# Modern Human Anatomy Program

UNIVERSITY OF COLORADO
**ANSCHUTZ MEDICAL CAMPUS**

# 2025

## Capstone Project Presentations

*Monday, April 28, 2025*

# 2025 Modern Human Anatomy Program
# Capstone Poster Presentations

## April 28, 2025

**Education 2 Bridge**
**University of Colorado Anschutz Medical Campus**

| | |
|---|---|
| 12:00 PM – 1:00 PM | Lunch |
| 1:00 PM – 2:00 PM | Presentations for Session I posters |
| 2:00 PM – 3:00 PM | Presentations for Session II posters |

# Session I Poster Presenters
# 1:00 PM – 2:00 PM

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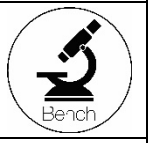
| Briana Davis | **2** | 6 | Block Party! A mixed reality haptic simulator aiding in greater success and self-reported confidence in administering Inferior Alveolar Nerve Blocks |   |
| Sydney Hayden | **3** | 7 | Putting The "See" in Cells: Developing a Neuroprotective Gene Therapy for Retinal Ganglion Cells to Prevent Vision Loss in Glaucoma |   |
| Omnia Khan | **4** | 8 | From Virtual Simulations to Real-World Application: Evaluating Fusion Software and Physical Zirconia Dental Models |   |
| Abigail Kucera | **5** | 9 | Chronic In-Vivo Imaging to Define Age-Related Alterations in Oligodendrogenesis Shows Reduction in Oligodendroglia Behaviors in Middle-Aged Mice |   |
| Andreza Lins | **6** | 10 | The Influence of Vagus Nerve Stimulation on Synapses and Microglia in a Demyelination Mouse Model |   |
| Abigail Wohlfert | **7** | 11 | Spatially Mapping Insulin/mTOR Pathway Dysregulations in Human Hippocampi from Subjects with Down Syndrome and Alzheimer's Disease |   |

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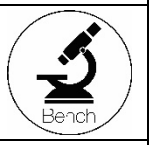
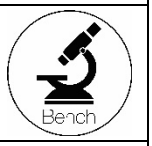
| Michelle Bui | **9** | 13 | "STAG": Spatial Transcriptomics on Angiocentric Gliomas |   |
| Jacinto Carrasco | **10** | 14 | Insulin and Glucose Dynamics and Hypothalamic Structure in Youth with Adamantinomatous Craniopharyngioma |   |
| Brendan Hinckley | **11** | 15 | Quantification of SEMA7A and CD68 Immunohistochemistry in Tumor and Peritumor Regions of Postpartum and Nulliparous Breast Cancer Using MATLAB |   |
| Almond McKinley | **12** | 16 | Returning Personhood to a Medical School Osteological Collection Utilizing Forensic Methods |   |
| Marian Ordoñez | **13** | 17 | Comparison of dental sharpness in wear series of Procolobus verus and Cercopithecus diana from Taï Forest, Cotê d'Ivoire |   |
| Shannon Sweeney | **14** | 18 | Risk Factors for Pulmonary Hemorrhage Following Percutaneous Intervention for Congenital Pulmonary Vein Stenosis |   |
| Liesel Von Imhof | **15** | 19 | Creating Visual Guides for Pediatric Brain Tumor Analysis |   |

Thank you to faculty serving on capstone committees, as these projects would not be possible without your commitment to the success of our students.

| MSMHA Student | Capstone Committee Chair | Capstone Mentor | Committee Member |
|---|---|---|---|
| **Emi Buchanan** | John Thompson, PhD | Daniel Kramer, PhD | Briauna Blezinski Johnson, MS and Adrianna Westbrook, MPH |
| **Michelle Bui** | Ernesto Salcedo, PhD | Angus Toland, MD | Maureen Stabio, PhD |
| **Maria Carpio** | Thomas Finger, PhD | Jill Kaar, PhD | Samantha Wilson, MS |
| **Jacinto Carrasco** | Ernesto Salcedo, PhD | Allison Shapiro, PhD | Brianna Smith, BS |
| **Briana Davis** | Maureen Stabio, PhD | Thomas Greany, DDS | Laurice De La Rosa, BS, RDH |
| **Sydney Hayden** | Lisa Lee, PhD | Natalia Vergara, PhD | Maureen Stabio, PhD |
| **Brendan Hinckley** | Ernesto Salcedo, PhD | Traci Lyons, PhD | Petra Dahms, PhD |
| **Omnia Khan** | Caley Orr, PhD | Thomas Greany, DDS | Paul Morse, PhD |
| **Abigail Kucera** | John Thompson, PhD | Ethan Hughes, PhD | John Caldwell, PhD |
| **Andreza Lins** | Lisa Lee, PhD | Cristin Welle, PhD | Ernesto Salcedo, PhD |
| **Almond McKinley** | Paul Morse, PhD | Caley Orr, PhD | Michala Stock, PhD |
| **Marian Ordoñez** | Caley Orr, PhD | Paul Morse, PhD | Zachary Zylstra, MS, DDS |
| **Shannon Sweeney** | Ernesto Salcedo, PhD | Jenny Zablah, MD | Catalina Vargas-Acevedo, MD |
| **Liesel Von Imhof** | Ernesto Salcedo, PhD | Todd Hankinson, MD | Eric Prince, BS |
| **Abigail Wohlfert** | John Caldwell, PhD | Ann-Charlotte Granholm-Bentley, PhD, DDS | Samuel Guzman, MD |

## Session I: 1:00 PM – 2:00 PM

## Poster #1 Maria Carpio

### *Sleeving the Knowledge Gap: Enhancing Pediatric Robotic Sleeve Gastrectomy Perioperative Education via E-health Technology*

Capstone Committee: Ernesto Salcedo (chair), Jill Kaar (mentor), Samantha Wilson

**ABSTRACT:**
Pediatric patients are being diagnosed with obesity at increased rates, leading to bariatric procedures to improve quality and longevity of life. Robotic gastric sleeves are minimally invasive in nature, involving a longitudinal cut of the fundus, leaving a long, thin banana-shaped stomach. Surgical providers in safety-net healthcare systems, serving predominately racially and ethnically minorized and low-income patients, seek to provide patients with care that decreases language barriers, considers the patient/families' level of health literacy when educating families on treatment options, and allows families to manage aspects of their own care. The use of technology via electronic health (e-health) education is a promising strategy to offer a standardized and corradiated care approach, having the capability to be personalized to each family's needs by using a patient-centered approach. The objective of this study was to pilot an e-health educational program to replace standard, provider-delivered educational care which has been found inefficient for clinicians, not ideal for families, and has led to inequitable care. We hypothesized that families who complete the e-health bariatric educational care will not differ in their readiness for surgery, anxiety/satisfaction of surgical treatment, and their readiness to complete post-surgery tasks compared to families who have provider-delivered educational care. In partnership with Inside Out Medicine (IOM) and the Children's Hospital Colorado (CHCO) media team, we created a self-service e-health educational platform for patients undergoing bariatric surgery. All new patients presenting at the CHCO bariatric surgery clinic (Jan-March 2025) were sent links via text message before (pre-test) and after (post-test) their initial clinical visit to a web-based data collection tool to assess surgery readiness, anxiety about the surgery, and satisfaction of the knowledge they were provided by the surgical team. The implementation of the e-health program (One-4-ALL) was designed to guide patients undergoing bariatric surgery through their 6-month pre-surgical education. Educational materials a) improved knowledge on what to expect during surgery, b) reinforced their postoperative lifestyle changes and c) encouraged successful patient-outcomes for 30 days post-surgery. This approach has shown an improvement upon our current standard education as the web-based approach offers the benefits of education in a family's preferred language and at their own pace. Additionally, the web-based platform has shown a decreased burden on clinicians to provide standard education and instead allowed them to tailor education to the specific needs of the family.

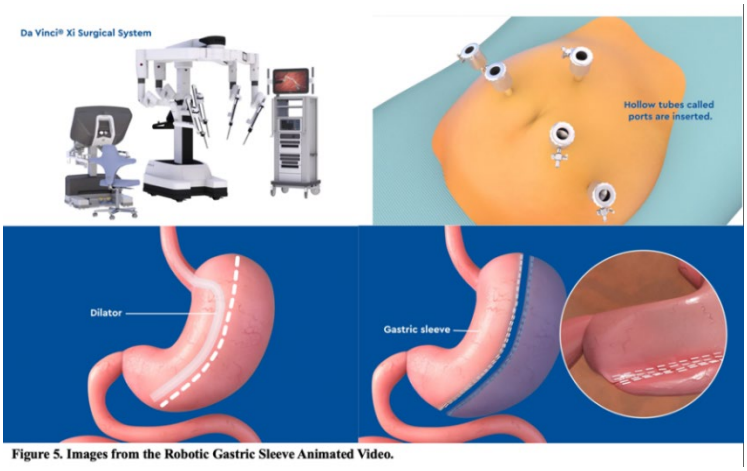


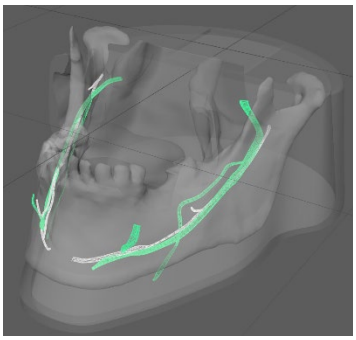

Figure 5. Images from the Robotic Gastric Sleeve Animated Video.

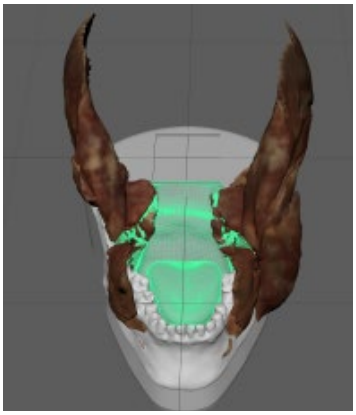
## Poster #2 Briana Davis

### *Block Party! A mixed reality haptic simulator aiding in greater success and self-reported confidence in administering Inferior Alveolar Nerve Blocks*

Capstone Committee: Maureen Stabio (chair), Thomas Greany (mentor), Laurice De La Rosa

**ABSTRACT:**
The inferior alveolar nerve block (IANB) is a challenging anesthetic technique to master in dentistry. This holds for dental students, and new and practicing dentists as success and confidence performing the IANB have been irrefutably low. The literature delineates a significant gap between written and practical assessment performance among injection naïve dental students. Currently the University of Colorado requires dental students to perform two laboratory sessions to practice these local anesthetic techniques on each other. This quality improvement study aims to implement an improved mixed-reality haptic model for second-year dental students to practice before their scheduled laboratory sessions with fellow dental students. We hypothesize that students who use the improved simulator before practicing on a student partner will demonstrate greater anesthetic success and higher self-reported confidence than those who use the simulator after partner practice. A total of 71 second-year dental students volunteered to practice injections with an improved IANB haptic simulator either before or after practicing the technique on their student partners. The students were divided into groups A and B. Group A practiced with the simulator before practicing on their student partners (n=48). Group B practiced with the simulator after their first clinical laboratory session (n=23). Self-reported confidence and injection accuracy were assessed during the IANB simulator practice and the laboratory session for Group A and during the laboratory session for Group B. The success of the IANB during the laboratory session was subjectively through self-reported confidence and objectively through the student partner disclosing experiencing numbness in the target neural pathway through a response to stimulus over the ipsilateral canine root eminence. Group A achieved successful anesthesia in 74.4% of cases, while Group B succeeded in 15.0% ($p < 0.001$). Both groups felt more confident overall when performing an IA on other students versus on patients. When performing the patient-based (PT) IANB increased from 4.76 to 6.68 ($p < 0.001$). Group B demonstrated improvements in confidence for patient-based injections from 4.55 to 7.98 ($p<0.05$). Measurements were obtained using a 10-point Visual Analog (VAS) scale. In conclusion our hypothesis that Group A will perform better in anesthetic success and showcase improved self-reported confidence was supported by our data. This proved consistent with the updated 3Dimensional model improvements and user interface implemented in this study.





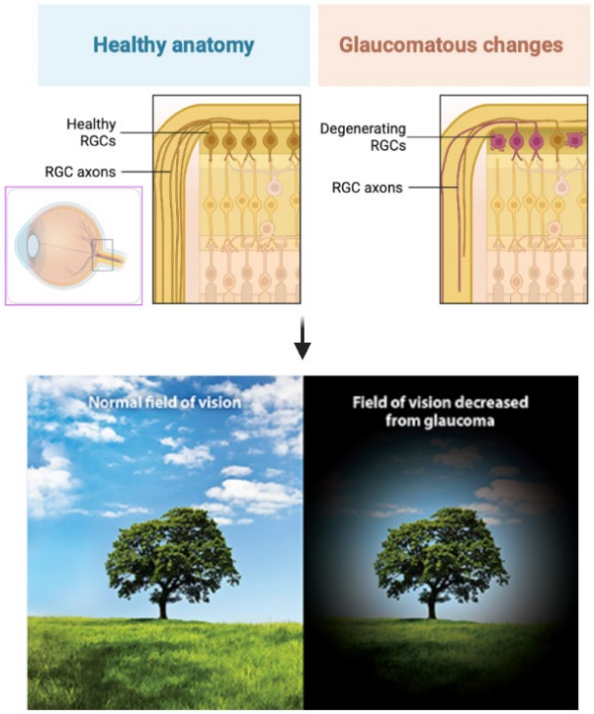
## Poster #3 Sydney Hayden

### *Putting The "See" in Cells: Developing a Neuroprotective Gene Therapy for Retinal Ganglion Cells to Prevent Vision Loss in Glaucoma*

Capstone Committee: Lisa M.J. Lee (chair), M. Natalia Vergara (mentor), Maureen Stabio

**ABSTRACT:**

Glaucoma is the leading cause of irreversible blindness in the world, affecting over 80 million people worldwide. It is a disease characterized by the death of retinal ganglion cells (RGCs) and the optic nerve, often associated with increased intraocular pressure. Since RGCs do not regenerate when injured, it is critical to develop therapies targeted for RGC survival. Previous studies have validated a gene therapy approach that delivers HSPB1, a gene encoding small heat shock protein with neuroprotective properties, to RGCs in animal models of glaucoma. Though those results were promising, it is important to determine how human cells will respond to this gene therapy, so that it can be further developed for clinical trials. Therefore, our goal is to evaluate the neuroprotective properties of HSPB1, delivered via adeno-associated virus serotype 2 (AAV-2), on the survival of human RGCs. To accomplish this, we cultured RGCs in vitro by dissociating retinal organoids (ROs) that were grown from human induced pluripotent stem cells (hiPSCs). We evaluated the composition of our cultures by immunofluorescence (IF) at 2 weeks post-dissociation and confirmed a robust expression of the pan-RGC marker RBPMS in 99% of the DAPI stained cells. Moreover, we identified the presence of various RGC subtypes, including DSGCs, ON-OFF RGCs, and ipRGCs in our cultures. We then transduced RGCs with either AAV2-empty vector (control) or AAV2-HSPB1 on day 7 post-dissociation and performed IF with anti-Hsp27 at 2 weeks post-dissociation. Our results confirmed a high transduction efficiency and the ability of the vector to deliver the gene. To evaluate the efficacy of this treatment approach, we challenged RGC cultures, transduced with either vector, using $H_2O_2$ to induce oxidative damage, or a cytokine mixture consisting of IL-1β, TNF-α and IFN-γ to induce an inflammatory insult. Using a Live/Dead assay, we found that the HSPB1-transduced cells had a higher survival rate compared to the control cells. Finally, we tested our gene therapy in vivo in a mouse model of optic nerve crush (ONC), and our preliminary results suggest a protective effect of this treatment on the resident RGCs. Together, these results indicate that HSPB1 has neuroprotective effects over human and mouse RGCs exposed to glaucoma-related insults, and thus, AAV2-HSPB1 may be a viable gene therapy to protect against RGC death in patients with glaucoma. Future studies characterizing RGC subtype-specific survival and expression of AAV2-HSPB1 would be valuable to understand how the mosaicism of the retina may be affected using this gene therapy.



## Poster #4 Omnia Khan

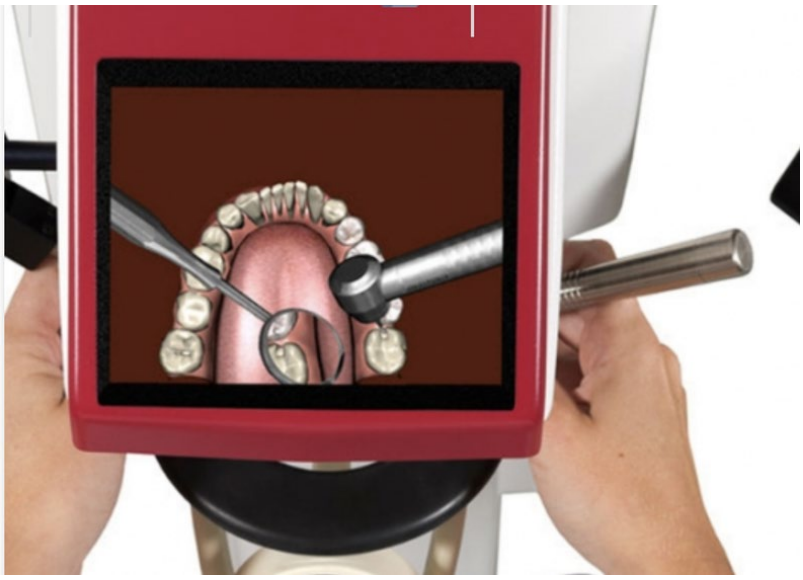
### *From Virtual Simulations to Real-World Application: Evaluating Fusion Software and Physical Zirconia Dental Models*

Capstone Committee: Caley Orr (chair), Thomas Greany (mentor), Paul Morse

**ABSTRACT:**

One of the most common procedures performed by dentists is the filling of cavities, in which the affected region of the tooth is prepared (typically with drilling) before the filling material is applied. Cavity preparations are thus considered an essential procedure for dental students to master. Dental education traditionally relies on experience and visual cues from established dentists and academic professionals, resulting in inconsistent treatment outcomes and subjective grading for dental students on their cavity preparations. These inconsistencies may confuse dental students about the requirements for cavity preparations and contribute to ambiguity in dental school and later in practice regarding what should be considered standard when preparing a tooth. In this study, we primarily focus on increasing the axial wall depth during cavity preparation, a factor that can affect a tooth's strength and longevity post-filling but has received little attention. The objective of this project is to develop a standardized reference tool for cavity preparations to minimize variability and improve both educational and clinical outcomes for dental students during training and in their future practice.

Using a virtual dental trainer (Haptics Simodont), nine virtual preparations were performed on a lower left bicuspid tooth to simulate Class II cavity restorations. In each successive preparation, the mesial axial wall was deepened by approximately 1 millimeter (mm) until the final one passed through the distal surface of the tooth. These virtual preparations were then uploaded to Fusion software (FEA) for finite element structural analysis, estimating the tooth's stability in load-bearing capacity based on alterations to axial wall depth—essentially simulating bite forces to identify fracture points and evaluating the overall strength of the tooth. Practical experiments were then performed to determine whether real-life teeth would fracture similarly to the predictions made by FEA on virtual models. The virtual preparations were milled in zirconia, secured in steel fixtures, and tested under an Instron machine, which applied load pressures comparable to those in FEA. The physical strength (fracture points) of the zirconia models closely aligned with the strength predictions made in FEA, supporting that we may move forward with building a virtual library of ideal cavity preparations for all teeth in the human mouth, serving as a reliable reference for assessment in dental education and as a guide for clinicians in real-world practice.

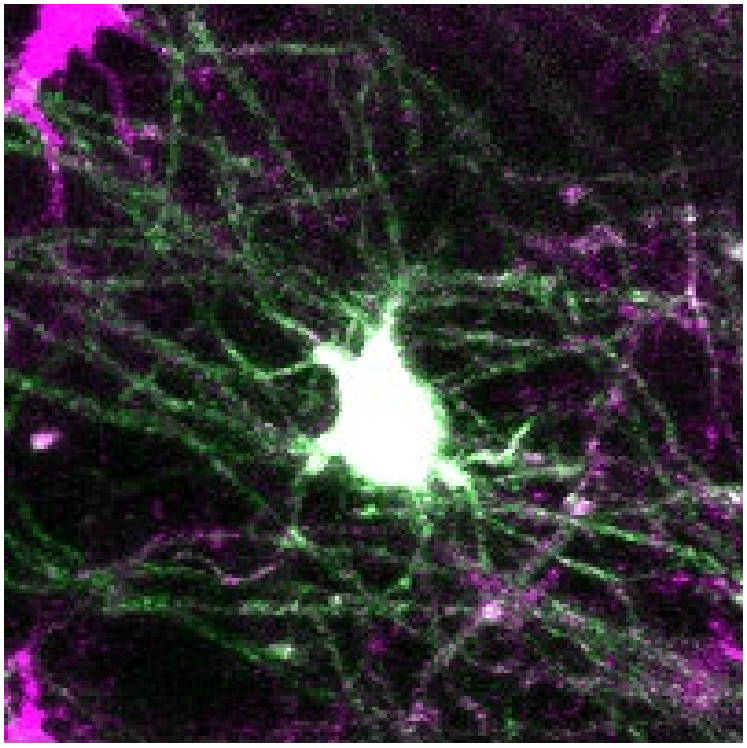


## Poster #5 Abigail Kucera

### *Chronic In-Vivo Imaging to Define Age-Related Alterations in Oligodendrogenesis Shows Reduction in Oligodendroglia Behaviors in Middle-Aged Mice*

Capstone Committee: John Thompson (chair), Ethan Hughes (mentor), John Caldwell

**ABSTRACT:**
Cognitive decline occurs with age in part due to myelin degradation and oligodendrocyte loss. Oligodendrocytes are myelin forming cells of the central nervous system and enwrap neuronal axons with myelin sheaths to increase the speed of action potentials. Oligodendrocyte precursor cells (OPCs) generate new myelinating oligodendrocytes throughout life in a process called oligodendrogenesis. There's reduced oligodendrogenesis in the aging brain, and OPCs isolated from aged brains have reduced differentiation potential in vitro. However, the mechanisms of age-related reduction in oligodendrogenesis are unknown. We performed longitudinal in vivo two-photon imaging of oligodendroglia in healthy (n = 5) and demyelinated middle-aged mice (n = 7). Then, we used real-time fate mapping to assess differentiation, proliferation, and survival of OPCs in the primary motor cortex of the middle-aged mouse brain. We compared the rate of differentiation and survival across age and found differentiation and survival of OPCs are reduced in aged animals, suggesting that both processes are impaired in the aged brain. Finally, to understand how OPCs respond to demyelinating injury in the middle-aged brain, we fed mice a cuprizone diet for 3 weeks to induce oligodendrocyte loss. We found cuprizone-induced oligodendrocyte loss in middle aged mice and a subsequent regeneration of lost oligodendrocytes. We found the rate of OPC differentiation is unchanged during regeneration; however, OPC survival after differentiation is increased compared to age-matched controls. Our data suggest that aging may affect multiple aspects of oligodendrogenesis, including proliferation, differentiation, and survival of oligodendroglia in the context of health and disease.

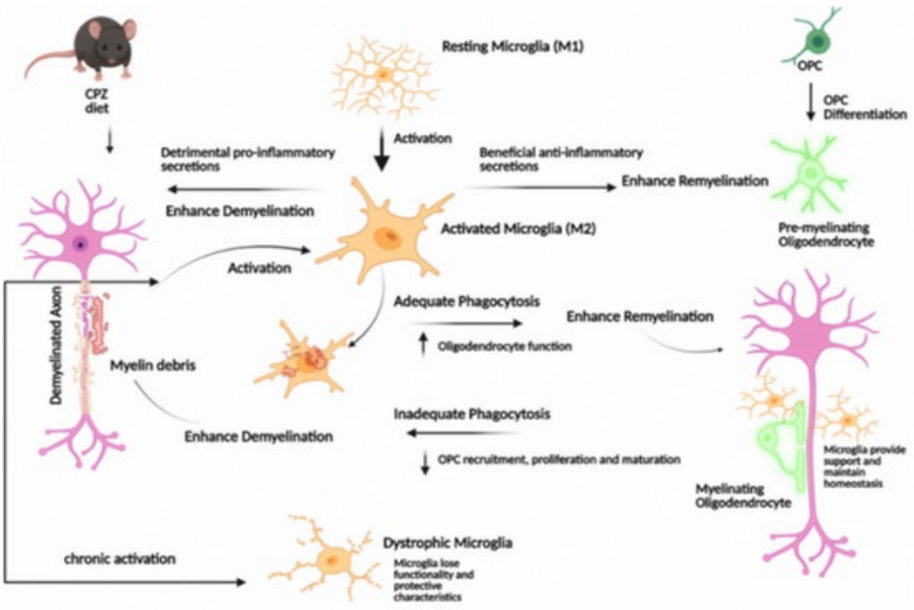


# Poster #6 Andreza Lins

## The Influence of Vagus Nerve Stimulation on Synapses and Microglia in a Demyelination Mouse Model

Capstone Committee: Lisa M.J. Lee (chair), Cristin Welle (mentor), Ernesto Salcedo

**ABSTRACT:**
Multiple Sclerosis (MS) is an autoimmune disease of the central nervous system, marked by progressive axonal demyelination, neurodegeneration, and chronic neuroinflammation.[2] [6] Beyond demyelination, MS pathology involves the persistent release of inflammatory cytokines, synaptic dysfunction, and chronic activation of microglia—the resident immune cells of the CNS—in neurodestructive states.[7] [1] The vagus nerve, a key regulator of the autonomic nervous system and the neural inflammatory reflex, has recently emerged as a potential therapeutic target to mitigate neuroinflammation via vagus nerve stimulation (VNS). This study investigated the effects of long-term (7 days) and short-term (single treatment) VNS on synaptic density and microglial activity in the primary motor cortex of a cuprizone-induced demyelination mouse model. We hypothesized that long-term VNS would increase microglial engulfment and promote neuroprotective microglia, while VNS would have no effect on synapse density. Using immunohistochemistry, confocal microscopy, and automated image analysis, we assessed synaptic density and microglial activity across animals receiving short-term (n = 4) and long-term (n = 2) VNS following a 3-week demyelination period with the dietary toxin cuprizone. Two-tailed t-tests were used for analysis. Results suggest cuprizone-mediated demyelination and VNS do not affect synapse density; however, they do affect microglial properties. These results pave the way for further investigation into the mechanisms by which VNS influences synapse density, microglial activity, and other pathways affecting CNS function, refining its therapeutic potential for MS.

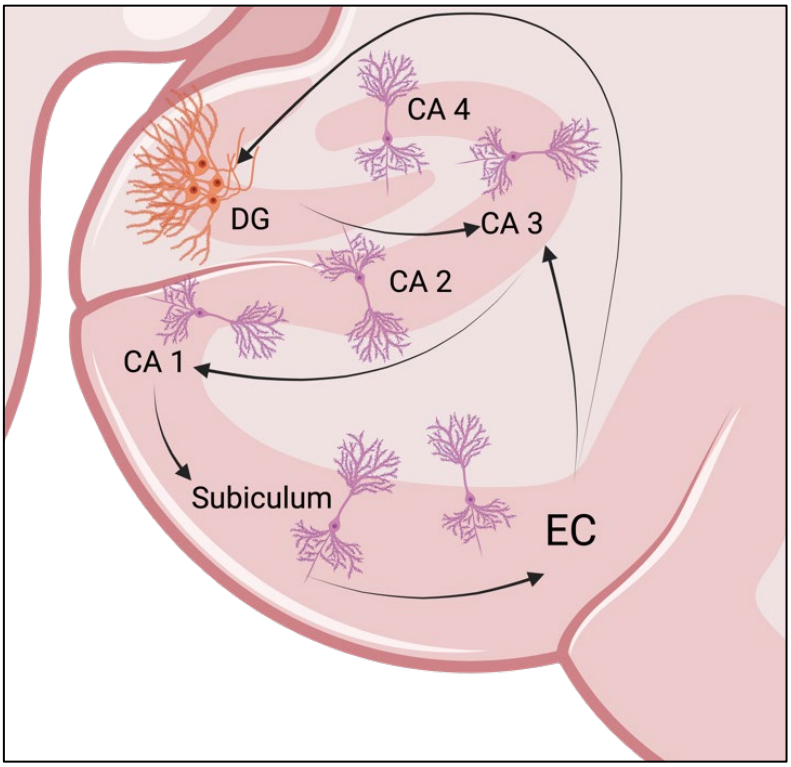


## Poster #7 Abigail Wohlfert

### *Spatially Mapping Insulin/mTOR Pathway Dysregulations in Human Hippocampi from Subjects with Down Syndrome and Alzheimer's Disease*

Capstone Committee: John Caldwell (chair), Lotta Granholm-Bentley (mentor), Sam Guzman

**ABSTRACT:**
Down syndrome (DS) is a chromosomal disorder associated with systemic dysregulations and increased risk for age-related disorders, particularly Alzheimer's disease (AD). This vulnerability may stem from the triplication of the amyloid precursor protein (APP) gene or disruptions in signaling pathways such as mTOR, which regulates cell growth and survival. Dysregulations of upstream mTOR regulators, like insulin and PI3K, have been linked to the accumulation of amyloid-beta (Aβ) plaques and neurofibrillary tangles, which are hallmarks of AD. However, the role of mTOR signaling in DS-associated AD (DS-AD) remains unclear. In this study, we employed spatial transcriptomics (ST) and immunohistochemistry (IHC) targeting phospho-mTOR (Ser2448) and phospho-S6 (Ser240/244) to examine insulin/mTOR signaling in post-mortem hippocampi from individuals with DS-AD versus healthy controls (HC). We hypothesized that transcriptional activity and protein activation within this pathway would show region-specific alterations in DS-AD. Our data revealed specific upregulations and downregulation of insulin/mTOR signaling, particularly in the dentate gyrus (DG), CA3/CA4 regions, and subiculum. Immunohistochemistry showed significant increases in phospho-mTOR density in the DG of DS-AD versus HC ($p = 0.0052$) and AD ($p = 0.0057$), and elevated phospho-S6 staining in the CA4 region of DS-AD versus DS ($p = 0.02$). Through integration of IHC phosphorylation data with ST profiles, we gain valuable insight into the altered states of key signaling areas within the insulin/mTOR pathway, highlighting region- and cell-specific molecular changes that may underlie hippocampal dysfunction in DS-AD. These changes suggest signs of insulin resistance, specifically in the DG, that may impair neurogenesis, learning, and memory.



## Session II: 2:00 PM – 3:00 PM

## Poster #8 Emi Buchanan

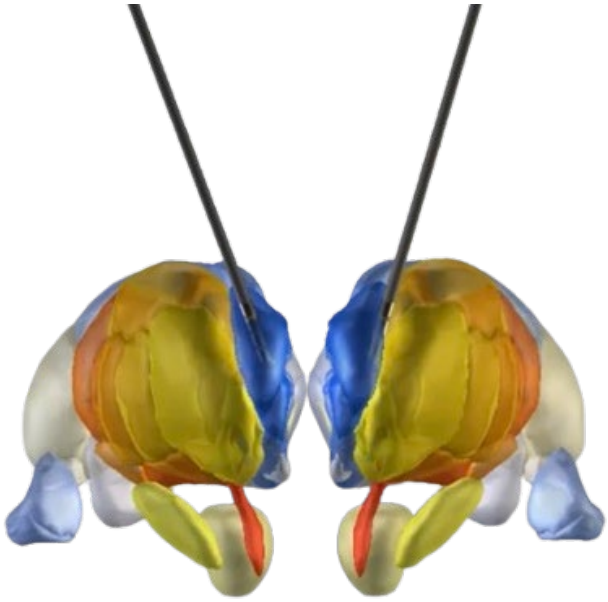

### *Evaluation of Atlas-Based Post-Operative Reconstruction of Anterior Nucleus of the Thalamus: A Treatment for Drug-Resistant Epilepsy*

Capstone Committee: John Thompson (chair), Daniel Kramer (mentor), Briauna Blezinski Johnson, Adrianna Westbrook

**ABSTRACT:**
Epilepsy is a chronic neurological disorder affecting 50 million people worldwide. Deep brain stimulation (DBS) of the anterior nucleus of the thalamus (ANT) is a safe and effective treatment for drug-resistant epilepsy (DRE) when other options are exhausted1. However, the optimal location within the ANT for maximizing clinical efficacy remains unclear. This study investigates atlas-based methods for reconstructing DBS electrodes to inform optimal therapeutic contact location for seizure reduction in adults with DRE.

Twelve patients with DRE who underwent ANT-DBS were included. Pre- and postoperative scans were used to estimate contact location using two methods: 1) a template-space approach and 2) a subject-space approach. Within these approaches, the Illinsky and Morel thalamic atlases were used. Statistical analysis determined which combination of atlas and approach most effectively localized therapeutic contacts. The most effective method was then used to identify target structures associated with favorable outcomes.

Localization analysis revealed significant differences in target structure overlap across atlases ($F(2,1337)= 8.76$, $p = <0.001$). Post-hoc comparisons revealed that the Morel atlas in template-space yielded the highest average overlap (Morel-Template = 68.66%, Illinsky-Template = 14.40%, Morel-Subject = 8.51%). Although seizure reduction was not significantly linked therapeutic contact location, anatomical trends were observed.



These findings suggest that DBS efficacy involves a complex interplay between ANT localization. The Morel atlas in template-space was the most effective predictor of target overlap. This study enhances understanding of ANT targeting – particularly the mammillothalamic tract – for improving outcomes and guiding DBS planning for the optimization of this life-changing procedure.

## Poster #9 Michelle Bui

### *"STAG": Spatial Transcriptomics on Angiocentric Gliomas*

Capstone Committee: Ernesto Salcedo (chair), Angus Toland (mentor), Maureen Stabio

**ABSTRACT:**
Angiocentric glioma is a rare, low-grade brain tumor of children and young adults characterized by its strong association with drug-resistant epilepsy. Angiocentric gliomas are frequently driven by MYB::QKI fusions, a key oncogenic event. We report the clinical and pathologic findings in four cases, incorporating spatial transcriptomics in two viable cases to compare to a low-grade glioma. The mean age of diagnosis was 8.3 years (range 3-20 years). All patients had a history of drug-resistant epilepsy. Two tumors were in the frontal lobe and one tumor each was present in the temporal and occipital lobes. Histologically, the tumors were characterized by diffuse growth and prominent perivascular tumor cell arrangements. All cases were negative for OLIG2, positive for GFAP, and showed perinuclear dot-like expression of EMA. MYB::QKI fusion was confirmed in a single case via next-generation sequencing. Compared to the control low-grade glioma, spatial transcriptomics by 10X Genomics Visium HD revealed homogenous tumors with significantly upregulated MYB, QKI, and AKT1 expression. MYB appears to promote proliferation, potentially via AKT1-mediated cell cycle dysregulation. Both MYB and AKT1 are involved in the mTOR and MAPK pathways. The tumor-rich areas also show over-expression of the MTOR gene. Over-expression of mTOR was confirmed with phospho-S6 immunohistochemical staining. This study underscores the utility of spatial transcriptomics in dissecting the microenvironment of epileptogenic gliomas. By delineating gene expression patterns within the tumor and adjacent parenchyma, this approach offers insights into tumor biology, epileptogenesis mechanisms, and potentially informs future diagnostic and therapeutic strategies

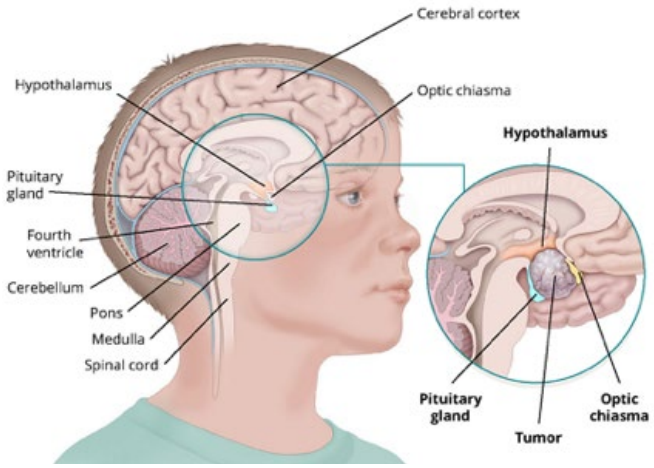

# Poster #10 Jacinto Carrasco

## *Insulin and Glucose Dynamics and Hypothalamic Structure in Youth with Adamantinomatous Craniopharyngioma*

Capstone Committee: Ernesto Salcedo (chair), Allison Shapiro (mentor), Brianna Smith

**ABSTRACT:**

Background: Adamantinomatous Craniopharyngioma's (ACP) are benign brain tumors that largely affect the pediatric population (ages 5-15). ACP tumors are known to impinge on surrounding structures that can influence overall metabolic health, notably the hypothalamus, which is frequently damaged in the process of surgical or radiologic intervention. However, the impact of treatment for ACP, and possible reduction of hypothalamic volume via surgical or radiologic damage, on key metabolic functions, like insulin secretion and glucose homeostasis remains unclear. Thus, the goal of the current project was to determine how hypothalamic volume of those treated for ACP relates to insulin secretion and glucose response during a metabolic stimulus.




Methods: Structural brain scans (T1-weighted MPRAGE) were completed on youth with and without ACP via magnetic resonance imaging (MRI). Using a study-developed segmentation protocol, hypothalamic volume was estimated from structural scans via manual segmentation in the software program, ITK-SNAP. In ACP youth only, insulin and glucose were measured at 5 timepoints during an oral glucose tolerance test (OGTT). From the OGTT, insulin and glucose area under the curve (AUC) and the homeostasis model assessment-estimated insulin resistance (HOMA-IR) score were derived. Hypothalamic volume was compared between youth with and without ACP via independent t-test, and in ACP youth only, Pearson correlations were estimated between hypothalamic volume and insulin and glucose AUCs and HOMA-IR.

Results: Six youth with ACP (17 yrs $\pm$ 5.12) and eleven youth without ACP (15 yrs $\pm$ 1.87) were included in this study. No significant difference was found in hypothalamic volume between ACP and non-ACP youth (683 $mm^3 \pm 252.2$ $mm^3$ vs. 737.3 $mm^3 \pm 177.1$ $mm^3$, p-0.72). However, within ACP youth, insulin and glucose responses were overwhelmingly abnormal, and hypothalamic volume was inversely correlated with insulin (r = -0.179) and glucose (r = -0.486) AUC.

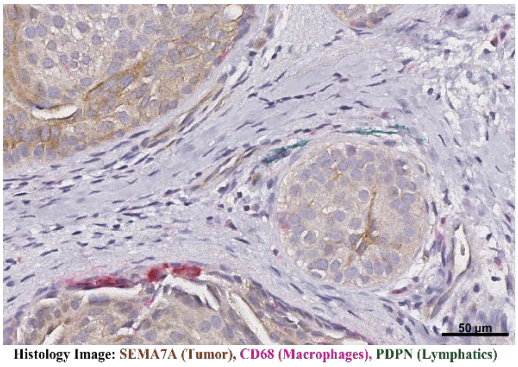
Conclusion: In this small clinical sample of ACP youth, despite similar hypothalamic volume to non-ACP peers, youth having been treated for ACP demonstrate significantly disrupted metabolic parameters related to degree of hypothalamic damage. Further work is needed in larger cohorts to fully characterize hypothalamic volume and insulin and glucose dynamics in ACP youth to better inform interventions for metabolic comorbidities across the life span.

# Poster #11 Brendan Hinckley

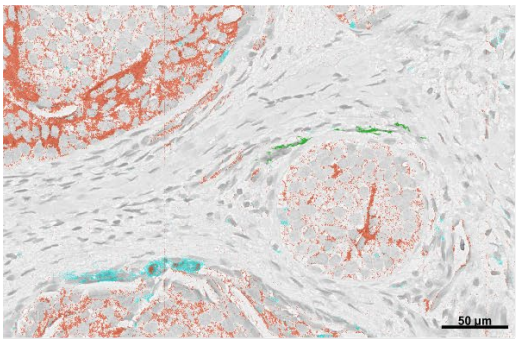
## *Quantification of SEMA7A and CD68 Immunohistochemistry in Tumor and Peritumor Regions of Postpartum and Nulliparous Breast Cancer Using MATLAB*

Capstone Committee: Ernesto Salcedo (chair), Traci Lyons (mentor), Petra Dahms

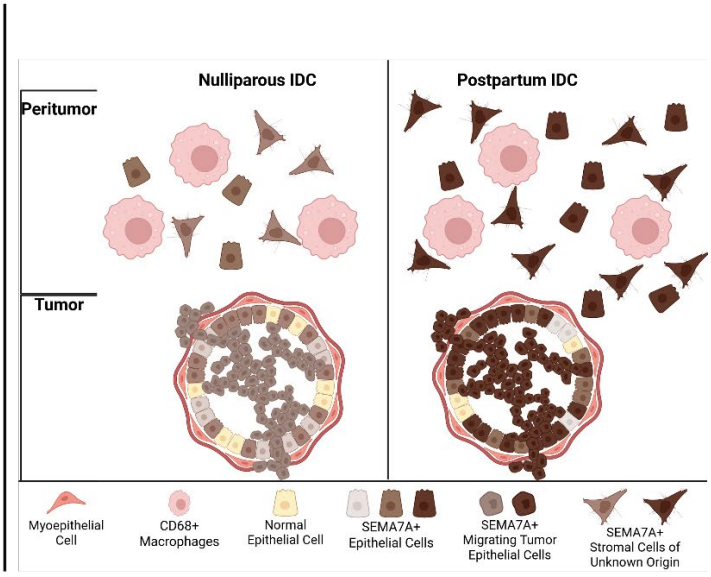
**ABSTRACT:**
Postpartum breast cancer (PPBC) is a distinct and aggressive subtype of breast cancer that arises following childbirth. Although pregnancy ultimately reduces lifetime risk, it transiently increases risk in the years after delivery, during which diagnoses are associated with rapid progression and poor prognosis. Our lab investigates histological markers linked to this risk, including semaphorin 7a (SEMA7A), the macrophage marker CD68, and the lymphatic marker PDPN. However, current histological methods are time intensive. To address this, we developed and validated a MATLAB-based segmentation algorithm for triple-stained PPBC slides, offering a more efficient and objective approach to analyzing complex tissue microenvironments. Validation was performed visually and by reproducing known SEMA7A expression trends. We applied this tool to analyze intratumor and peritumor regions in PPBC and nulliparous (never pregnant) breast cancer samples. Consistent with previous results, SEMA7A expression in tumor regions was significantly higher in PPBC compared to nulliparous patients in both normal-adjacent ducts and invasive ductal carcinoma (IDC) tumors ($p = 0.029$ and $p = 0.005$, respectively). In the peritumor region, CD68 levels did not differ significantly between parity groups; however, SEMA7A expression was significantly elevated in PPBC IDC samples ($p = 0.017$). This may reflect greater tumor cell infiltration into surrounding tissue or increased SEMA7A expression by stromal cells, which our method cannot distinguish from tumor cells. These findings may indicate altered macrophage phenotype or function in PPBC. Together, our results support a unique peritumoral immune environment in PPBC and highlight the utility of MATLAB-based segmentation for revealing clinically relevant tissue features.




Histology Image: SEMA7A (Tumor), CD68 (Macrophages), PDPN (Lymphatics)




MATLAB Labels: SEMA7A (Tumor), CD68 (Macrophages), PDPN (Lymphatics)



# Poster #12 Almond McKinley

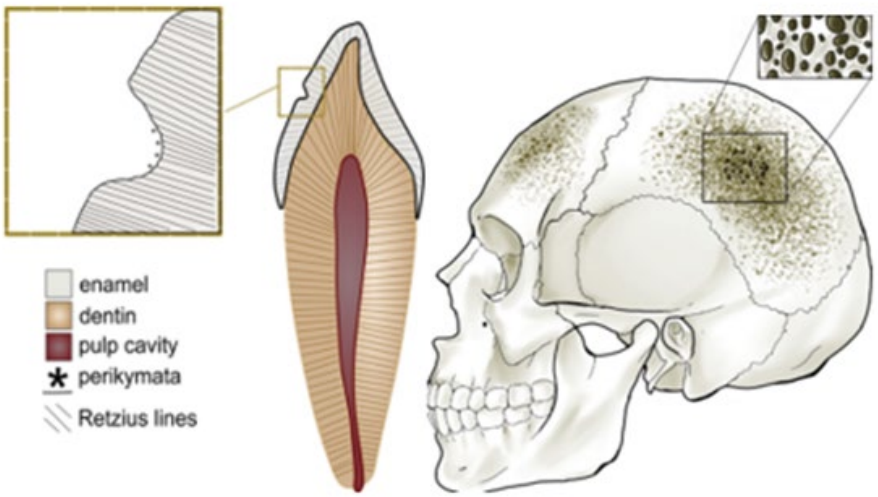
## *Returning Personhood to a Medical School Osteological Collection Utilizing Forensic Methods*

Capstone Committee: Paul Morse (chair), Caley Orr (mentor), Michala Stock

**ABSTRACT:**
This project critically examines a 20th-century skeletal collection acquired by the University of Colorado School of Medicine through biological supply companies during the 1970s and 1980s, many of which sourced remains via the India bone trade. Lacking provenience, consent, and cultural documentation, these remains exemplify broader issues in the history of anatomical sourcing and the commodification of human bodies. In light of contemporary ethics, the project seeks to reframe the collection through a dual framework of respectful documentation and rehumanization.

We established an anthropological protocol centered on reassociating disarticulated remains, adapting inventory and forensic analysis forms, and developed an accession numbering system to establish a comprehensive osteological record. Biological profiles were constructed using established methods to conduct age-at-death estimation using dental development and suture closure, sex estimation using cranial traits, and ancestry assessment via both non-metric and metric (FORDISC) analyses. Preliminary findings from 208 cranial elements reveal diverse origins, with results highlighting the inadequacy of existing forensic reference datasets—particularly for individuals historically marginalized in global skeletal trade networks and underrepresented in forensic databases.

By integrating forensic methods with a bioethical framework, this project challenges traditional views of skeletal collections as anonymous data sources. Instead, it emphasizes personhood and historical context, advocating for a pedagogical shift in anthropological, anatomical and medical education rooted in empathy, transparency, and consent.




*Dabrowski, 2021 – for the tooth, Ferrando-Bernal, 2023 – for the skull*

## Poster #13 Marian Ordoñez

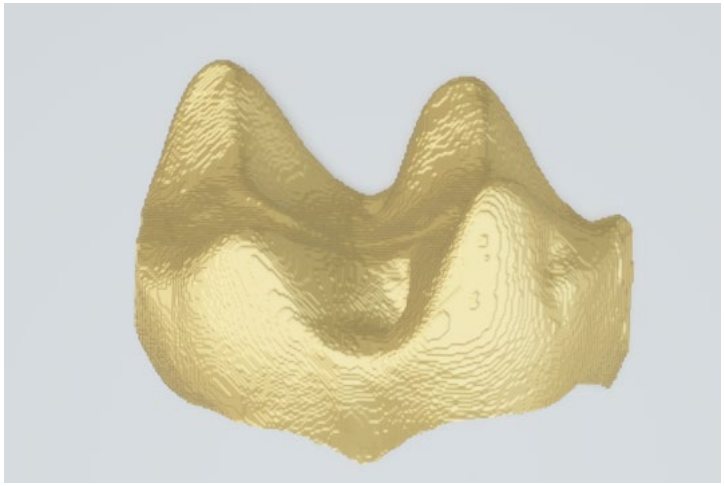
### *Comparison of dental sharpness in wear series of Procolobus verus and Cercopithecus diana from Taï Forest, Cotê d'Ivoire*

Capstone Committee: Caley Orr (chair), Paul Morse (mentor), Zachary Zylstra

**ABSTRACT:**

This study focuses on Procolobus verus and Cercopithecus diana, two sympatric monkey species that have been the focal point of research for many years within the Taï Forest, Cotê d'Ivoire, one of the only large stretches of forest free from human disturbance remaining in West Africa. For over 15 years, researchers have carefully studied the dietary behaviors of all eight monkeys in the Taï Forest. The feeding data can be compared to the dental morphology exhibited by each species from specimens collected in the Tai Forest after individuals die from natural causes.

The goal of this study was to compare the occlusal wear between folivorous (P. verus) and frugivorous (C. diana) species, as well as quantify the occlusal sharpness within each. Wear and sharpness were then compared within each species to see how dental sharpness-a key attribute for processing tough dietary items-was affected by wear. Second molars were segmented from micro-CT scans of each species, and surfaces were generated and modified following the established protocol from previous research. Wear was measured as the dentine exposure ratio (DER) in occlusal view from 2D specimen images, while sharpness was quantified as convex Dirichlet normal energy (DNE) using the R package in molaR. A Kruskal—Wallis test found a significant difference in DER between the two species ($p=0.007$), establishing that folivorous P. verus was more worn the frugivorous C. diana. A Kruskal-Wallis test for difference in DNE between the two species was also significant ($p<0.001$), indicating that P. verus had a sharper occlusal surface on average than that of C. diana. While DNE does not change with increasing DER in C. diana ($p=0.158$), DNE in P. verus follows a complex relationship with wear, initially decreasing but dramatically increasing as wear does, to levels of sharpness equivalent to those of unworn teeth. A regression of DNE against DER within P. verus is highly insignificant (p=o.405), however, the relationship between the variables is.



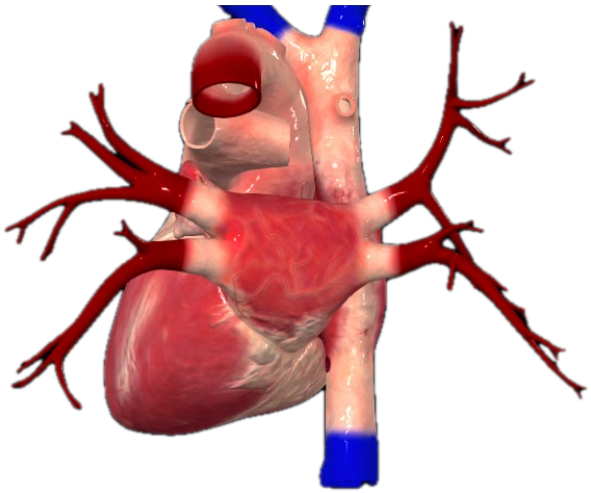
## Poster #14 Shannon Sweeney

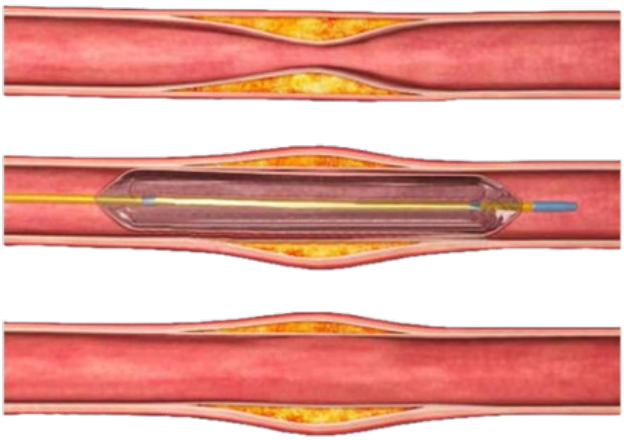

### *Risk Factors for Pulmonary Hemorrhage Following Percutaneous Intervention for Congenital Pulmonary Vein Stenosis*

Capstone Committee: Ernesto Salcedo (chair), Jenny Zablah (mentor), Catalina Vargas-Acevedo

**ABSTRACT:**
Pulmonary hemorrhage (PHm) is a rare but potentially fatal complication that has recently emerged as the most common adverse event in pediatric patients undergoing percutaneous intervention for pulmonary vein stenosis (PVS). The pathophysiology of PHm in this context remains poorly understood, largely due to the complexity and variability of pulmonary venous anatomy and physiology. In healthy individuals, four pulmonary veins return oxygenated blood to the left atrium; however, anatomical variants are common and can significantly alter pulmonary hemodynamics. PVS patients often present with these variations and with disrupted venous drainage, leading to widespread pulmonary vascular remodeling. Notably, unilateral pulmonary vein stenosis has been shown to cause bilateral lung injury due to flow redistribution and increased venous pressures across the pulmonary vasculature.

This retrospective study analyzed 199 PVS catheterization procedures performed between March 2020 and February 2024 to identify predictors of PHm. PHm occurred in 7.9% of cases, with a median patient age of 25 months. Significant risk factors included the number of involved veins, four-vessel disease, and the need for ventilatory support. For each additional vein involved at diagnosis, the odds of PHm increased 2.3 times, while patients with four-vessel disease had 8.12 times higher odds of PHm. Post-intervention, the need for ventilatory support increased 21.1-fold in PHm cases. However, the use of cutting balloons during intervention significantly reduced the likelihood of requiring ventilatory support post-procedure. These findings highlight key anatomical and clinical risk factors for PHm in pediatric PVS patients and underscore the need for individualized procedural planning. Further research is necessary to refine interventions and mitigate PHm risk in this vulnerable population.





# Poster #15 Liesel Von Imhof

## *Creating Visual Guides for Pediatric Brain Tumor Analysis*

Capstone Committee: Ernesto Salcedo (chair), Todd Hankinson (mentor), Eric Prince

**ABSTRACT:**
Reviewing medical images to identify and diagnose brain tumors requires advanced neuroanatomical knowledge and a detailed understanding of tumor formation. However, variations between brain structures and pathology exist, and disagreements on shape, size, and classifications of ambiguous tumors or anatomical structures can arise even among highly trained physicians. Artificial intelligence (AI) is rapidly being integrated into medicine. For example, AI is currently being used to assist in preoperative neurosurgical and radiation planning to treat brain tumors. AI can also be used to identify structures of the brain, even those affected by tumor invasion. However, similar to human raters, AI raters may also fail to consistently identify ambiguous or altered structures. In order to compare the success rate of an AI model to a human rater, we need to first quantify the level of variation in and between human raters (intra- and inter-rater variability). Eye tracking equipment can quantify a user's evaluation of an image. This data has previously been shown to be correlated with the acquisition of pattern recognition skills critical in evaluating medical images (Darici, Reissner, and Missler 2023). In our study, we set to quantify intra-rater variation when analyzing different structures of the brain on magnetic resonance imaging (MRI) over multiple sessions. We used Tobii Pro Fusion eye-tracker equipment and custom radiology software to observe images from the Pediatric Brain Tumor Atlas. The software produced R, A, S (right, anterior, superior) values to map a three-dimensional coordinate in space along with a time value, to show location of the eye focus over time through the MRI. This study was designed to test the hypothesis that the variance on the eye-tracking data as well as overall eye-tracking session time would be lower in easily identifiable neuroanatomical structures as compared to ambiguous, atypical structures. Our findings will help to refine an AI model used for brain imaging analysis by identifying and characterizing structures with high intra-user variation for model improvement. By refining an AI model to more accurately identify affected brain structures, this model can be more reliably integrated and trusted in a clinical setting to assist in decision-making and ultimately improve outcomes for brain tumor patients.