cebus*). Although they often live in the same forests and share many characteristics, the two groups differ in their physical traits, feeding behaviors and diet (Wright et al 2009). Their omnivorous diet includes fruit, insects, and other animal matter, but the tufted capuchins eat more mechanically challenging foods.

Methods: The purpose of this study was to evaluate the feeding system morphology of the two capuchin monkeys by obtaining the volume and surface area of the enamel, dentin, pulp, and root of both the deciduous premolars and deciduous incisors. We also compiled the volume and surface area of the entire tooth and crown which consists of enamel, pulp, and dentin. With a 3D Slicer program, twelve deciduous erupted incisors and thirteen deciduous erupted premolars were analyzed.

Results: The results revealed significantly larger premolar tooth volume and surface area in tufted capuchins compared to untufted capuchins ($p = 0.002739$ and $p = 0.001833$). For the incisors, there was no difference in tooth volume or surface area in tufted compared to untufted capuchins ($p = 0.3325$ and $p = 0.3674$).

Conclusion: The results demonstrate the influence of premolar use in feeding compared to incisors while also the impact of tooth size in tufted versus untufted capuchins. This could possibly be due to the difference in processing forces being less about ingestion but rather mastication.



P3. Ontogenetic Trajectories of C2 Morphology in Tufted and Untufted Capuchins: Evidence for Divergent Developmental Patterns

Joy Lin, Joseph Sheridan

Mentor: Taylor Polvadore, Ph.D.

Objective: To characterize ontogenetic variation in overall C2 vertebral morphology and spinous process (SP) shape across infant, juvenile, subadult, and adult tufted (*Sapajus apella*) and untufted (*Cebus capucinus*) capuchins, and to assess whether patterns of morphological development differ between

genera. We hypothesized that genus-specific developmental factors influence C2 morphology both overall and in the spinous process (SP) across ontogeny.

Methods: C2 vertebrae from infant, juvenile, subadult, and adult tufted and untufted capuchins were examined using geometric morphometric methods. Three-dimensional landmark data were collected using 3D Slicer to characterize overall C2 morphology and SP shape. Morphological differences between genera and age classes were evaluated using growth trajectory analyses, ANOVA, pairwise comparisons, and principal component analysis (PCA). Growth trajectories were used to assess patterns of ontogenetic change in C2 morphology between the two genera, while comparisons among age classes evaluated developmental shifts in vertebral shape. PCA was used to visualize patterns of morphological variation and overlap among specimens and age classes.

Results: Significant differences in overall C2 morphology between tufted and untufted specimens were detected during infancy ($p = 0.008$) and adulthood ($p = 0.001$), whereas juveniles and subadults did not differ significantly between genera. Both genera exhibited significant ontogenetic changes in C2 morphology and size, with untufted specimens demonstrating a steeper growth trajectory than their tufted counterparts. Within tufted specimens, a pronounced morphological shift occurred between the subadult and adult stages. In untufted specimens, adults differed significantly from most younger age classes. Analysis of SP shape revealed significant intergeneric differences only among infants ($p = 0.003$); no significant differences were detected between genera among juveniles, subadults, or adults. PCA demonstrated substantial overlap among juvenile specimens, indicating increased morphological variability during this developmental stage.

Conclusion: Overall C2 morphology undergoes substantial ontogenetic change in both *Sapajus apella* and *Cebus capucinus* specimens, while SP shape appears comparatively conserved after infancy. The significant differences observed between genera in infants and adults suggest that developmental trajectories of overall C2 morphology differ between tufted and untufted capuchins. These findings support the hypothesis that genus-specific developmental factors influence C2 morphology. We further hypothesize that differences in infant carrying frequency and positioning may produce differences in cervical loading, contributing to variation in overall C2 morphology.



4. Ontogenetic Variation in Third Cervical Vertebral Shape in Tufted and Untufted Capuchins

John Hejl, Kimberly Lopez

Mentor: Taylor Polvadore, Ph.D.

Objective: To evaluate ontogenetic variation in the third cervical vertebrae (C3) shape in tufted (*Sapajus* spp.) and untufted (*Cebus* spp.) capuchins to determine whether the shape of the third cervical vertebra and morphology differ across developmental stages.

Methods: Three-dimensional (3D) models of C3 were analyzed via computed tomography (CT) from 39 capuchins, 27 *Sapajus* and 12 *Cebus*. The specimens were categorized into four age groups: infants, juveniles, subadults, and adults. 3D anatomical single point landmarks and curved semilandmarks were collected in 3D Slicer. The landmarks and semi-landmarks of all the specimens

were aligned and compared using RStudio. ANOVAs were then used to test for differences in C3 shape among the varying age groups within each genus and between genera. When it was determined that C3 shape differed significantly across age groups, pairwise comparisons were done to determine which specific developmental stage differed from one another.

Results: Differences in age category significantly explained C3 shape variations in *Sapajus* ($R^2 = 0.307$, $p = 0.004$). While further pairwise analysis showed that adults differed significantly from infants ($p = 0.007$), juveniles ($p = 0.001$), and subadults ($p = 0.005$), while infants, juveniles, and subadults did not significantly differ from one another. Age categories also significantly explained shape variation in *Cebus* ($R^2 = 0.607$, $p = 0.018$). There were significant pairwise differences within the juvenile category, however there was only one juvenile *Cebus* sample. Between genera, adult C3 shape differed significantly ($R^2 = 0.656$, $p = 0.002$), whereas differences were not significant among subadults ($p = 0.234$), juveniles ($p = 0.063$), or infants ($p = 0.085$). C3 shape was also significantly associated with centroid size in *Sapajus* ($R^2 = 0.106$, $p = 0.040$), but not in *Cebus* ($R^2 = 0.072$, $p = 0.180$).

Conclusion: C3 morphology varies throughout capuchin ontogeny. The most evident difference was between *Sapajus* and *Cebus* occurring in adulthood. Adult *Sapajus* and *Cebus* displayed statistically significant differences in C3 shape whereas such differences were not statistically significant in the remaining younger age categories. The significant relationship between centroid size and C3 shape in *Sapajus* suggests that changes in vertebral size are related to changes in cervical shape during development. These results are consistent with changes in development of the cervical spine although this study did not test the effects of varying behavior such as posture or body size. Interpreting the juvenile *Cebus* result is limited by the small sample size, additional juvenile specimen would be needed to determine when exactly during development do the morphological changes in C3 first emerge. Future studies incorporating larger immature samples and direct measures of feeding posture may help clarify the mechanisms underlying developmental differences in C3 shape.



P5. Computational Fluid Dynamics Comparison of Virtual Surgical Techniques for Concha Bullosa: Crushing, Medial Laminectomy, and Lateral Laminectomy

Janice Yi

Mentor: Thomas P. Eiting, Ph.D.

Objective: Concha bullosa (CB), defined as pneumatization of the middle turbinate, is a common anatomic variation of the nasal cavity that commonly contributes to nasal obstruction, septal deviation, and altered sinonasal airflow. Several surgical techniques have been described for the treatment of symptomatic CB, including lateral laminectomy, medial laminectomy, and crushing. However, there remains no consensus regarding the optimal surgical approach. The objective of this study was to develop standardized, reproducible virtual surgical models of these techniques for subsequent computational fluid dynamics (CFD) analysis and comparison of their effects on nasal airflow to determine which approach may provide the most favorable objective outcome.

Methods: A computed tomography (CT) scan demonstrating bilateral concha bullosa and septal deviation was selected from a publicly available database of 490 CT scans. A three-dimensional model of the nasal airway was generated using 3D Slicer. The CT dataset was thresholded from -2658.31 to -457.95 , and non-target airspaces, including the paranasal sinuses and surrounding regions, were removed to isolate the nasal airway. Total nasal airway volume, concha bullosa airspace volume, and surface area were subsequently measured. The model was transferred to Geomagic Wrap for surface smoothing and preparation for virtual surgical modification.

Five models were developed: (1) the original unmodified anatomy, (2) septoplasty alone, (3) septoplasty with lateral laminectomy, (4) septoplasty with medial laminectomy, and (5) septoplasty with bilateral crushing. The original nasal airway volume was $41,156.1 \text{ mm}^3$. Septoplasty was simulated by repositioning the deviated portions of the septum toward the midline to reduce septal obstruction, resulting in a postoperative airway volume of $42,395 \text{ mm}^3$. Because septal deviation was present in the selected anatomy, the septoplasty model served as the standardized baseline for each subsequent CB intervention.

The baseline CB airspace volume was 747.815 mm^3 . To standardize the magnitude of intervention across techniques, each CB procedure was designed to produce a 50% reduction in CB volume, corresponding to 373.91 mm^3 of additional nasal airway space and a target total airway volume of approximately $42,768.91 \text{ mm}^3$. For lateral laminectomy, the lateral portion of the CB was reduced and airway space was expanded laterally while preserving the medial contour of the middle turbinate. For medial laminectomy, the medial portion was reduced to expand the airway medially while maintaining the lateral contour. Crushing was simulated by reducing the turbinate from both the medial and lateral surfaces until the standardized target volume was achieved. The resulting models were prepared for subsequent CFD analysis.

Results: Five anatomically comparable models representing the unmodified airway and four surgical conditions were successfully generated. The three CB surgical models achieved the predetermined target airway volume with minimal variation between techniques. Small differences from the target volume were unavoidable because of the spatial resolution and voxel-based segmentation constraints of the CT dataset and 3D Slicer. Nevertheless, a standardized virtual surgical workflow was successfully established, allowing the location of airway expansion to vary among surgical techniques while maintaining a comparable magnitude of CB volume reduction.

Conclusions: Standardized and reproducible virtual models of lateral laminectomy, medial laminectomy, and crushing for concha bullosa were successfully developed using a consistent volumetric target. Although conclusions regarding the relative effects of these procedures on nasal airflow cannot yet be drawn, this methodology provides a framework for controlled CFD comparison of CB surgical techniques. Future CFD analysis will evaluate differences in airflow distribution and resistance among the models and determine whether the location and pattern of middle turbinate reduction influence postoperative nasal airflow. Expansion to additional patient-specific anatomies will be necessary to assess the generalizability of these findings.



P6. Agility estimations of Eocene carnivorous mammals using inner ear reconstructions and body mass estimates

Michelle Anyanwu, Charlotte Poulson Mason, Bilal Uddin, Mohamad Cheikhali

Mentor: Spencer Mattingly, Ph.D.

Objective: This study aimed to estimate and compare the locomotor agility of various carnivorous mammals from the Eocene epoch (~56-33.9 Ma). To do so, it examined the relationship between semicircular canal size and body mass among each taxon, and compared it to a broader dataset of extinct and extant mammals. Ultimately, this work may provide the basis for broader anatomical, behavioral, or phylogenetic interpretations among early carnivorous mammals.

Methods: Previously acquired computed tomography (CT) scans of three Eocene carnivorous mammal taxa were analyzed: *Viverravus acutus*, *Galecyon chronius*, and *Quercygale angustidens*. The inner ears of each specimen were manually segmented in 3D Slicer to generate three-dimensional models of the preserved anatomy. Measurements of the inner ear, particularly the semicircular canals, were obtained from each model using the measuring tool in MeshLab. Body mass estimates were obtained from a combination of prior literature, and regression equations using occipital bicondylar width. Ratios of semicircular canal radius and body mass were then compared amongst each other, and to a broader sample of mammals from the Spoor et al., 2007 dataset.

Results: In total, four inner ear digital endocasts were constructed from the three taxa of interest. Average semicircular canal radius, in millimeters, for each taxon is reported as follows: *Viverravus a.* – 1.33; *Galecyon c.* – 1.65; *Quercygale a.* – 1.86. Body mass, in grams, for each of the three taxa was estimated as follows: *Viverravus a.* – 250; *Galecyon c.* – 6650; *Quercygale a.* – 5900. Comparisons of the ratio of semicircular canal radius to body mass showed that, in general, early carnivorous mammals fell on the lower end of the mammalian spectrum, sometimes approaching the middle, using a dataset of over 200 extinct and extant mammals. The closest carnivoran analogues to these early carnivorans include the Egyptian mongoose (*Herpestes ichneumon*), the common raccoon dog (*Nyctereutes procyonoides*), and the Eurasian otter (*Lutra lutra*). All of these extant analogues are interpreted as medium, to medium-fast, movers according to the original authors.

Conclusion: This study represents the first attempt to broadly estimate locomotor agility among early carnivorous mammals using reconstructions of the inner ear. The results suggest that, on average, early carnivorous mammals were likely “medium” in terms of their agility amongst mammals. Their closest living comparisons amongst carnivorans are predominantly ground-dwellers (or semi-aquatic) with relative quickness, but limited vertical mobility and climbing capability. As such, their semicircular canal-to-body mass ratios are well below that of highly arboreal mammals, such as many primates. These results thus cast doubt on some earlier reports indicating an arboreal nature for these predators.



P7. Characterizing Reproductive Stages in Bats: Optimization of Cytological Staining Methods

Nhu Bui

Mentor: Teri Orr, Ph.D.

Objective: The goal of the lab was to stain vaginal lavages from bats in an attempt to understand the histology and morphology changes throughout their reproductive stages. We used the Papanicolaou (PAP) stain for the process during which we encountered unexpected results. We set out to discover how purity and age of the stain used could affect staining quality and experimented with a different staining time from the regular staining process.

Methods: We initially followed the staining process from Lauren McDonald's experiment (2022), which was modified from the methods used in Staining Techniques for Vaginal Exfoliative Cytology of Rats (Srinivasan et al., 2017). We started by dipping the slides in PBS Saline for 30 seconds. The next steps were dipping 1 time in 95% Ethanol and then in 10% alcohol formalin for 10 seconds. Following was 6 slow dips in dH₂O. Then, we used a plastic pipette to apply non-acidified Harris hematoxylin and cover the slides with the solution for 50 seconds, followed by 6 slow dips in dH₂O. The slides were given 6 slow dips in 95% ethanol. Modified Orange G staining solution was next used for the slides with the pipetting method again for 1 minute and 5 seconds and 6 slow dips in 95% ethanol. We then used the modified EA staining solution to stain the slides for 1 minute and 5 seconds with a pipette. We repeated 95% Ethanol with 6 slow dips and then 100% ethanol with 6 slow dips. Afterward, the slides were immersed in HistoClear until they were ready to be coverslipped. After the first run, we modified the recipe by leaving the hematoxylin on the slide for 60 seconds instead of 50 seconds to test for different results. All slides were observed under the microscope with a camera and used Amlite for photographs of the findings.

Results: We tried to observe the slides both on 10x and 40x on the microscope while trying to identify cell organs such as the nucleus, cytoplasm, cell border, etc. After the first staining process with 2 lavage slides, we could not clearly identify any cells. At most, we could only discover trapped pigments with environmental artifacts on the slide, and no clear cells with boundaries were appreciated.

After testing the slides with 60 seconds of hematoxylin leave-on, we were able to define some cell debris with clearer staining appearing blue and/or dark pink, suggesting that the cells were able to pick up the stain. However, since we could not identify any clear evidence of cells with observable nuclei and characteristics of the cell, we did not count the findings as the cells of our interest.

Conclusion: We came to the conclusion that the problems might lie in the quality of the staining solutions used since they were in the lab for a period of time. Therefore, quality might have been affected by light, time, or contamination of pollutant particles. In future experiments, we will remake the stains and quality-check the solutions by filtering them before use.



P8. Stress Sensitivity in Different Regions of the Brain: Implications for Epilepsy

Camila Atencio, Miles Davis, Margarita Soltero Gutierrez, Jalin Haskins, Macy Mehdioun, Nathan Smole
Mentor: Kristin Gosselink, Ph.D.

Objective: Stress has been shown to be a significant seizure risk factor in individuals with epilepsy. Both experimental and clinical studies consistently demonstrate that acute and chronic stress influence seizure susceptibility through various neurological mechanisms. Through academic literature review and Fos staining in rat brain sections, we aim to identify the brain regions that are related to seizure activity and stress responses, and their degree of overlap.

Methods: Fos expression was determined by immunohistochemistry and quantified in the paraventricular hypothalamic nucleus (PVN) and temporal cortex of rats exposed to acute or repeated stress. Animals in the repeated stress group were exposed to 30 min of physical restraint each day for a total of 14 days. Acute stress rats were restrained only once, for 30 min, on day 14. Control rats were handled daily but never stressed. Perfused brain sections (30 μ m thickness; coronal) were Nissl stained for anatomical reference and immunohistochemically stained for Fos protein to indicate neuronal activation. Tissue sections were incubated overnight at room temperature in primary antiserum against Fos (1:10,000; Abcam), and for 1h at room temperature the next day in secondary antibody (Cy3-conjugated goat anti-rabbit IgG, 1:200; Jackson ImmunoResearch Labs) to visualize specific binding. Stained sections were mounted on gelatin-coated slides and coverslipped with glycerol mountant. Pictures of specific brain regions, the PVN, temporal cortex, and hippocampus, were captured with a digital imaging system coupled to a fluorescent microscope. The number of Fos-positive nuclei was counted in each region, either manually or with the assistance of ImageJ software.

A literature review was conducted, using the Google Scholar search engine to explore the link between stress and epilepsy in the brain regions for which Fos data were collected. Search terms such as “stress”, “epilepsy”, “effect on brain regions” were used to identify and select relevant articles for inclusion.

Results: Findings from the literature review emphasized that chronic or repeated stress promotes the development of epilepsy, or epileptogenesis, and increases seizure frequency through the increased secretion of cortisol. Importantly, dysregulation of the hypothalamic-pituitary-adrenocortical (HPA) axis is correlated to chronic stress and epilepsy, promoting excitatory signaling through the reorganization of epileptogenic brain networks. Human studies highlight the impact of increased cortisol responses due to stress, leading to increased neuronal excitability and lower seizure thresholds. Animal studies also demonstrate that both acute and chronic stress can activate or excite hippocampal-amygdala circuits, increase seizure sensitivity and cause higher CRH expression. Temporal lobe epilepsy, specifically involving the hippocampus, was shown to be very susceptible to stress. Another risk factor seen throughout the literature was chronic early-life stress, leading to HPA-axis dysregulation and, in turn, epilepsy development, weakened synaptic plasticity, and cortisol mis-management, affecting individuals into adulthood. Overall, results from the literature provide experimental data that show that increased stress exposures throughout life is risk factor for and a good predictor of augmented seizure frequencies. Stress may therefore be a common contributor to epileptogenesis.

ImageJ analysis of Fos staining in 6 sections through the temporal cortex of individual animals in each stress treatment group revealed a sum of 507 positive nuclei in Control rats, 194 in rats exposed to acute stress, and 272 in repeatedly stressed rats. In the PVN, as expected, the sum of Fos-positive nuclei

from 5 sections totaled 118 in the Control group, increased to 301 in the acute stress group, and then decreased to 124 in the repeated stress group. Manual counts of hippocampal Fos staining are in progress.

Conclusion: In conclusion, the literature supports a strong relationship between stress and epilepsy, and specifically epileptogenesis, particularly through the dysregulation of the HPA axis. Chronic stress appears to induce disordered HPA axis activation, impair synaptic plasticity, and facilitate neuronal hyperexcitability, specifically within the hippocampus and the temporal lobe of the cortex. In the rat brain, both acute and repeated stress reduced the number of nuclei staining positively for Fos in the temporal cortex compared to what was observed in non-stressed controls. This differed from what was seen in the PVN, where acute stress increased Fos expression and this response adapted or habituated with repeated stress exposure. In both regions, seeing the exact same stressor multiple times caused a shift away from the acute stress condition and allowed the brain to begin to return to its normal Control state.

This aligns partially with the findings from the literature review, emphasizing the important role of the temporal cortex in stress processing and seizure activity. On the other hand, increased epileptic activity was seen mainly under chronic stress conditions, which showed activation levels similar to Controls in our rat brain samples. Our study is currently limited by the low number of animals in our data set. Our conclusions are not strongly supported at this time, but future work will increase our “n”, expand the regions analyzed, and allow for statistical comparisons to be made. Importantly, for now, our results and the literature review findings describe the effects of stress, especially chronic stress, on brain regions that are known to contribute to seizures. It is crucial to provide counseling on stress management in individuals who suffer from epilepsy. Understanding this relationship can help neurologists recommend preventive and therapeutic approaches to their patients, reducing their exposure to stress and reducing epileptogenesis.



P9. Evaluation of Stress-Induced HYPE Expression in the Brain

Margarita Soltero Gutierrez*, Nathan Smole*, Macy Mehdioun*, Jalin Haskins*, Miles Davis*, Camila Atencio

*Equal contribution

Mentor: Kristin Gosselink, Ph.D.

Objective: Stress can negatively affect brain function and contribute to the progression of neurological diseases. This study measured the expression of Fos, a marker of activation, and Huntington yeast interacting partner E (HYPE) in rat brains following exposure to different amounts of stress. HYPE is involved in the unfolded protein response, its levels change in response to cellular stress, and its expression has been correlated with Huntington’s disease, Parkinson’s disease, and cancer.

Methods: Adult male rats were exposed to stress using an acrylic restraining device. The repeated stress condition had the rats in the restraining device for 30 min each day for a total of 14 days; the acute stress group of rats were restrained only on the last day for 30 min, and the control group had the open restraining device in their cage each day but were never stressed.

Nissl staining was done as a neuroanatomical reference and to confirm our areas of interest for future quantification. Fos expression was localized by immunohistochemistry, and Fos-positive nuclei were counted in the paraventricular nucleus (PVN), the amygdala and the CA2 and dentate gyrus regions of the

hippocampus. To perform the Fos immunostaining, brain sections were incubated in a rabbit anti-Fos primary antibody solution (1:10,000 dilution) overnight on a shaker at room temperature. The secondary antibody was a Cy3-conjugated goat anti-rabbit IgG (1:200 dilution) that was incubated for 1 hour on the shaker at room temperature. Immunohistochemistry for HYPE followed the same general procedure, with a rabbit anti-HYPE primary (1:2500 dilution) incubated for 2 nights on the shaker at room temperature. The secondary antibody solution was the same as the one used for Fos but applied during a 90 min incubation. Stained brain sections were subsequently mounted on gelatin-coated slides coverslipped with glycerol mountant.

Images for quantification were taken using a fluorescent microscope coupled to a digital imaging system. The settings used were 10x magnification for the hippocampus and 20x magnification for amygdala and PVN. Hippocampal Fos counts were performed manually, while ImageJ was used for the amygdala and PVN. Data analysis is ongoing for HYPE, where the density of staining will be measured with ImageJ.

Results: Sections stained for Fos were counted by two independent researchers who were blinded to the stress conditions, allowing a maximum of 10% difference between counts, and averaged for each section. Counts from a total of 5 or 6 sections per rat and brain region were summed to get a total count of Fos-positive nuclei. As expected, Fos expression in the PVN was highest in the acute stress group, where 301 nuclei were counted; Control and Repeated rats had nearly equivalent Fos staining, with totals of 118 and 112 nuclei, respectively. In the CA2 region, Fos counts were: Control = 320, Acute = 201, and Repeated = 220. Dentate gyrus Fos counts were: Control = 156, Acute = 172, and Repeated = 130. In the amygdala, the number of Fos-expressing nuclei was: Control = 331, Acute = 118, and Repeated = 170. Quantification of HYPE expression will be shared at a later time.

Conclusions: Different stress conditions lead to differences in Fos expression in regions across the brain that have varying functions. Similar to previous studies, the PVN of Control rats had low levels of Fos expression. Acute stress increased this expression, but then exposure to repeated restraint (the same stress seen over multiple days) led to an adapted or smaller Fos response. As the PVN is the site where stress responses are initiated (both hypothalamic-pituitary-adrenal axis and sympathetic nervous system activation), it is not surprising that acute stress had the biggest impact in our study.

The dentate gyrus also has the most Fos expression in the Acute animals, although the difference between groups were small and may not be significant. In the CA2 hippocampal area and the amygdala, both Acute and Repeated stress decreased Fos expression compared to Control. This study is currently limited by a small sample size, so we are unable to draw any strong conclusions. Future work will increase the n/group and allow for statistical comparisons. We have been able to identify HYPE expression but do not yet know if this expression is altered by stress exposure in our model.

Overall, understanding the stress-mediated expression of Fos and HYPE in the different regions of the brain may help determine the causes of neurological diseases or the development of drugs that target these mechanisms of stress for potential treatment. We will continue to examine and quantify HYPE expression and predict that it will be increased by stress. Such a response to organismal-level stress could lead to therapies that reduce or prevent stress in patients or modulate HYPE and by extension other components that affect protein folding in the brain.



P10. Biogenic Thiazolidines as Potential Mitochondrial-Protective Metabolites: Initial Evaluation of Cytotoxicity and Cellular Metabolic Effects in HeLa Cells

Jacqueline Tranmai, Ashlee Kim, Ryan Deming, Micah Tang,

Mentors: Alex Gasparian, Ph.D., Steven Karpowicz, Ph.D.

Background and Significance: Mitochondrial dysfunction and oxidative stress are central contributors to the pathogenesis of numerous neurodegenerative disorders. Biogenic thiazolidines, formed through condensation of endogenous thiols with carbonyl compounds, have been proposed as potential antioxidant metabolites. Before evaluating their ability to protect against mitochondrial toxicants, it is necessary to establish their safety profile and determine whether they influence cellular metabolism under basal conditions.

Hypothesis: Biogenic thiazolidine derivatives are non-cytotoxic in mammalian cells at pharmacologically relevant concentrations and may positively modulate cellular metabolic activity without adversely affecting cell viability.

Objective: To determine the cytotoxicity and biological activity of selected biogenic thiazolidines in HeLa cells following 24 h and 48 h exposure using complementary metabolic (alamarBlue) and cellular biomass (SRB) assays.

Methods: HeLa cells were exposed to seven thiazolidine derivatives (TA-0, TA-2, TA-4, TA-5, TA-11, TA-14, and TA-18) across a concentration range of 2 mM – 0.125 mM for 24 h or 1 mM – 0.0065 mM for 48 h. Cellular metabolic activity was assessed using the alamarBlue assay, while cellular biomass and viability were evaluated using the sulforhodamine B (SRB) assay. Statistical significance was determined by one-way ANOVA followed by Dunnett's multiple-comparison test against vehicle-treated controls.

Results: No compound demonstrated overt cytotoxicity in either alamarBlue or SRB assays after 24 h or 48 h exposure. SRB analysis showed no concentration-dependent reduction in cellular biomass, indicating that all tested compounds were generally well tolerated within the investigated concentration range. Although several statistically significant decreases in SRB staining were observed after 48 h exposure, these effects occurred at isolated concentrations and lacked a monotonic dose-response relationship, arguing against a classical cytotoxic response.

In contrast, several compounds increased alamarBlue reduction, suggesting enhanced cellular metabolic activity. TA-14 produced the most reproducible and concentration-dependent stimulatory effect at both time points. TA-5 exhibited the strongest metabolic enhancement after 24 h exposure, while TA-4 showed moderate but reproducible stimulation after 48 h. TA-0, TA-2, and TA-11 displayed non-monotonic responses, and TA-18 showed minimal biological activity. No corresponding concentration-dependent increases in SRB staining were observed, indicating that enhanced alamarBlue reduction likely reflected altered cellular metabolism rather than increased cell proliferation.

Conclusions: The tested biogenic thiazolidines exhibited a favorable in vitro safety profile in HeLa cells, with no evidence of concentration-dependent cytotoxicity after 24 h or 48 h exposure. Several compounds, particularly TA-14, increased cellular metabolic activity without affecting cellular biomass, suggesting a potential effect on mitochondrial or redox metabolism. These findings support further investigation of selected thiazolidines as candidate mitochondrial-protective and antioxidant compounds in oxidative stress models induced by mitochondrial toxicants such as MPP⁺ and menadione (vitamin K3).



P11. Evaluating Cervical Cancer Biomarkers Ki-67 and p16 and Their Relationship to hrHPV Infection

Stella Curtis, Rithika Treasa John, Shannon Lee, Julia Taki

Mentors: Debra E. Bramblett, Ph.D., Chris Hague, Ph.D.

Objective: There is a well-established association between cervical cancer and high-risk human papillomavirus (hrHPV); notably HPV16 and HPV18. As benign cells do not express p16 (tumor suppressor) and Ki-67 (marker of cellular division/growth) concurrently, their co-expression can show that the virus is actively making cell-cycle changes, leading to transformed cervical epithelial cells. We sought to quantify the expression of cervical cancer biomarkers Ki-67 and p16 in hrHPV-transfected cervical cells.

Methods: We used two cervical cancer cell lines: HeLa cells, which are an HPV18-positive line, and C33a cells, which are an HPV-negative line. Both cell lines were cultured with the appropriate mediums to reach adequate confluency for experimental purposes. We amplified HPV16 plasmid p1321 (ATCC #8641) in DH5 α competent cells (Thermo Scientific, Cat #EC0112) to generate sufficient quantities of HPV16 plasmid for future experiments. Plasmids were subsequently extracted using the QIAprep® Miniprep kit (Qiagen Cat#27104). The amplified HPV16 plasmids were introduced to both cervical cancer cell lines via transfection using Lipofectamine3000 (Invitrogen # L3000001) to overexpress HPV oncogenic proteins. pCMV-GFP (Addgene), a plasmid expressing green fluorescent protein, was included in each transfection experiment to assess transfection efficiency. Transfection efficiency was quantified using the Leica Mateo FL Digital Fluorescence Microscope to perform fluorescent microscopy, detecting GFP. Cervical cells were then lysed and total RNA was extracted from the cell lysate and isolated via the RNeasy® Plus Mini kit (Cat #74134). Using the isolated RNA, reverse-transcriptase quantitative PCR (RT-qPCR) was performed by first generating complimentary DNA (cDNA) using the QuantiTect Reverse Transcription Kit (Cat #205311). Using the CFX Opus 96 Real-Time PCR System (Biorad Cat #12011319), we then ran qPCR on our cDNA samples with a primer mix containing forward and reverse primers specific to Ki-67 (NM_002417) and p16 (NM_000077) with a fluorescent probe for probe-based detection (Integrated DNA Technologies).

Results: Transfection efficiency was measured at 100% in both HeLa and C33a cells using fluorescent microscopy. By running RT-qPCR on RNA isolated from both transfected cells (TR) and non-transfected cells (mock), we confirmed HPV16 E6/E7 expression in both cell lines (HeLa Δ Ct = 6.44, C33a Δ Ct = 9.45). Notably, we observed a small amount of amplification from our mock cells. This could be a false positive result due to the sensitivity of RT-qPCR or it could be indicative of contamination. By running RT-qPCR to quantify expression of HPV16 biomarkers p16 and Ki-67 RNA in both mock and TR cells of each cell line, we observed no significant difference in the expression of p16 in any of the groups (HeLa Δ Ct = -1.12, C33a Δ Ct = -0.45). We also observed no significant difference in the expression of Ki-67 in any of the groups (HeLa Δ Ct = -0.81, C33a Δ Ct = -0.32).

Conclusions: Current standards of screening include pap cytology and HPV blood test, both of which come with limitations ranging from false negatives, technician subjectivity, and lack of clinical utility.

Recognizing the increased rates of cervical cancer that are seen in underserved communities, we aimed to find cervical cancer biomarkers applicable to timely screening methods that can be utilized in communities with disparities in access. A vital step in this advancement is first confirming and quantifying biomarkers that are sensitive and specific to cervical cancer.

In our experiments, Ki-67 and p16 biomarkers were expressed as expected, but were not specific to HPV16 or HPV18 expression. Moving forward, we hope to perform RNA sequencing on RNA from the transfected cell lines to identify other genes which may show altered expression in cases of hrHPV. Following that, we plan to evaluate other biomarkers, such as TP53, for higher specificity and sensitivity to cervical cancer. We also hope to further delve into loop-mediated isothermal amplification (LAMP) techniques that may be more practical in point of care treatment.



P12. Concentration-Dependent Effects of Common Local Anesthetics on In Vitro HeLa Cell Wound Healing and Cytotoxic Disruption of Monolayer Integrity.

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Mentor: Christopher Hague, Ph.D.

Introduction: Scratch-wound assays are commonly used to evaluate cancer cell migration, an important component of tumor invasion and wound repair biology. Prior work suggests that ropivacaine may reduce activity of the mammalian target of rapamycin (mTOR) pathway, a signaling pathway involved in cell growth, metabolism, and tissue repair, which could contribute to delayed wound closure and potentially prolonged post-surgical recovery. However, potentially cytotoxic agents can complicate interpretation by causing cellular rounding, detachment, monolayer disruption, or collapse of cells into the wound space, which may alter scratch-width measurements independently of true migration. Apparent wound closure may also vary within the scratch itself, with greater narrowing observed near the center of the wound than at the edges, possibly due to differences in local cell density or accumulation of detached cells. Local anesthetics, including lidocaine, bupivacaine, and ropivacaine, have been reported to affect cell viability, adhesion, and migration in concentration-dependent ways. This study investigated how these anesthetics influence wound-closure dynamics in HeLa cervical cancer cells. We hypothesized that higher anesthetic concentrations would alter apparent wound closure through both impaired migration and cytotoxic disruption of monolayer integrity.

Methods: HeLa cervical cancer cells were cultured to form confluent monolayers and subjected to a scratch-wound assay. Cells were treated with varying concentrations of lidocaine, bupivacaine, or ropivacaine and monitored longitudinally over multiple days. Scratch distances were measured and normalized to calculate the percentage of wound area remaining open over time. Bupivacaine concentrations ranged from 0.0003 to 3 mM, with untreated control wells included. Lidocaine- and ropivacaine-treated wells were similarly compared across concentrations and time points. Trends were evaluated descriptively by comparing percent wound openness across drug, concentration, and day, with attention to whether changes in wound width reflected organized closure versus cytotoxic monolayer disruption. Representative scratch regions were also reviewed for edge effects, including differences between apparent closure at the center of the scratch and closure near the wound edges.

Results: Contrary to the initial expectation that ropivacaine would produce the greatest delay in closure, bupivacaine demonstrated the clearest concentration-dependent alteration in wound-closure dynamics. By

Day 3, control wells had a mean percent still open of approximately 0.13, while low-dose bupivacaine conditions remained near control levels. In contrast, mid-dose bupivacaine showed increased wound openness, and high-dose bupivacaine at 1-3 mM showed the greatest impairment, with mean percent still open values of approximately 0.39. Lidocaine showed a weaker pattern, with most concentrations approximating control by Day 2, while 3 mM lidocaine remained more open than control. Ropivacaine demonstrated the least consistent effect, though higher concentrations showed a mild trend toward greater wound openness. In high-dose conditions, changes in scratch appearance may reflect not only reduced migration but also cytotoxic effects such as cellular rounding, detachment, debris accumulation, and disruption or collapse of the monolayer. Detached or nonviable cells appeared to accumulate toward the middle of some scratches, creating apparent wound filling that may not represent healthy new cell migration. Greater apparent closure was also observed in the center of some scratches than near the edges, suggesting a possible edge effect related to uneven cell density or redistribution of detached cells.

Conclusion: These data suggest that local anesthetics differentially affect wound-closure dynamics in HeLa cervical cancer cells, with bupivacaine producing the strongest concentration-dependent delay in closure. Lidocaine and ropivacaine demonstrated weaker or less consistent effects, primarily at higher concentrations. Because cytotoxic collapse, monolayer disruption, edge effects, and central accumulation of detached cells can alter apparent scratch width independently of true migration, wound-closure data should be interpreted alongside morphologic assessment and independent viability measurements. Future studies should incorporate viability assays, standardized statistical testing, mTOR pathway analysis, and imaging-based analysis of wound-edge integrity to distinguish impaired migration from cytotoxicity-related artifacts and clarify the clinical relevance of local anesthetic selection in post-surgical wound healing.



P13. Sustained UPI Peptide Release from Embedded Microparticles to Enhance Vascular Graft Endothelialization

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Mentor: Chris Bashur, Ph.D.

Statement of Purpose: Tissue-engineered vascular grafts (TEVGs) are a promising alternative for coronary and peripheral artery bypass, but limited endothelialization and graft stenosis are still challenges. We have previously shown that a UPI peptide can target epsin – vascular endothelial growth factor receptor 2 (VEGFR2) interaction in mice and prevent VEGFR2 internalization [1]. Further, our prior research has also shown that incorporation of epsin-mimetic UPI peptides within TEVGs allowed rapid endothelialization and 100% patency at 1 week [2]. However, we hypothesize that local, more sustained release from microparticle carriers is important for longer-term grafting outcomes. Thus, the goals of this study are to develop microparticle-incorporated luminal coatings for more extended delivery of UPI peptides and to assess their effects on graft endothelialization and remodeling.

Methods: Poly (DL-lactide-co-glycolide) (PLGA) microparticles were prepared using a water/oil/water double emulsion technique with entrapped peptide (2 mg/g peptide/PLGA). Scrambled peptides and water-only control microparticles were also prepared. After lyophilization, SEM imaging and the Micro BCA assay were used for assessment. The microparticles were incorporated into a luminal gelatin coating

inside electrospun polycaprolactone (PCL) conduits using needles of varied gauges. The coating thickness was analyzed using optical coherence microscopy (OCM). *In vitro* endothelialization of the conduits was assessed with GFP-positive human umbilical vein ECs (HUVECs). End-to-end grafting in rat infrarenal aortae was performed for 4 weeks, and ultrasound and histological characterization is ongoing. Significance is assessed with one-way ANOVA and Tukey multiple comparisons.

Results: PLGA microparticles exhibited diameters less than the size of capillaries (i.e., average diameter $6.62 \pm 4.1 \mu\text{m}$) (Fig. 1). FITC-tagged UPI peptides demonstrated inclusion of the peptides within the microparticles. The UPI peptides were released continuously from the microparticles over 5 days, and they continued to release at lower levels afterwards. These microparticles were also successfully incorporated within a luminal gelatin coating with no evidence of delamination. CryoSEM showed a smoother luminal surface. OCM results showed a consistent gelatin layer with peptide-loaded microparticles. Coating thicknesses were 26.13 ± 6.16 , 30.05 ± 1.76 , and $59.63 \pm 12.72 \mu\text{m}$ for needle templates of 18, 20, and 22 gauge, respectively. The 20 gauge needle produced the most consistent results and was therefore used for further studies. GFP+ HUVEC attached to coated conduit lumen (Fig. 2). After 3 days, greater cell spreading and attachment was observed on UPI-gelatin-coated scaffolds than the uncoated electrospun mesh control. PCR analysis is ongoing to compare the EC phenotype on UPI vs. water loaded samples. An *in vivo* study demonstrated that UPI-microparticle loaded grafts remained viable after 4 weeks ($n=3$), with no signs of stenosis. Histology and immunofluorescence are being performed to further compare UPI vs. water-loaded grafts.

Conclusion: This study showed that extended and controlled release of UPI peptides can be achieved for PLGA microparticle-embedded conduits. These coatings were consistent with controllable thicknesses. Preliminary cell culture studies demonstrate the benefit of the coating on HUVEC attachment. *In vivo* studies are ongoing to characterize the impact of UPI peptides on graft remodeling. Overall, this long-term UPI delivery strategy may be important clinically where graft endothelialization takes longer than in rodent models.

References:

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Funding: American Heart Association grants 18AIREA33960390 and 24AIREA1195356



P14. Opportunistic Coronary Artery Calcium Scoring on Low-Dose CT Lung Cancer Screening: A Literature Review

Adam Schomer

Mentor: Kunal Mitra, Ph.D.

Objective: Low-dose computed tomography (LDCT) for lung cancer screening is already being used to detect early-stage malignancy, but the same scans can also reveal coronary artery calcium (CAC), a marker of subclinical atherosclerosis. This review explored how well CAC can be assessed on non-gated LDCT

lung cancer screening scans, whether these findings meaningfully predict cardiovascular risk, and what barriers currently prevent routine opportunistic CAC reporting in clinical practice.

Methods: We performed a focused literature review using Google Scholar and PubMed to identify studies and guideline or scientific statements addressing coronary artery calcium (CAC) assessment on low-dose CT (LDCT) lung cancer screening and related non-gated chest CT scans. Searches combined terms for low-dose CT or lung cancer screening with CAC or coronary calcification, non-gated or non-gated CT, Agatston score, reporting or radiology reports, referral, and artificial intelligence. In Google Scholar, these queries yielded between 101 and 1,200 results per string. In PubMed, a specific query requiring lung cancer screening, low-dose CT, CAC, and non-gated CT returned 16 citations, while broader queries for lung cancer screening + low-dose CT + CAC and non-gated CT + Agatston score + lung cancer screening returned 31 and 143 records, respectively. Titles and abstracts from both databases were screened, and a total of 23 peer-reviewed studies and guideline/scientific statements directly addressing CAC on LDCT, non-gated chest CT, or lung cancer screening populations were retained for detailed synthesis.

Results: The results demonstrate how CAC assessment on non-gated LDCT showed strong agreement with dedicated electrocardiogram-gated cardiac CT. There were reported correlations between LDCT- and gated CT-derived CAC measures ranging from $r = 0.94$ to $r = 0.981$ and the area under the curve values up to 0.994 for detecting high-risk CAC. CAC was common in lung cancer screening populations, with a 1,002-patient cohort, 53.4% of patients had CAC, and major adverse cardiovascular events increased from 1.1% in patients without CAC to 8.6% in those with severe CAC. The studies evaluating clinical impact consistently found that reporting CAC on LDCT was associated with increased use of statins and cardiology referral compared with unreported incidental CAC. Despite this, the literature consistently highlighted underreporting of CAC on LDCT, variable reporting practices, and a lack of standardized follow-up pathways once CAC is identified.

Conclusion: LDCT lung cancer screening offers an underused opportunity to identify patients at elevated cardiovascular risk using imaging they already undergo. The current evidence shows that CAC can be meaningfully assessed on non-gated LDCT, and it allows researchers to predict adverse cardiovascular outcomes in screening cohorts. This outcome often prompts changes in preventive care, such as initiating statins or a cardiology referral, when it is reported. Researchers still need to standardize reporting language, clear management pathways, and perform prospective outcome studies before opportunistic CAC scoring can be routinely implemented in lung cancer screening programs. These gaps point toward the next step: developing and testing systematic, potentially AI-assisted workflows for CAC detection and reporting in real-world LDCT screening populations.



P15. Explainable AI for Multiclass Brain Tumor Classification

Shrivatsa Sundarraj, Sharukh Khan, Wenxi Liu, Michael Trimboli, Matthew Newmarch

Mentor: Xianqi Li, Ph.D.

Objective: To evaluate the accuracy and interpretability of artificial intelligence models for distinguishing glioma, meningioma, pituitary tumor, and no tumor on brain MRI.

Methods: Brain MRI images were obtained from two publicly available datasets containing four diagnostic categories: glioma, meningioma, pituitary tumor, and no tumor. Exact duplicate images were removed before analysis, resulting in 7,585 unique images. The dataset was divided into training, validation, and independent test sets of 5,309, 1,137, and 1,139 images, respectively. Three deep learning approaches were evaluated: a convolutional neural network, a Swin Transformer trained from random initialization, and an ImageNet-pretrained Swin Transformer. Diagnostic performance was assessed using accuracy, balanced accuracy, F1-score, and receiver operating characteristic area under the curve (ROC-AUC). To examine how the models reached their predictions, activation mapping, Grad-CAM, Grad-CAM++, LIME, and SHAP were applied to representative test images.

Results: The pretrained Swin Transformer achieved the highest overall performance, with 98.77% accuracy, 98.86% balanced accuracy, a macro F1-score of 98.81%, and a macro ROC-AUC of 0.9998. Its class-specific F1-scores were 0.9854 for glioma, 0.9783 for meningioma, 0.9980 for no tumor, and 0.9906 for pituitary tumor. The convolutional neural network and non-pretrained Swin Transformer achieved accuracies of 94.82% and 93.33%, respectively. Meningioma was the most difficult category for these two models. In representative cases, the pretrained model correctly classified all four diagnostic categories and showed more localized Grad-CAM and Grad-CAM++ responses around visible abnormalities in glioma and meningioma images. In contrast, the other models demonstrated broader attention patterns and both misclassified the selected glioma case as meningioma.

Conclusion: The pretrained model demonstrated high accuracy across all four diagnostic categories and more localized visual explanations in selected tumor cases. These results suggest that transfer learning combined with explainable AI may support accurate and interpretable MRI-based brain tumor classification. Further evaluation using independent clinical datasets and systematic validation of explanation maps is needed before these methods can be considered for clinical decision support.



P16. Comparative Efficacy of Platelet-Rich Plasma, Mesenchymal Stem Cell Therapy, and Extracorporeal Shockwave Therapy in Tendon and Ligament Repair: A Mechanistic Review and Weighted Matrix Analysis

Hamza Nawaz

Mentor: Kunal Mitra, Ph.D.

Objective: To compare the clinical efficacy of platelet-rich plasma (PRP), mesenchymal stem cell (MSC) therapy, and extracorporeal shockwave therapy (ESWT) for tendon and ligament repair in human populations by examining each therapy's underlying molecular and cellular mechanisms, establishing shared measurable clinical outcome metrics, and applying a weighted decision matrix to systematically identify the most efficacious modality to guide evidence-based practice in sports medicine and orthopedic surgery.

Methods: A structured literature review was conducted across PubMed, PMC, and Google Scholar (2018–2026) using the following search terms: 'platelet-rich plasma tendon,' 'mesenchymal stem cell ligament repair,' 'extracorporeal shockwave therapy tendinopathy,' and 'regenerative therapy musculoskeletal

comparison.' Inclusion criteria required human clinical studies with specific tendon or ligament pathology indications, encompassing RCTs, systematic reviews, and meta-analyses. Studies were restricted to populations with diagnoses including Achilles tendinopathy, patellar tendinopathy, lateral epicondylitis, rotator cuff pathology, and ACL injury. Animal-only, in vitro, and non-musculoskeletal studies were excluded. A total of 30 studies were incorporated after title, abstract, and full-text screening. Primary outcome measures included VAS, VISA-A, DASH, and MRI/ultrasound-based structural assessment. Seven comparative criteria were weighted by clinical priority: pain reduction (25%), functional recovery (20%), structural/histological healing (20%), safety profile (10%), invasiveness/accessibility (10%), evidence quality (10%), and duration of effect (5%). Evidence quality was calibrated using the OCEBM hierarchy. Each modality was scored 1–5 per criterion; scoring discrepancies were resolved by defaulting to the highest-quality available evidence. Weighted scores were summed to produce composite efficacy totals.

Results: All three modalities operate through mechanisms aligned with the four-phase wound healing cascade, each exhibiting a distinct mechanistic profile and clinical evidence base. PRP delivers a supraphysiologic bolus of PDGF, TGF- β 1, VEGF, EGF, and IGF-1 via platelet alpha-granule degranulation, activating MAPK/ERK and PI3K/Akt signaling cascades in tenocytes and fibroblasts to drive collagen synthesis and cell proliferation. Leukocyte-poor (LP-PRP) formulations demonstrated superior outcomes in chronic tendinopathy by reducing pro-inflammatory mediator burden compared to leukocyte-rich preparations. Level I RCTs demonstrated mean VAS pain score reductions of 3.2 points and VISA-A improvements of 16% at 6 months versus controls. MSC therapy exerts effects through paracrine immunomodulation (IL-10, IDO, PGE2) and VEGF-mediated neovascularization; adipose-derived MSCs showed comparable efficacy to bone marrow-derived sources with lower harvest morbidity. Structural remodeling via ultrasound and MRI revealed significant tendon collagen reorganization at 6 months (OR 2.58 vs. sham). ESWT induces mechanotransduction via acoustic cavitation, upregulating VEGF and TGF- β 1 while substance P depletion produces durable analgesia; recurrence rates at 12 months were 16.5% vs. 23.6% for sham. Adverse event rates: ESWT 0%, PRP 1.2% minor reactions, MSC 3.4% procedural complications. Weighted matrix: PRP 4.05/5.00, ESWT 3.75/5.00, MSC 3.55/5.00. PRP led in pain reduction (4/5) and functional recovery (4/5); ESWT in accessibility (5/5) and safety (5/5); MSC in structural healing (5/5) but lowest in evidence quality (2/5) and invasiveness (2/5).

Conclusion: PRP represents the most clinically efficacious regenerative modality for tendon and ligament repair based on aggregate evidence, driven by robust Level I RCT data, an autologous safety profile with low adverse event rates, and broad point-of-care accessibility across practice settings. ESWT is a compelling first-line non-invasive option; particularly for mid-portion tendinopathies, chronic insertional pathology, and patients for whom injection procedures carry elevated risk or cost burden. MSC therapy holds the greatest structural regenerative potential and is most appropriate for higher-grade pathology requiring substantial tissue reconstitution, though widespread adoption remains constrained by regulatory variability, elevated procedural cost, and a predominantly Level III–IV evidence base specific to tendon and ligament applications. No single modality uniformly outperforms across all criteria, and converging data suggest that bimodal combination strategies PRP+ESWT for early-to-mid-grade tendinopathy and MSC+PRP for advanced structural lesions merit prioritization in future prospective comparative trials. Patient selection based on pathology grade, chronicity, and prior treatment response should guide modality choice, and future investigations should prioritize cost-effectiveness analyses given the significant procedural cost differential across modalities. Key limitations include heterogeneity in outcome reporting, variability in PRP preparation protocols (LP-PRP vs. LR-PRP), and long-term follow-up data limited to 24

months for MSC interventions. Unified classification systems, standardized outcome measures, and adequately powered head-to-head RCTs stratified by pathology grade and anatomical site are critically needed. Until such evidence matures, modality selection should be guided by pathology severity, patient activity demands, and available resources.



P17. Predictive Biomarkers for Immune Checkpoint Inhibitor Therapy: Current Evidence and Future Directions

Dimpal Kasabwala and Merit Mikhael

Mentor: Alexander Gasparian, Ph.D.

Objective: This narrative review evaluates established and emerging predictive biomarkers for response to immune checkpoint inhibitor therapy, including PD-L1 expression, tumor mutational burden, and MSI-H/dMMR. It also examines biomarkers of tumor immunogenicity and the tumor microenvironment and explores integrated biomarker models to improve prediction of treatment response, patient selection, and personalized immunotherapy.

Background: Immune checkpoint inhibitors (ICIs) have revolutionized cancer therapy, producing durable responses in patients across multiple malignancies. However, clinical benefit remains highly variable, with many patients demonstrating primary resistance, acquired resistance, or treatment-limiting toxicity. Consequently, substantial efforts have been directed toward identifying biomarkers that can predict which tumors are most likely to respond to immune checkpoint blockade. These biomarkers reflect different components of the antitumor immune response, including a tumor's ability to generate neoantigens, present those antigens to the immune system, recruit effector immune cells, and sustain antitumor immune activity within the tumor microenvironment. Established biomarkers such as PD-L1 expression, tumor mutational burden (TMB), and microsatellite instability/mismatch repair deficiency (MSI-H/dMMR) are already used in clinical practice, while a growing number of emerging biomarkers are being investigated to improve patient selection and treatment outcomes.

Methods: A narrative review of peer-reviewed literature was conducted using PubMed, ScienceDirect, and the Cochrane Library. These databases were selected to capture complementary sources of evidence, including primary clinical and translational studies, systematic reviews, meta-analyses, and landmark investigations evaluating established and emerging biomarkers associated with response to immune checkpoint inhibitors.

Results: PD-L1 expression remains the most widely used clinical biomarker, reflecting a tumor's reliance on the PD-1/PD-L1 pathway to suppress antitumor immunity. However, its predictive value is limited by intratumoral heterogeneity, temporal variability, and differences among testing platforms. Tumor mutational burden (TMB) and microsatellite instability/mismatch repair deficiency (MSI-H/dMMR) are associated with increased neoantigen generation, enhancing the likelihood that tumor cells will be recognized by the immune system. Growing evidence also highlights the importance of the tumor microenvironment. High densities of CD8⁺ tumor-infiltrating lymphocytes (TILs), T-cell inflamed phenotypes, and interferon- γ -related gene-expression signatures are generally associated with improved

responses, supporting the concept that checkpoint inhibitors are most effective when a pre-existing but suppressed immune response is already present. In contrast, tumors with absent or limited T-cell infiltration are frequently associated with resistance. Emerging biomarkers such as neoantigen burden, antigen-presentation signatures, and composite transcriptomic profiles may further refine assessment of tumor immunogenicity and immune activation. Growing evidence suggests that integrated biomarker models combining genomic, transcriptomic, and tissue-based markers may outperform individual biomarkers in predicting response to immune checkpoint inhibitors.

Conclusions: No single biomarker reliably predicts response to immune checkpoint inhibitors across all tumor types. While PD-L1 expression, TMB, and MSI-H/dMMR remain clinically useful, each reflects only one aspect of the tumor-immune interaction. Future approaches will likely rely on integrated biomarker platforms combining measures of tumor immunogenicity, antigen presentation, immune-cell infiltration, and inflammatory signaling to improve patient selection and treatment personalization.



P18. Prevalence of Abdominopelvic Bleeding in Abdominal Trauma Patients With & Without Anticoagulant/Antiplatelet Use

David Denisov, Ali Raja, Mireya Arreguin, Peter Maniuos, Braxon Maida

Research Mentors: Robert M. Rodriguez, MD, Ali Raja, MD, Malkeet Gupta, MD, William R. Mower, MD, Ph.D.

Background and Objectives: Multiple investigators have described increased prevalence of intracranial bleeding with anticoagulant and antiplatelet (AC/AP) use in blunt trauma patients, but there is little data on AC/AP effects on abdominopelvic (A/P) bleeding in trauma. Comparing adult blunt trauma patients who are on AC/AP agents versus those who are not, we sought to determine the prevalence of 1) A/P bleeding on computerized tomography (CT) and 2) injury requiring intervention.

Methods: We conducted a prospective, observational study of adult (> 14 years) blunt trauma patients who underwent A/P CT from 2015 to 2022 at 4 trauma centers. We recorded use of preinjury aspirin, direct oral anticoagulants (DOACs), warfarin, clopidogrel, & other AC/AP agents. The primary outcome was prevalence of bleeding on A/P CT comparing patients on AC/AP & those not on AC/AP. The secondary outcome was injury requiring intervention, defined as A/P injuries that required procedures and transfusions.

Results: Of 2483 patients, 68.8% were male; median age was 40.9 years; primary mechanisms of injury were motor vehicle crash (27.8%), motorcycle crash (21.1%) & automobile versus pedestrian (14.6%); 174 (7%) were taking AC/AP medications: 56 aspirin alone, 49 a DOAC alone, 35 warfarin alone, 14 clopidogrel alone, 17 a combination of 2+ agents, & 3 on other agents. Compared with patients not on AC/AP, patients on AC/AP had similar relative risk (RR) of any bleed on A/P CT (RR 0.98, 95% CI 0.68–1.41). There was no difference in RR of any bleed on A/P CT with individual agents: aspirin alone (RR 1.40, 95% CI 0.84–2.34), a DOAC alone (RR 0.67, 95% CI 0.29–1.54), warfarin alone (RR: 0.56, 95% CI 0.19–1.66), clopidogrel alone (RR 0.93, 95% CI 0.26–3.38), or a combination of agents (RR 0.77, 95% CI 0.21–2.84). Compared with patients not on AC/AP, patients on AC/AP had similar RR of injury requiring intervention (RR 1.07, 95% CI 0.63–1.80). There was no difference in RR of injury

requiring intervention with individual agents: aspirin alone (RR 0.95, 95% CI 0.36-2.46), a DOAC alone (RR 1.08, 95% CI 0.42-2.80), warfarin alone (RR 0.76, 95% CI 0.20-2.93), clopidogrel alone (RR 1.90, 95% CI 0.52 – 6.89), or a combination of agents (RR 0.78, 95% CI 0.12–5.25).

Conclusion: In this prospective, multicenter observational study, adult blunt trauma patients on preinjury AC/AP treatment were not at increased risk for abdominopelvic bleeding or significant injury requiring intervention.



P19. Development and Characterization of 4D Shape Memory Polymer Hydrogel Scaffolds with Nanosilica Coating for Tendon and Ligament Tissue Engineering

Karen Ngantcha

Mentors: Vipul Kishore, Ph.D., Diya Pillai Babu

Objectives: Tendon and ligament injuries represent a significant clinical burden, with current treatment strategies limited by the poor intrinsic healing capacity of these tissues and the inadequacy of conventional static scaffolds to recapitulate the native mechanobiological environment. 4D scaffolds, constructs capable of dynamic shape or property changes in response to external stimuli, offer a compelling strategy to better replicate these conditions and promote tissue regeneration. The specific objectives of this study were to: (1) fabricate dual-crosslinked hydrogel scaffolds incorporating shape memory polymers (SMPs) within a collagen and xanthan gum (XG) matrix, (2) apply a nanosilica (nSi) surface coating, (3) characterize scaffold composition and morphology via ATR-FTIR and SEM, and (4) evaluate the cytocompatibility of the scaffolds with human mesenchymal stem cells (MSCs) over a 21-day culture period.

Methods: Hydrogel scaffolds were fabricated by combining collagen (6 mg/mL), xanthan gum (XG, 10 mg/mL), SMPs (1 mg/mL), and VA-086 photoinitiator with nanosilica. Following casting, scaffolds underwent thermal gelation at 37°C, UV-crosslinking (1 min), and genipin-mediated chemical crosslinking (0.625% w/v in 1× PBS, 24 h). Scaffolds were subsequently washed with PAA (0.1% w/v in 20% ethanol) and coated with nSi. Scaffold composition was assessed by ATR-FTIR spectroscopy, and surface morphology and elemental composition were examined by SEM. Cytocompatibility was evaluated using the Alamar Blue metabolic assay: MSCs were seeded onto scaffolds in 96-well plates in triplicate and assessed at Days 3, 7, 14, and 21 by incubating with a 1:9 AlamarBlue : growth medium solution at 37°C with 5% CO₂ for 2 hours, followed by fluorescence measurement at 555–585 nm.

Results: ATR-FTIR analysis confirmed characteristic collagen amide band signatures along with spectral features consistent with successful genipin crosslinking and XG incorporation. SEM analysis demonstrated nSi deposition on the scaffold surface, confirming effective coating. Alamar Blue metabolic assay data are currently being collected across all time points; preliminary findings suggest MSC viability is maintained on the fabricated scaffolds through the culture period.

Conclusion: These findings demonstrate that 4D SMP-based hydrogel scaffolds with nSi surface coating can be successfully fabricated with confirmed chemical and morphological properties. The Alamar Blue assay results indicate that the scaffold formulation supports MSC viability, establishing a foundation for further biological assessment. Future work will investigate the stimuli-responsive shape-memory behavior

of these constructs and their capacity to promote osteogenesis, with the long-term goal of improving bone-ligament integration in ACL reconstruction.



P20. COVID-19 Vaccination Refusal Among Cancer Survivors in China

Leon Zhao

Mentor: Jagdish Khubchandani, Ph.D.

Objective/Background: Numerous studies scrutinized the safety and efficacy of COVID-19 vaccines across various settings and groups. Yet, COVID-19 vaccination hesitancy remained a concern throughout the pandemic. While most vaccine refusal and hesitancy studies focused on the general population, little is known about trends and determinants of COVID-19 vaccine hesitancy among vulnerable populations such as those with cancer and specifically, in Asia.

Methods: Using China as a sample country, we conducted a scoping review to assess COVID-19 vaccine refusal among cancer survivors. Original data based studies were searched across multiple search engines using selected keywords and inclusion/exclusion criteria. A final pool of 10 studies with 11,131 cancer survivors from China were included in the review.

Results: COVID-19 vaccine refusal rates among the reviewed studies ranged from 6% to 65%. The major reasons for COVID-19 vaccination refusal were concerns about safety, side effects, and efficacy. Negative family or social influences, belief of negative impact on cancer, and lack of a trusted source were other reasons for refusal. Older age was associated with higher vaccine acceptance tendencies.

Conclusion: Despite extensive recommendations from professional and government agencies across the world and prioritization for early access, cancer survivors in China showed high COVID-19 vaccine avoidance. Evidence-based interventions should be implemented in clinics and for cancer care continuum to increase vaccine uptake among cancer survivors not only in China, but worldwide.



P21. Proposal of Association Between Loss of Smell and Cardiovascular Disease: A Meta-analysis

Mantas Sliesoraitis, Filiberto Lopez, Janice Yi

Mentor: Jagdish Khubchandani, Ph.D.

Overview: This systematic review and meta-analysis will evaluate the association between olfactory dysfunction and cardiovascular disease in adults. Methodology is outlined below, and a comprehensive search of this emerging topic could shed unique perspectives and synthesize newly available data on a significant risk factor for cardiovascular disease as well as clarifying the magnitude of association. This protocol outlines proposed methodology, a brief overview on the topic, data synthesis methods, and risk of bias assessment.

Introduction: According to the American Heart Association (2024), heart disease and stroke could impact 60% of the US population by 2050. Cardiovascular pathology of all causes is a significant consideration to be taken into account by clinicians. The association between the loss of sensation in patients maintains a complex relationship in regard to their overall health. Oftentimes, shared systems in one area will impact the closely related structures. Our consideration as clinicians of the unique potential risk factors that may influence the patient population has implications for the way that we tailor treatment toward each individual. When we are better able to heuristically consider the possibility of pathogenesis from simple tests such as that of sensory tests, we are able to better approach patient care with understanding of systemic physiologic nuance.

Loss of smell (anosmia) is an emerging topic in literature as a potential screenable risk factor for cardiovascular disease. The proposed relationship is complex. Many new studies show a level of association - Chamberlin et al. (2024) followed adults across 12 years. This study proposes that the association may be due to a variety of factors including shared vascular networks, a preference toward poorer food choices, depressed mood, social isolation, and physical inactivity. This meta-analysis will explore the associational risk of olfactory disease and loss of smell (anosmia) in adult populations. This will encompass both partial and complete loss of smell, a topic which has recently been introduced as a risk factor for a variety of cardiovascular disease. Cardiovascular disease encompasses a wide variety of conditions to include hypertension, myocardial infarction, cerebrovascular infarction, atrial and ventricular fibrillation among many other vascular disease etiologies.

Methods:

Proposed Search Methodology

Doing a preliminary search of the currently available content on the topic shows a wealth of newly researched studies in the field. These studies have all been published within the past 10 years, with the vast majority being published after 2020. As of July 2026, there have been no systematic reviews exploring this topic. A meta-analysis in the field could shed light and offer more comprehensive information on the complex nature of this topic.

Search strings will be developed for the following databases, and databases were searched from their inception date until date of search: Medline (OVID interface), Embase (OVID interface), Cochrane Central Register of Controlled Trials, SCOPUS and PubMed. There will be no language restrictions. For inclusion criteria, we will include adult human populations (above the age of 18) who have experienced loss of smell (anosmia as well as hyposmia and dysosmia) as well as related vascular disease. Populations studied will be from longitudinal cohorts. As for exclusion, studies focusing only on viral related causes of anosmia (COVID-19), pediatric populations (human populations under the age of 18), studies focusing on single olfactory-related pathologies (i.e. nasal polyps, turbinate hypertrophy, chronic rhinitis), studies on non-human populations, studies focusing only on late-stage neurodegenerative disease (i.e. Dementia, Alzheimer's) in order to avoid confounding of variables, iatrogenic anosmia conditions to include chemotherapy or anosmia related to surgical complications will all be excluded.

Data Synthesis and Bias Prevention

In studies with pooled risk estimates we will calculate Relative Risks (RR), Odds Ratio (OR) or Hazard Ratio (HR) with confidence intervals separately. For continuous outcomes, standardized mean differences (SMD) and mean differences (MD) will be calculated. Heterogeneity will be found with Chi squared test (significance at $p < 0.10$) and quantified with I squared (significance at $>50\%$) As a result of anticipated high levels of variation across studies, Restricted Maximum Likelihood (REML) for primary analysis method. Analysis will be conducted using R with the “metafor” and “meta” packages, or Stata.

Risk of bias will differ from study assessed. Risk of bias will be done from two individual reviewers thoroughly read and assessed by a third, addressing any discrepancies as they arise. Risk of bias assessment will be adapted depending on the type of study being reviewed. For randomized control trials, Cochrane RoB 2 (Revised Risk of Bias Tool) will be utilized, for non-randomized or observational studies, the ROBINS-E (ROBINS-E (Risk of Bias in Non-randomized Studies - of Exposures) tool will be utilized. Studies will be evaluated for study cohorts, comparability of cohorts, and exposure/outcome.

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P22. MRSA Colonization Among Medical and Nursing Populations: A Literature Review

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Mentor: Debra E. Bramblett, Ph.D.

Objective: The objective is to evaluate evidence on MRSA colonization in medical and nursing populations to determine whether profession or clinical exposure alters carriage. Gaining insight into these differences may identify gaps in MRSA prevention and guide medical and nursing students to reduce transmission to patients. Our literature review will be used to guide our hypothesis that MRSA colonization increases as medical and nursing students progress from preclinical to clinical training.

Methods: A literature review was conducted to characterize existing research on methicillin-resistant *Staphylococcus aureus* (MRSA) colonization and associated risk factors among healthcare-related student and professional populations. Search strategies were iteratively broadened to identify studies examining MRSA among nursing students, medical students, nurses, physicians, healthcare workers, and clinical populations across different geographic regions. Thirteen studies were selected based on their relevance to the research topic, publication recency, and alignment with the search terms and research interests. Studies were excluded when the full text was inaccessible or when the study population was limited to a narrowly defined healthcare worker group that did not align with the intended scope of the analysis. This approach allowed us to identify studies with methodologies relevant to our planned project, which will assess MRSA risk factors through survey data and subsequent MRSA testing among preclinical and clinical medical and nursing students.

The selected studies were analyzed across eight methodological areas. These included the study population characteristics, definitions of MRSA colonization, duration of research, survey design, statistical analysis, geographical location, laboratory testing methodologies, and study results. These areas were selected to allow comparison of methodologies across studies and to identify considerations that may be relevant to our own study design, data collection, and future manuscript development. Findings from the

literature review will be compiled into a standardized data table to facilitate comparison across studies and guide the methodology of our planned MRSA risk factor analysis.

Results: Among the analyzed findings, MRSA carriage varied significantly by population and setting. A German cardiac care center found that only 1 of 149 (0.7%) healthcare workers carried MRSA, while a New Delhi study found that among doctors and nurses there were 27 of 368 (7.3%) that carried MRSA. A West Bengal hospital found that 28% of the 50 healthcare workers carried MRSA. These 3 aforementioned studies did not report specific profession carriage rates.

Profession specific findings were inconsistent, in a Brazilian pediatric healthcare worker study the MRSA colonization rates were 5.1% overall while nurses specifically had a 16.7% colonization rate ($P = .022$). On the other hand, a Japanese surgical-ward study found that there was a higher MRSA colonization rate among physicians, 31%, than nurses, 3%, ($P = .02$).

Studies comparing increased clinical training did show an association with higher carriage rates. U.S. resident physicians had baseline rates of 2.50% in PGY-1 compared to 4.94% in PGY-2-5 ($P = .68$), while a Quebec study found 0.4% among medical residents versus 0% among preclinical students ($P = 1.00$). An Oman study reported nasal MRSA carriage among preclinical students as 11.4% versus 20.8% ($P > .05$) in clinical year medical students. Overall, these studies suggested a trend toward MRSA exposure with greater clinical exposure, however they were not statistically significant in most cases. Geographic variation in MRSA prevalence should be considered when interpreting the carriage rates.

Risk factor findings alluded to the idea that poor hand hygiene, recent patient contact and contact with MRSA positive patients were associated with carriage. One study showed adult ICU settings showed possible MRSA transmission among patients, healthcare workers, equipment and environmental surfaces. Conclusion: Based on our literature review, MRSA carriage varied substantially across healthcare populations, with reported prevalence ranging from 0.7% to 31% among healthcare workers. Across the reviewed studies, no statistically significant difference was found between MRSA carriage and level of clinical exposure or professional role. However, the absence of statistical significance should not be interpreted as evidence that no association exists. Some studies reported higher carriage among nurses, whereas others reported higher rates among physicians, and studies comparing preclinical students with residents or more clinically experienced students produced similarly inconsistent findings.

Interpretation of these results is limited by differences in study populations, healthcare settings, sampling strategies, laboratory methods, study designs, and assessment of potential risk factors. In addition, the available literature includes limited longitudinal research following students as they transition from preclinical education to direct patient care, and relatively few studies have specifically evaluated this question within U.S. medical and nursing student populations. The relationship between clinical exposure and MRSA acquisition remains insufficient rather than disproven. These limitations highlight the importance of further longitudinal studies using standardized sampling methods and risk factor assessments to determine whether MRSA carriage changes with increasing clinical exposure among medical and nursing students.



P23. *Coccidioides* Seroprevalence in the Las Cruces Population

Mariana Castaneda, Charisse Dumlao, Aaron Jeanloz, Fernanda Pardo, and Brian Tonthat

Mentor: Michael Woods, Ph.D.

Coccidioidomycosis, also known as Valley Fever, is a fungal infection that has been a growing public health concern for the southwestern region of the United States with reported cases increasing substantially over the past two decades. While most infections are asymptomatic (60%) the number of complicated infections is rising. Infection with Valley Fever can lead to disseminated disease, increased mortality risk, or lifelong complications. The challenge lies in the establishment of early detection protocols since risk factors to identify those who may develop systemic disseminated disease remain unclear. This study aims to document the exposure to this pathogen by tracking the seroprevalence in the Las Cruces population. In the summer of 2026, we used an immunodiffusion assay to look for serologic evidence of exposure of the known endemic species of *Coccidioides* in the region, *C. Posadasii* in serum samples of volunteers. Antibodies were detected in 6 of 112 (5.36%) serum samples, demonstrating serological evidence of *Coccidioides* exposure within the sampled population. This result was substantially lower than previously observed seropositivity using lateral flow assay. Future work should include a larger population sample as well as serum volume to allow for reliable comparison across assays and allow for better estimates of seropositivity of the Las Cruces population.



P24. Physicians as Public Health Advocates in the United States: Practices, Training, and Call for Action

Jessica Te, Julius Hubby

Mentor: Jagdish Khubchandani, Ph.D.

Objective: To characterize the current state of physician advocacy in the U.S., including common advocacy practices, existing avenues of training, and persistent barriers, and to identify gaps between physician training and public health advocacy needs in order to propose actionable recommendations for medical schools, residency programs, and professional organizations.

Methods: We conducted a rapid literature search for a narrative review examining physician engagement in public health advocacy, drawing on multiple scholarly databases including PubMed and Google Scholar. Search terms targeted physician advocacy practices, advocacy training models (e.g., residency curricula, advocacy fellowships, professional society programs), and barriers to engagement. Studies were screened and included based on the relevance to the aforementioned criteria. Data was extracted and synthesized narratively across three domains: (1) justifications for physician advocacy drawn from professional codes, ethics literature, and outcomes research; (2) quantitative data on physician advocacy engagement levels, categorized by type (professional engagement, policy communication, policy development/research, political participation, and high-level advocacy); and (3) characteristics of existing advocacy training curricula, including format (didactic, web-based, experience-based), requirement status, and reported gaps such as faculty expertise and time constraints. Findings were organized into tables summarizing reasons for advocacy, advocacy engagement rates by type and study, and training exposure by study. Based on this synthesis, we developed a set of recommendations for formalizing advocacy training across medical education and practice settings.

Results: Six justifications for physician advocacy emerged: professional/ethical duty (grounded in AMA and Physician Charter standards), health equity, improved patient outcomes, public trust, physician reimbursement, and physician well-being. Engagement data showed substantial variation: in one study (n=886), 21.3% reported no advocacy engagement, while 57.8% engaged through professional society membership; 35.6% contacted legislators and 19.1% shared policy information with patients, but high-level activities were rare (9.4% reported to a public office, 2.3% testified, 1.5% drafted legislation). A second study (n=437) found 23% engaged through professional societies, 32% voted in a state election, and 12% provided testimony. Time constraints were the most commonly cited barrier to engagement. Training data revealed inconsistent exposure: reported rates of no formal advocacy training ranged from 15% (n=709) to 61.5% (n=13) across studies. Where training existed, didactic methods predominated for required coursework (91%), while experiential learning was more common in elective formats (78%). Commonly cited structural gaps included lack of faculty expertise (72%) and inadequate faculty time (69%). Notably, only 20 of 535 members (under 4%) of the 119th U.S. Congress are physicians, despite health care representing approximately 18.0% of the U.S. GDP.

Conclusion: Physician advocacy engagement and training remain inconsistent across the U.S., with many physicians reporting limited or no formal preparation and citing time, curricular gaps, and lack of faculty expertise as primary barriers. Existing justifications for advocacy are well-established in professional codes and ethics literature, but engagement in higher-level activities such as legislative testimony or policy drafting remains rare. Promising training models — including cascading mentorships, community-centered fellowships, and structured models — demonstrate that advocacy can be taught effectively without a wholesale restructuring of medical education. We recommend that medical schools, residency programs, and professional organizations lower barriers to entry, formally credit advocacy work alongside other scholarly activities, standardize adaptable training models across specialties, and pair trainees with experienced physician-advocate mentors. These findings are based on a narrative rather than systematic review, and existing literature largely describes program structure rather than measured outcomes; further outcome-based research is needed to determine whether advocacy training changes long-term physician behavior, reduces burnout, or influences policy.



P25. Intellectual Humility Among Medical Students

Adaeze Chukwudebe

Mentor: Mary Lacaze, M.D.

Objective: The primary objective of this study is to characterize levels of intellectual humility (IH) among first-year medical students at Burrell College of Osteopathic Medicine using the Comprehensive Intellectual Humility Scale (CIHS). We will also examine whether specific dimensions of IH are associated with how students respond to hypothetical situations involving uncertainty and limitations in knowledge. Additionally, we will explore students' perceptions of the traits associated with intellectual humility and successful peers and faculty, as well as demographic and socioeconomic factors associated with IH. These findings may help identify factors that can inform future approaches to fostering intellectual humility within medical

education.

Methods: This cross-sectional survey study will be administered electronically through Qualtrics to medical students at Burrell College of Osteopathic Medicine, with a target sample of up to 300 participants. Following informed consent, participants will be asked whether they are familiar with the term intellectual humility (IH) and, if so, to provide their own definition. Participants will then complete the 22-item Comprehensive Intellectual Humility Scale (CIHS; $\alpha = 0.89$; Krumrei-Mancuso & Rouse, 2016). The survey will also include four scenarios involving uncertainty, followed by an optional opportunity for participants to describe similar experiences they have encountered.

Participants will subsequently be provided with a definition of IH and asked to evaluate a hypothetical scenario where they are asked to select which peer they would like to work with. Additional open-ended questions will ask participants to describe a peer and a faculty member whom they look up to, identify the traits they value in these individuals, and indicate whether they believe these individuals demonstrate IH. Demographic questions will assess age, gender identity, race/ethnicity, and socioeconomic background. The survey will conclude with a debriefing statement.

Planned quantitative analyses will include descriptive statistics, including means, standard deviations, frequencies, and percentages. Relationships between IH and participant characteristics and experiences will be examined using correlational analyses and other appropriate statistical tests. Open-ended responses will be analyzed thematically to identify common perceptions of IH, experiences with uncertainty, and traits associated with IH.

Anticipated Results: We anticipate that the study will characterize levels of intellectual humility among first year medical students and identify experiences and characteristics associated with higher levels of IH. We also anticipate identifying common traits that medical students associate with intellectual humility in peers and faculty members.

Anticipated Conclusion: This study will provide insights into IH among medical students and the experiences and characteristics that may be associated with its development. Findings may help inform future research and educational approaches aimed at fostering greater intellectual humility, meaningful collaboration, and engagement with uncertainty in medical training.



P26. Clinicians Face Misinformation Without Training: A Review of Exposure and Perceptions

Vivian Leung, Rebecca Ayiku

Mentor: Jagdish Khubchandani, Ph.D.

Objective: Health misinformation is a routine clinical challenge, contributing to treatment refusal, vaccine hesitancy, and strained patient-provider communication. Most clinicians see themselves as an effective channel for correcting misinformation, yet report receiving little formal training, and evidence guiding such training remains fragmented. This review synthesizes evidence on clinicians' exposure, perceptions, and training on misinformation to identify structural gaps informing clinical education.

Methods: A narrative review of PubMed and Google Scholar (2016-2026) was conducted using search terms including ‘clinicians’, ‘healthcare providers’, ‘infodemic’, ‘misinformation’, and ‘vaccine hesitancy.’ From a broader pool of 68 studies screened for relevance, 11 quantitative and mixed-method studies meeting inclusion criteria were selected for synthesis, examining clinician exposure, perceptions, and training related to health misinformation across multiple countries and clinician professions.

Results: Clinician exposure to patient-held misinformation was consistently high, reaching 94.2% among 2,183 licensed practitioners in North Carolina, with similarly elevated rates in India (68.2% of 758), nationally in the U.S. (74.3% of 531), Brazil (76.1% of 15,132) and Saudi Arabia (89.6% of 768); however, these studies varied in how misinformation exposure was defined and measured, limiting direct comparability across settings. Among clinician-reported concerns, vaccine-related misinformation was the most frequently cited concern. Clinicians widely reported that misinformation posed a growing challenge to patient care, with 86% of more than 1,000 U.S. physicians perceiving it as an increasing problem and 72% of 806 U.S. physicians reporting that it made patient care more difficult. Despite this concern, formal training was rare: only 18% of practitioners reported receiving it. Educational interventions improved clinician confidence where evaluated: in one academic detailing program, confidence in combating vaccine misinformation rose from 52% before training to 87% afterward, and physicians trained in empathetic-refutational interviewing reported greater perceived competence than those trained in motivational interviewing.

Conclusion: These findings reveal a persistent gap between clinicians’ perception of misinformation as a growing problem and their actual preparation to address it. Existing evidence relies heavily on self-report and lacks a standardized definition of misinformation, limiting comparability across studies. While clinician exposure and perceptions have been well characterized, real-world communication practices remain understudied: large randomized trials have already shown that empathetic-refutational communication approaches increase trust and receptiveness to correction, but this evidence has yet to be tested with practicing clinicians in actual patient encounters. This review itself is limited by its reliance on two databases and variability in how exposure was operationalized across the source literature. Public health and medical education efforts should therefore prioritize multi-site trials that test clinician-delivered communication strategies in real encounters against independently verified outcomes, such as reduced belief in misinformation or improved patient understanding, alongside adoption of a standardized definition.



P27. Gender Concordance in Healthcare: A Systematic Review of Patient Preferences and Outcomes Associated With Physician Gender

Andrea Anchondo, Delaram Doorandish

Mentor: Jagdish Khubchandani, Ph.D.

Objective: Female physician representation has steadily risen across the country. In 2014, female physicians formed 28.7% of the physician workforce, and in 2025, that rose to 34.9%. With this change, we sought to determine if there is a significant association between 1) patients and their preference for gender concordant physicians and 2) patient outcome and their physician's gender. Our aim is to explore how the shift toward gender balanced representation in healthcare affects patient care.

Methods: A secondary quantitative analysis of extracted data was completed with 50 studies published in the United States from 2015 to 2026. Publications were selected if they presented original quantitative research done in the United States, included patient and physician gender, as well as reported either patient preference for physician gender or healthcare outcomes, whether clinical or patient reported. For publications included for the first objective, data was extracted on patient gender and whether their stated preference was concordant or discordant with their gender. With the data extracted from the selected studies, 2x2 contingency tables were constructed comparing same-gender versus opposite-gender physician preference. Odds ratios were calculated to estimate the strength of this association, and 95% confidence intervals were used to assess the reproducibility of each estimate. Chi-square goodness of fit testing was used to evaluate whether same-gender physician preference differed significantly from opposite-gender preference. For smaller studies, Fisher's exact test was used. Statistical significance was defined as a two-sided p value less than 0.05. For the second objective, a systematic review and secondary quantitative analysis were also done, but this time to assess the relationship between patient and physician gender concordance with healthcare outcomes in the United States. Lower mortality rates, increased preventive care adherence, and blood pressure control were some of the indicators used to define a "good" healthcare outcome. The association between gender concordance and outcome was determined using Pearson's chi-square test. Fisher's exact test was used when there were fewer patients in the study. Odds ratios and 95% CIs were calculated from the extracted data. An OR greater than 1 indicated higher odds of a positive outcome among gender-concordant pairs. All tests were two-sided, and statistical significance was defined as $p < 0.05$.

Results: Of the 25 literature studies examining patient-physician gender preferences, fifteen (60%) reported that female patients were more likely to prefer female physicians, two (8%) reported that male patients preferred male physicians, and eight (32%) found no significant gender preference ($p < 0.05$). Among the 25 studies evaluating the association between physician gender and patient outcomes, twelve (48%) reported more positive outcomes among female patients treated by gender-concordant physicians, three (12%) reported more favorable outcomes among male patients treated by gender-concordant physicians, and ten (40%) reported no significant differences in outcomes ($p < 0.05$).

Conclusion: The findings from this literature analysis notes that patient-physician gender concordance may have strong implications for both patient preferences and patient outcomes. Although a wide range of medical specialties were examined, female patients demonstrated a stronger preference for female physicians and were more likely to experience positive health outcomes when treated by a gender-concordant physician. In contrast, male patients showed a less congruent preference for male physicians and a weaker association between gender concordance and improved outcomes. This review indicates that the underrepresentation of women in medicine may have implications for patient care. Further research is warranted to examine how the increasing representation of female physicians may influence the delivery and progress of healthcare in the United States.



P28. A Scoping Review of Leader Fairness in Sport Research

Sufyan Siddiqui and Verzhin Vicky Shagrikyan

Mentor: Katherine E. Hirsch-Agnew, Ph.D.

Fairness remains to be an important component of effective leadership in multiple contexts according to Van Knippenberg et al. (2007); however, research evaluating leader fairness within sports continues to be limited and fragmented. Much of the current research in the field is built upon the understanding of fairness from an organizational psychology lens, highlighting the need to understand how fairness can be applied within the sport context.

The purpose of this study was to summarize and examine the existing literature on leader fairness in sport. The study was guided by the following questions: (a) What is the size and scope of empirical research exploring leader fairness in sport? (b) What populations and perspectives have been examined? (c) How is fairness defined and theorized within sport leadership research? (d) What methodologies and data collection methods have been used? (e) What constructs have been identified as correlates, predictors, and outcomes of fairness perceptions? and (f) What future research directions have been identified by fairness scholars? A scoping review was conducted to explore the scope of research, population studies, conceptualization and theorization of fairness, methodologies used, constructs associated with fairness perceptions, and directions for future research. Following Arksey and O'Malley's (2005) scoping review framework, a systematic literature search identified 1,215 records for initial screening, with the final sample containing 61 articles representing 64 studies published between the years 2004 and 2025. Study characteristics were characterized using frequency analyses.

The preliminary findings indicate that research predominantly examined multiple sports contexts and sports leadership positions including coaches, adults, elite athletes, and performance-oriented sports contexts, with cross-sectional designs accounting for 88.2% of all empirical studies. Colquitt's four-dimensional organizational justice framework (2001) was the most frequently cited theoretical framework, while it was found that distributive and procedural justice were the most frequently measured fairness dimensions. Authentic leadership, autonomy support, and high school type were the most frequently examined predictors of fairness, while cohesion, satisfaction, commitment, and performance were the most frequently examined outcomes. Future research calls for greater examination of fairness outcomes and consequences, fair leadership, and diverse populations and contexts.

These findings provide an overview of how leader fairness has been studied in sport while noting important gaps in populations, methodologies, and conceptualizations, in the hopes that this review will provide a foundation for more consistent and contextually relevant research on fair leadership within sport.

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P29. Gender Representation on Medical School Websites: A Longitudinal Content Analysis of Institutional Websites, 2015–2025

Simran Dhillon, Uchenna Odu, Ashley Sanderson

Mentor: Timothy Ketelaar, Ph.D.

Objectives: University websites provide institutions with an important means of presenting themselves to prospective students and the broader public. The photographs/images selected for these websites provide a useful record of how institutions visually represent their students, faculty, and communities—and how these representations have changed over time. The present study examines changes in gender representation in images appearing on the websites of a sample of U.S. medical schools between 2015 and 2025.

Methods: Archived versions of institutional websites were retrieved using the Internet Archive’s Wayback Machine. Images appearing on archived webpages were systematically collected and coded for the presence of identifiable human faces in six medical colleges (3 Colleges of Osteopathic Medicine, and 3 Colleges of Allopathic Medicine). Trained human coders then classified the number and apparent gender of individuals appearing in each image.

Results: The resulting data permit us to examine both the overall composition of institutional website imagery and changes in the relative representation of women and men across time. Data were also analyzed using an AI-based workflow. We will present preliminary findings from this longitudinal dataset, including the number and types of images collected, the frequency of human faces appearing in institutional imagery, differences in the representation of women and men, changes in gender representation from 2015 to 2025, and comparisons across medical schools.

Conclusion: These analyses represent an initial application of the broader University Website Content Analysis Project, which uses archived institutional websites to study changes in how universities visually represent their communities over time.



P30. Understanding the Relationship Between Imagery, Body Image, and Body Checking

Luiza Zaccaria Bertolini, Isabella Astorga

Mentor: Katherine Hirsch-Agnew, Ph.D.

Objective: Imagery is the mind’s ability to construct or recreate experiences using sensory information (Kossert & Munroe-Chandler, 2007). Mental images can be vivid, emotionally intense, and realistic, influencing how individuals respond to imagined experiences (Hijne et al., 2020). Further research exploring individual’s experiences using imagery related to their appearance can lend insight into how imagery poses similarities to body checking behaviors. The purpose of the present study was two-fold: (1) to examine the relationships between appearance-related imagery, body image, and body checking

behaviors and (2) to understand and analyze individuals' experiences, thoughts, and emotions associated with appearance-related imagery during their exercise and daily lives. We developed a greater understanding of imagery and its connection to body image, motivation to exercise, and emotional reactions by reading the literature.

Methods: **Guidance:** Participants included 499 athletes from primarily the United States, United Kingdom, and Canada, with additional participants from Australia, Ireland, and New Zealand. The sample was 66.5% male ($n = 332$), 31.5% female ($n = 157$), and 2.0% identified with other gender identities or preferred not to answer. Participants competed across recreational (32.9%), university (30.3%), semi-professional (15.8%), club (14.0%), and professional (7.0%) levels. Participants represented a wide range of sports, including soccer, basketball, tennis, football, rugby, swimming, gymnastics, dance, and athletics, with reported sport participation ranging from 1 to 31 years.

This study used a convergent mixed-methods survey design, with quantitative and qualitative data being collected at the same time. Participants completed a one-time online survey hosted on Qualtrics. Quantitative measures included demographics; physical activity assessed using the International Physical Activity Questionnaire–Short Form (Craig et al., 2003); body checking behaviors assessed using the Body Checking Questionnaire (Reas et al., 2006); positive and negative body talk assessed using the Body Talk Scale (Lin et al., 2021); body image assessed using the Multidimensional Body-Self Relations Questionnaire (Cash, 2000); and appearance-related imagery assessed using the appearance/health imagery subscale of the Exercise Imagery Inventory–Revised (Giacobbi et al., 2010).

Qualitative data was collected through multiple-response and open-ended questions examining the physical characteristics participants visualize during appearance-related imagery, associated thoughts and emotions, perceived helpfulness, and reasons for their ratings for each category of weight, size, shape. Data analysis is ongoing. Initial quantitative analyses were conducted using JASP, including descriptive statistics of participant demographics. JASP and Mplus will be used to conduct the main analyses to investigate relationships among imagery, body image, and body checking variables. These analyses will be conducted in the Fall of 2026. The qualitative data is being analyzed using content analysis. This process involves reviewing open-ended responses from all participants to apply codes consistently, identify patterns across codes, and group related codes into broader categories and themes. The qualitative analysis is currently ongoing and will be completed in the Fall of 2026.

Results: At present, 35 codes have been generated to explain participants' responses regarding their experiences using appearance imagery. Results will be presented regarding initial themes developed, including the physical characteristics visualized, associated thoughts and emotions, perceived helpfulness, and additional comments. The frequency of participants' use of appearance imagery for different purposes will also be presented. Initial results from frequency analysis of appearance imagery and the 35-code qualitative codebook indicated trends in people's views of imagery as neutral, unhelpful, or helpful. Unhelpful imaging was more often linked to negative views of body shape, size, and weight, whereas helpful imagery was regularly linked to exercise desire and appreciation of body functionality. Quantitative analysis is still ongoing.

Conclusion: This study will provide insight into the relationships of appearance-related imagery, body image, and body checking behaviors while also using individuals' subjective experiences of appearance-related imagery during exercise. The findings can help clarify how appearance-related imagery relates to body-related thoughts, emotions, and behaviors and provide direction for future research examining imagery and body image in exercise settings. Upon completion of the quantitative and qualitative analyses

in the Fall of 2026, final conclusions will be based on the integration of quantitative and qualitative findings. These findings may be useful in creating body-image interventions which encourage positive and useful imagery while helping people in recognizing and decreasing imagery that might reinforce negative body-checking habits and body dissatisfaction.



P31. Exploring preferences for formal and informal athlete leadership: Perspectives of intercollegiate athletes and coaches

Katherine Miller and Leyn Alatrach

Mentor: Katherine Hirsch-Agnew, Ph.D.

Objective: Athlete leadership in intercollegiate sport includes formal leaders, such as captains, and informal leaders who gain influence through peer relationships and credibility (Loughead et al., 2006). Despite growing interest in how these roles share leadership responsibilities (Mertens et al., 2020), little is known about how athletes and coaches distinguish between them. This study examined preferred characteristics and behaviors of both leader types.

Methods: A qualitative research design was used to examine the perceptions of athlete leadership among intercollegiate athletes and coaches. Participants included 22 individuals, including 13 intercollegiate athletes (4 formal leaders, 7 informal leaders, and 2 non-leaders), and 9 intercollegiate coaches (5 head coaches and 4 assistant coaches) representing athletic programs across multiple sports. Data was collected through one-on-one semi-structured interviews conducted virtually on Microsoft Teams. Audio recordings were transcribed verbatim and analyzed using reflexive thematic analysis (Braun & Clarke, 2006, 2016, 2019, 2021). This analysis was used to identify patterns and themes related to participants' perceptions of formal and informal athlete leadership and to explore how preferences for both leadership types compare.

Results: The themes were categorized within findings that were specific to formal athlete leadership, informal athlete leadership, and shared across both leadership types. Participants viewed formal leaders as responsible for providing structure, accountability, and representation of team standards. Formal leadership titles were often seen as recognition of previously demonstrated leadership behaviors and carried heightened expectations for consistency, discipline, authority, and role modeling. Informal leaders were described as influential contributors to team culture who reinforced formal leaders' messages, generated positive energy, fostered inclusion, and provided approachable social and emotional support. Participants frequently emphasized that effective informal leaders gained influence through trust and authentic relationships rather than positional authority. Across both leader types, athletes and coaches highlighted the importance of shared leadership, collaboration, and distributed influence. Many participants expressed a preference for multiple leaders with diverse personalities and strengths rather than relying on a single captain or leadership group.

Conclusion: Athletes and coaches viewed formal and informal leaders as serving distinct but complementary functions within intercollegiate sport teams. Formal leaders were primarily associated with accountability, structure, and representation, whereas informal leaders were linked to team culture, motivation, and interpersonal support. Although differences existed, participants reported substantial overlap in the behaviors expected of both leader types and frequently described leadership as a shared

responsibility. Findings suggest that leadership effectiveness may depend less on who is assigned formal titles and more on how multiple formal and informal leaders work together to support team functioning. Coaches may benefit from intentionally developing both formal and informal leaders' leadership abilities and creating environments that promote collaborative leadership across the team.



P32. Gender Representation in Super Bowl Advertising: A Longitudinal Content Analysis of Super Bowl Commercials (2013 to 2025)

Oanes Mahmood, Braxon Maida

Mentor: Timothy Ketelaar, Ph.D.

Objective: Super Bowl commercials are among the most widely viewed and culturally prominent forms of advertising in the United States. The present study examines whether the representation of females and males in Super Bowl advertising has changed over the past 15 years by systematically analyzing the gender of individuals appearing in commercials broadcast between 2013 and 2025. For the purpose of this presentation, these analyses were restricted to only odd number of years between 2013 to 2025.

Methods: Super Bowl commercials were identified using a publicly available advertising archive (iSpot.tv) organized by year and position within each game (e.g., whether the commercial was broadcast during the 1st quarter, 2nd quarter, etc.). Digital copies of the commercials from each year's Super Bowl broadcast were collected and stored using a standardized video-curation protocol. A sample of approximately 10 commercials broadcast across the different time periods (e.g., 1st quarter, 2nd quarter, half-time, etc.) were then selected for analysis and two trained human coders reviewed each commercial and counted the number of unique individuals with visible human faces appearing in each commercial. These faces were then classified according to apparent gender (female, male, or not categorizable). This resulted in looking at Super Bowl commercials across 7 different years.

Results: Of primary interest is the relative representation of females and males in Super Bowl commercials each year from 2013 to 2025. Preliminary analyses will describe the average number of unique human faces present in each Super Bowl commercial and the relative representation of females and males in Super Bowl advertising each year. Analyses will examine whether gender representation has changed between 2013 and 2025, focusing on changes in the proportion of identifiable individual faces classified as female versus male. Results from independently coded commercials may also compared to results generated from an AI-based tool for counting and categorizing human faces.

Conclusion: This study uses a longitudinal archive of Super Bowl commercials to examine historical changes in the visual representation of females and males in one of the most prominent forms of American advertising. The findings will provide an initial quantitative description of gender representation in Super Bowl advertising over time and establish a systematically coded dataset that can support subsequent analyses of demographic representation and comparisons between human and AI-assisted content-analysis methods.



P33. “How Much is Too Much?”: Assessing Ideal Teammate Interaction in Intercollegiate Sport

Anshu Dandu

Mentor: Katherine Hirsch-Agnew, Ph.D.

Objective: The objective of this study was to examine Canadian intercollegiate varsity athletes’ perceptions of what constitutes an ideal amount of weekly interaction time with teammates across various contexts. Additionally, the study evaluated whether different individual and contextual factors affected preferred interaction times, and explored perceived consequences of spending too little or too much time interacting with teammates.

Methods: A cross-sectional survey design was used to collect data from 165 intercollegiate U Sports varsity athletes ($M_{age} = 20.49$ years, $SD = 1.87$; 101 men, 59 women) across 14 sports. Participants completed a four-part questionnaire on Qualtrics evaluating: (1) demographic information, tenure, playing time, and living arrangements; (2) contexts of interaction with teammates (e.g., living together, classes, study hall, practice breaks, dressing room, mandatory/voluntary team events); (3) minimum and maximum desired hours per week spent with teammates in each context to foster cohesion; and (4) open-ended responses regarding perceived consequences of teammate interaction. Descriptive statistics (mean, *standard deviation*, range) were calculated for preferred interaction times. Averaged ideal interaction times (derived from minimum and maximum scores) were analyzed across demographic variables using independent-samples *t*-tests, MANOVAs, and univariate ANOVAs. An inductive content analysis is currently ongoing to identify important themes about perceived consequences of interaction frequency noted in the qualitative open-ended responses.

Results: Across all contexts, athletes reported a total mean preferred interaction time of 41.74 hours/week ($SD = 24.39$, range = 6.75 – 110.00). Athletes desired the most interaction time while living together ($M = 11.42$ hrs/wk, $SD = 14.12$) and the least during breaks at practice ($M = 3.05$ hrs/wk, $SD = 2.78$). Independent *t*-tests revealed men reported significantly higher total preferred interaction time ($M = 48.06$ hrs/wk) than women ($M = 30.56$ hrs/wk); $t(127.37) = -4.20$, $p < 0.001$, with significant differences between classes ($p = 0.008$), study hall ($p < 0.001$), practice breaks ($p = 0.032$), lifts ($p < 0.001$), dressing room ($p = 0.009$), and voluntary events ($p = 0.040$). MANOVA showed significant differences across sports; $F(90, 1080) = 2.28$, $p < 0.001$, partial $\eta^2 = 0.71$. Specifically, Canadian football athletes consistently reported higher preferred interaction times across multiple contexts compared to other sports. Living conditions significantly affected total interaction preferences; $t(136) = -7.02$, $p < 0.001$. Athletes living with teammates preferred significantly more interaction time ($M = 58.74$ hrs/wk) than those living without teammates ($M = 25.10$ hrs/wk). Differences by playing time ($p = 0.069$) and team tenure ($p = 0.069$) were non-significant. The results from the ongoing qualitative content analysis are preliminary and indicate that athletes perceive spending too little time together as leading to diminished trust, weaker social bonds, and poor team communication. Furthermore, preliminary findings show that excessive interaction is perceived to cause social burnout, interpersonal conflict, clique formation, and a lack of personal space.

Conclusion: The findings indicate that varsity athletes desire substantial weekly interaction with teammates to build and maintain team cohesion. However, ideal interaction quantities are significantly influenced by gender, sport type, and living arrangements. More specifically, men, Canadian football players, and student-athletes cohabiting with teammates express greater desires for interaction to establish stronger group identification, distinct social bonding mechanisms, and integrated daily routines. Conversely, playing

time and team tenure do not significantly alter interaction preferences, indicating that core desires for belonging remain consistent regardless of role or experience. These results highlight the importance of recognizing contextual and demographic variations in athletic environments, ensuring optimal levels of interaction that support cohesion. Furthermore, preliminary qualitative findings highlight that having an optimal balance of interaction is critical. Insufficient interaction hinders foundational trust and communication, while excessive interaction risks burnout and social friction. As qualitative analysis remains ongoing, these initial results emphasize the importance to design team environments that build trust and cohesion without leading to social burnout.



P34. Case-Based Learning for Abetalipoproteinemia

Alexander Salas

Mentor: Wendy Innis, Ph.D.

Introduction: Case-based learning serves as a vital tool for medical education institutions to develop clinical reasoning skills of students in preparation for healthcare rotations. Clinicians demonstrate the capacity to expertly integrate knowledge across multiple body systems while simultaneously interpreting patient history, physical examination findings, laboratory data, and population health considerations to formulate diagnostic and treatment decisions. To address the complexities of clinical reasoning development, this publication delivers a clinical case-based learning exercise structured on gastrointestinal malabsorption characterized by abetalipoproteinemia, a condition with significant implications that spans across the gastrointestinal, nervous, circulatory, endocrine, and musculoskeletal systems. This case reinforces students to think critically and apply multi-modal medical aspects, enabling learners to establish strategic concepts and skills expected in clinical practice. For reference, the cost expenditures associated with gastrointestinal related efforts totaled \$111.8 billion in 2021 (Peery, 2025). Thus, the incidence of malabsorption related conditions is of major concern both globally and in the United States.

Methods: The case-based learning exercise is designed for a total duration of 120 minutes, with 90 minutes allocated for group discussions along with problem solving, and the remaining 30 minutes for feedback. The feedback is incorporated within the exercise to provide the opportunity for clinician perspectives on essential pre-clinical competencies in addition to addressing key concepts, and offer general feedback for both students and faculty. Discussion groups composed of 6-8 students per group are recommended to complete the included illness script worksheet attached to this case-based learning activity. Preparatory materials for students and faculty facilitation guides are required to be distributed 1 week prior to the session.

Discussion: This project delivers the fundamental framework that medical education institutions can modify according to curriculum topics, student skill level, and institutional goals for future case-based learning. By connecting clinically relevant content with expert-informed reasoning strategies, this activity provides a comprehensive guide supporting novice students to initial clinical skills development. This publication contributes to the growing body of evidence supporting case-based learning and offers an innovative approach for cultivating the clinical reasoning competencies in educational settings that students and healthcare professionals can apply for future healthcare practice.

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Abstracts – Oral Presentations

O1. Comparative Evaluation of DLP and Extrusion-Based 3D Bioprinting for Modeling Vascularization and Pulmonary Fibrosis in Cellular Constructs

Lucas Betancourt

Mentors: Sampada Koirala, MS, Brian Billings, MS, Kunal Mitra, PhD

Background: 3D bioprinting builds living, tissue-like structures by depositing cells suspended in a supportive gel, or bioink, layer by layer. It is a growing tool for creating simplified models of human tissue that can be used to study disease and test treatments outside the body. Different printing methods carry different tradeoffs: Digital Light Processing (DLP) uses light to solidify each layer, while others physically extrude material through a nozzle. Understanding these tradeoffs is an important first step before building more complex, physiologically realistic models, including future constructs intended for microgravity research and tissue regeneration.

Objective: To compare two 3D bioprinting methods for building living tissue constructs and to identify practical considerations that inform protocol development for future, more complex models.

Methods: Using a light-based (DLP) 3D printer, we built small tissue constructs made of skin fibroblasts embedded in bioink, including a hollow channel designed to mimic a blood vessel. These constructs were exposed to high-glucose conditions to simulate metabolic stress. Separately, hollow channels were lined with endothelial cells to test whether they could attach and survive. Using an extrusion-based 3D printer, we built solid fibroblast constructs and exposed them to a signaling protein known to drive fibrosis, along with a compound designed to block that process. Constructs from both printers were assessed using fluorescent staining and confocal microscopy to evaluate cell viability and behavior.

Results: The light-based printer reliably produced constructs with an intact hollow channel, and endothelial cells successfully attached and survived along that channel. During imaging, we also observed changes in fibroblast shape suggestive of possible cellular stress, most noticeable at later timepoints, though further imaging is needed to confirm the cause. In the extrusion-printed constructs, the tissue-scarring signal was successfully induced and could be effectively blocked; this pattern was consistent across three independent batches (n=10 constructs per group per batch). Overall cell health was good, though we identified ways to improve how evenly cells are distributed in future prints.

Conclusion: This project's primary aim was less about drawing conclusions from the disease-relevant conditions tested, and more about developing practical, reproducible bioprinting protocols to support

future tissue-engineering and microgravity research. Both printing platforms showed distinct strengths and limitations depending on the structure being printed; the lessons learned here, including how bioink properties affect print outcomes, will directly inform more advanced construct designs such as multi-cell models and implementation of microfluidic perfusion systems to recapitulate in vivo microenvironments.



O2. Insertion of an Internal Joint Stabilizer Through a Posterolateral Approach for the Management of Complex Elbow Instability

Nikalus Skipp, Ana Love, Jazzlyn Gonzalez

Mentors: Miguel A. Pirela-Cruz, MD, Deana Mercer, MD

Objective: To describe the surgical technique for IJS insertion through a posterolateral approach (PLA) for complex elbow injuries involving multiple anatomical structures. The internal joint stabilizer (IJS) has emerged as an alternative to hinged external fixation, providing internal dynamic stabilization, improved patient tolerance and reduced risk of soft-tissue complications. Although the IJS is commonly inserted through a lateral approach, some injuries may need broader exposure.

Methods: The PLA provides extensile exposure to the posterior, lateral, and medial aspects of the elbow through a single incision. The approach uses the interval between the ulna and the anconeus muscle to assess the radiocapitellar and ulnohumeral joints. A structured sequence of reconstruction is followed. Coronoid fixation, radial head management, ligamentous reconstruction, and ulnar nerve decompression are performed before IJS assembly. Fluoroscopic guidance is used to ensure accurate placement of the central axis pin.

Results: The PLA facilitates single-incision management of complex elbow instability. Proper sequencing improves visualization and implant positioning, avoids interference among fixation elements, and supports a concentric ulnohumeral reduction. Once assembled, the IJS maintains stable reduction and permits controlled range of motion.

Conclusion: The PLA for IJS insertion is an effective technique for complex elbow injuries requiring access to multiple anatomical structures through a single incision. It facilitates efficient IJS placement, achieves stable fixation, and promotes early mobilization while minimizing complications associated with external fixation.



O3. Reversible Bilateral Amantadine-Associated Corneal Edema With Residual Endothelial Changes One Year After Discontinuing Medication

Shrishti Jain

Mentor: Parul Deshpande, M.S., D.N.B

Objective: Amantadine-associated corneal edema is a recognized but underappreciated adverse effect that may occur even after prolonged exposure and often resolves after drug cessation. However, clinical resolution does not necessarily reflect true endothelial recovery.

Methods: A 67-year-old woman with Parkinson's disease had been on amantadine for about 5 years. She presented with worsening vision in both eyes and was diagnosed with central corneal edema, endothelial pigmentation, guttata, and Descemet folds. Amantadine was stopped in consultation with her neurologist, and a clinical follow-up, slit-lamp imaging, and specular microscopy were conducted over one year.

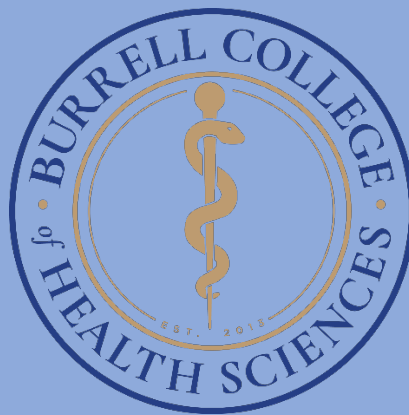
Results: The initial slit-lamp exam showed widespread corneal edema, making it hard to see the intraocular structures. After stopping amantadine, her condition improved significantly. There was complete resolution of corneal edema and restoration of corneal clarity at the one-year mark, as shown by slit-lamp images. Central corneal thickness returned to normal (OD 489 μm , OS 493 μm), and her visual acuity improved.

Despite this significant clinical improvement, some endothelial abnormalities remained. These included bilateral endothelial pigmentation and unilateral guttata with Descemet folds. Specular microscopy after one year showed ongoing and uneven endothelial dysfunction, with endothelial cell density of 770 cells/ mm^2 in the right eye and 1209 cells/ mm^2 in the left. Both eyes displayed abnormal endothelial shape, including increased variation (up to 62%) and low hexagonality ($\sim 32\%$).

Conclusion: This case presents a notable contradiction. The significant resolution of corneal edema following long-term amantadine use does not mean endothelial health improved. While slit-lamp images showed clear corneas, objective specular results confirmed ongoing endothelial dysfunction. These findings highlight the need to review medications in cases of unexplained bilateral corneal edema and stress the importance of objective endothelial assessments when planning future eye surgeries, particularly cataract surgery.



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