# The Explorer

## Journal of USC Student Research

# Contents

## THE **EXPLORER** 2025

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**DIVISION ARTICLES**

**Yang Chai, DDS, PhD**
**Interim Dean**

**Associate Dean of Research**
**George and MaryLou Boone Chair in Craniofacial Molecular Biology**
**Director, Center for Craniofacial Molecular Biology**
**University Professor of Dentistry,**
**Stem Cell Biology and Regenerative Medicine, and**
**Otolaryngology-Head & Neck Surgery**

# FROM THE **DEAN**

Dear Ostrow Students and Colleagues:

Each Spring, we eagerly anticipate Ostrow's Research Day. There's nothing quite like witnessing the excitement and passion on our students' faces as they present their research results. I also love reading about their work in The Explorer, our award-winning publication, created by Ostrow's Student Research Group. We can all take great pride in the long-standing tradition of Research Day: not only has its success served as the inspiration for the genesis of other such events at USC, it is the largest such event on campus and this year we are showcasing more research projects than ever before.

I feel such pride seeing our students, residents, postdocs, and faculty dedicate themselves to the scientific principles of our professions. Whether they're studying dentistry, biokinesiology, physical therapy, or occupational science/occupational therapy, it's clear that to succeed, they must cultivate an unquenchable thirst for knowledge. We all need to stay at the forefront of research, adopt new technologies, and continuously adapt our practices to keep up with the rapid evolution of biomedical science and technology. Our true success in educating our trainees will be measured by how deeply we instill in them a lifelong passion for learning.

As part of a research-intensive university, we have always placed a high priority on scientific investigation. Ostrow is ranked No. 3 among U.S. dental institutions in terms of funding from the National Institute of Dental and Craniofacial Research (NIDCR), our highest ranking yet. This reflects the NIDCR's confidence in our research faculty and staff. Similarly, the USC Chan Division of Occupational Science and Occupational Therapy, along with the USC Division of Biokinesiology and Physical Therapy, maintain their top rankings in U.S. News & World Report, highlighting the ongoing excellence in both research and clinical practice within these divisions.

I want to extend my congratulations to all our faculty and student researchers for your hard work, long hours and unwavering dedication in completing this year's research projects. Please also join me in thanking the staff who organize this celebratory event, the students who write and edit The Explorer, and the faculty judges who volunteer their time to speak with our trainees about their award-worthy projects.

Fight On!

(PHOTO/KEN LUND)

# INTRODUCTION TO **RESEARCH DAY**



**Amy E. Merrill**, *PhD*

*Associate Professor*
*Chair, Department of Biomedical Sciences*
*Acting Associate Dean of Research*
*Herman Ostrow School of Dentistry of USC*

Dear Colleagues,

Welcome to the Herman Ostrow School of Dentistry of USC Research Day 2025! This annual event continues to be a highlight of our academic calendar, celebrating the outstanding research contributions of our students, staff, and faculty across Dentistry, Occupational Science, Occupational Therapy, Biokinesiology, and Physical Therapy. Today, we come together to showcase groundbreaking discoveries that reflect USC's unwavering commitment to advancing healthcare, scientific knowledge, and academic excellence.

As educators and mentors, we take pride in cultivating an environment where innovation thrives. Seeing our students engage in cutting-edge research—whether in labs, clinics, or interdisciplinary collaborations—reinforces the importance of our mission. Their work exemplifies the core values of the Herman Ostrow School of Dentistry: integrity; excellence; cultural engagement; well-being; open communication; and accountability. Our commitment to fostering critical thinking and scientific exploration ensures that students are well-prepared for their future roles as clinicians, educators, and researchers, making lasting contributions to patient care and healthcare advancements.

The discoveries presented today offer a glimpse into the future of our professions, and we are honored to support the next generation of scientific leaders. Their dedication and passion continue to push the boundaries of knowledge, strengthening our collective impact on global healthcare.

We are also excited to share this year's edition of *The Explorer*, highlighting the latest research projects and celebrating the achievements of our exceptional scholars at the Herman Ostrow School of Dentistry. Through its pages, you will find inspiring stories and pioneering work that reaffirm our commitment to research excellence. Please join me in congratulating all our students and researchers on their remarkable contributions. Let's take this opportunity to recognize and celebrate their success on Research Day 2025.

Fight on!

# ABOUT THE **COVER**

The cover image showcases a three-dimensional (3D) reconstruction of confocal microscopy images of a tissue-cleared *vGlut2-Cre;tdTomato* mouse embryo at embryonic day 13.5 (E13.5). This approach was used to map the intricate spatial distribution and detailed innervation patterns of excitatory glutamatergic neurons within the developing craniofacial region.

The *vGlut2-Cre;tdTomato* mouse was chosen for its ability to genetically label neurons with the fluorescent marker tdTomato, enabling precise visualization and analysis of these neurons in a highly transparent tissue environment achieved through advanced tissue-clearing techniques. This model not only highlights the complex architecture and connectivity of neurons but also provides invaluable insights into their developmental trajectory and functional organization within the craniofacial region.

-Sa Cha

## RESEARCH DAY 2025
# **PLANNING COMMITTEE**

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| Christopher Chiaromonte | Nicole Tam |
| Amanda Preciado | Kimi Nakaki |

# INSIDE HERMAN OSTROW'S GENERAL PRACTICE RESIDENCY AT LA GENERAL MEDICAL CENTER WITH DR. MARK MEHRALI

By Mina Alhamody & Kyle Rex

Dr. Mark Mehrali, DDS, FACD, FICD, is an Associate Professor who has been teaching at the General Practice Residency (GPR) at the Herman Ostrow School of Dentistry fo r 29 years. This post-graduate residency accepts four residents for a one-year residency where the residents split their educational experience between Los Angeles General Hospital and the VA Hospital Los Angeles. The residents get in-depth, hands-on clinical experience with complex, multifaceted cases with medically-compromised patients who need comprehensive dental treatment to improve their oral health.

*Dr. Mark Mehrali*

Dr. Mehrali achieved his Bachelor of Arts in both Chemistry and Economics from the University of California, Santa Barbara in 1987. He then achieved his DDS degree from the University of California, San Francisco in 1991. After receiving his DDS degree, Dr. Mehrali went on to attend the University of Illinois at Chicago for his General Practice Residency in 1992. He has also received prestigious honors as a Fellow of the American College of Dentistry and a Fellow of the International College of Dentistry in 2012 and 2019, respectively. In addition to his tenure as a Professor with Herman Ostrow, Dr. Mehrali has owned and operated a practice in Camarillo, CA for 32 years.

Outside of dentistry, Dr. Mehrali has been a first-responder as an ocean lifeguard for the Los Angeles County Fire Department for 44 years. He is typically stationed at Malibu Beach. In addition, his passion for pottery and ceramics has helped to contribute to his precise, technical hand skills as a clinician.

Within Herman Ostrow's General Practice Residency, residents train primarily at the LA General Medical Center in Boyle Heights or the VA Outpatient Clinic in West Los Angeles, the former of which Dr. Mehrali teaches. At LA General, residents can learn from and work together with a diverse faculty, including periodontists, orthodontists, oral surgeons, endodontists, and other general dentists. Here, residents get the opportunity to learn how to manage comprehensive cases after traumatic incidents, treatment in conjunction with radiation therapy for cancer, and special needs patients who require anesthesia for dental work.

Dr. Mehrali believes that working and teaching at LA General is extremely fulfilling to its faculty and residents because it allows them to serve an underserved population of Los Angeles. At LA General, they receive many individuals who are unhoused or may not have the financial capabilities to receive dental–or medical–treatment anywhere else. However, at LA General, these individuals can receive care from a wide array of medical specialties, including Ear, Nose, and Throat, Plastic Surgery, and Anesthesiology residents, in addition to dental practitioners.

The collaboration that GPR residents get to have with the medical personnel at LA General is an important distinction that Dr. Mehrali emphasizes. Here, the residents get to practice on complex cases such as individuals who have been in major car accidents or have had gunshot wounds to the face. At LA General, they can first be restored by plastic and oral surgeons. Then, the residents in the GPR Program can help restore those same patients' ability to eat and have an esthetic smile, all under the same roof.

One interesting case that Dr. Mehrali and his residents worked on involved a 74-year-old woman who presented to the hospital with a squamous cell carcinoma on her left mandible and a history of congestive heart failure. At LA General, she received surgery for the disease and underwent chemotherapy and radiation therapy. Due to her radiation exposure, Dr. Mehrali and his residents could not use a traditional approach of implants with her prosthetics. Instead of using a normal partial denture, which previously had poor retention in her mouth, Dr. Mehrali used a special swing-lock partial denture (see Figure 1,2). With this, the swing lock denture was able to engage with her teeth on the opposite side of her mouth, thus providing the stability necessary to successfully restore her dentition. Although the aesthetics of the prosthetic may not seem ideal with the visible I-bars along the lower anterior teeth, the added retention they provided the patient allowed her to chew comfortably, something she was unable to do before.

Another case that Dr. Mehrali worked on involved a healthy, 33-year-old male patient who was diagnosed with an am-
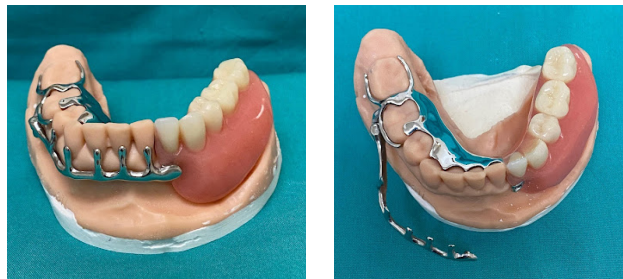


*Figure 1: (Left) Patient's swing-lock partial denture on a cast of her teeth. (Right) Swing-lock denture showing the swinging retention mechanism.*

eloblastoma by his general dentist, seen as the radiolucency in the left mandible (Figure 3, 4, 5). At LA General, the OMFS team was able to surgically remove the ameloblastoma and other affected tissue s, along with the reconstruction of his mandible. Dental implants



*Figure 2: Swing-lock partial denture in patients mouth.*

were placed subsequently, and due to the vertical height discrepancy from the implants to the occlusal plane, a bar with locator attachments was fabricated and a partial denture was made for the patient. The patient's new prosthetic blended seamlessly with his remaining dentition, and restored him with the ability to eat and chew, even though his condyle was



*Figure 3: Initial panoramic radiograph indicating the ameloblastoma in the left mandible.*
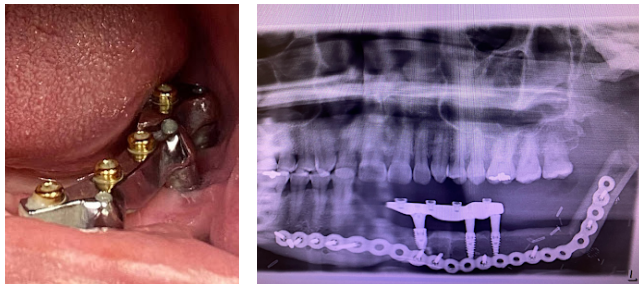


*Figure 4: Patient (left) and a panoramic radiograph (right) after mandibular reconstruction and placement of implants and bar with locator attachments.*



*Figure 5: Patient with his prosthetic placed.*

still missing on the left side. Dr. Mehrali believes that giving patients their function back–such as being able to eat and swallow properly–is his favorite part of dentistry. To him, seeing the patient's joy after they undergo their procedures makes his career the most rewarding.

To Dr. Mehrali, working at LA General Hospital allows him to push boundaries beyond dentistry. About a decade ago, Dr. Mehrali encountered an elderly patient who was afflicted with stage 3 lung cancer and stage 4 throat cancer that came to LA General seeking treatment for an atrophic mandible

and the inability to chew with his dentures. With the team of residents, Dr. Mehrali was able to restore the patient's lower jaw with the delivery of two implants and a new, removable prosthesis. This allowed him to regain the ability to eat, which consequently let him gain about 10 pounds. It was after all this treatment that both Dr. Mehrali and his patient found they had a common passion–running marathons.

While Dr. Mehrali was mentioning his plans to run in the New York Marathon, his patient exclaimed how he had always dreamed of running a marathon. With LA General being a low-income, county-supported clinic, Dr. Mehrali took him under his wing to help him fulfill his dream of running a marathon. After buying his patient new running shoes and signing them both up for the upcoming Los Angeles Marathon, the dynamic duo began their preparations to take on the 26.2 mile trek around the city.

On the day of the marathon, the two walked the whole race together (Figure 6). Dr. Mehrali remarks how his patient was diabetic, so they would have to stop every hour to check his blood sugar during the race, remedying any fluctuations at the hydration stations with water or Gatorade. After completing their marathon, the two of them proceeded to complete two more marathons together. To Dr. Mehrali, that man was not only his patient, but an inspiration and great friend.

Dr. Mehrali emphasizes how meaningful and fulfilling his career as an Associate Professor in the GPR program at LA General Medical Center has been in working with an underserved population and teaching the newest generation of dentists how to manage challenging cases, many times in a collaborative fashion with other dental specialists and physicians. He concluded by imploring us to remember that it is called 'dental practice,' not 'dental perfect.' In dentistry, one is always learning how to improve, one day at a time, one procedure at a time, and experience never seems to catch up, but we are striving for perfection for the treatment we provide to our patients. To that end, Dr. Mehrali is still gaining experience to enhance the outcomes of the dental treatment provided at LA General Hospital. The General Practice Residency really prepares its residents to move into hospital practice, general practice, or a chosen specialty with skills learned from the diverse faculty at the hospital. Dr. Mehrali closed by stating it is an honor to provide such great care with a team of faculty and residents that have the same passion to teach and treat these special patients.
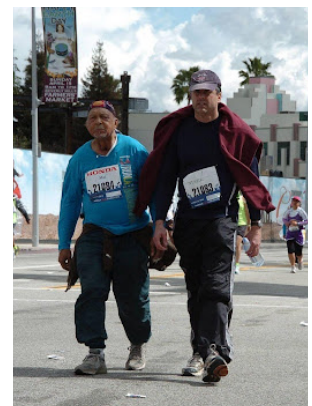


*Figure 6: Dr. Mehrali (right) with his patient (left) walking the 2012 LA Marathon*

# *Using Your Brain:*
# New Developments in Understanding Neurodevelopmental Disorders

By Micah Lee & Mustafa Zaghmouri

Dr. Lu Wang's journey to academia illustrates an evolving curiosity about the development of the human brain, guided by influential mentors and a growing passion for impactful, patient-centered research. Dr. Wang began her academic career at Lanzhou University, graduating with a B.S. in Biology in 2011, and later a PhD at Tsinghua University in Molecular and Cell Biology in 2017. Dr. Wang's undergraduate years were full of uncertainty, however, as she did not initially envision a career in research, since she lacked a strong passion for the field. Despite the immense feeling of doubt, Dr. Wang continued to surround herself with supportive mentors who offered guidance and showed her the positive implications that research can have on peoples' lives. Positive experiences while working in labs alongside invaluable mentorship ultimately helped her navigate her way into research. These mentors provided her with an environment where she could explore her interests organically, eventually unleashing her enthusiasm for science and research.

Dr. Wang's early career experiences led her to focus on neurodevelopmental disorders, particularly the developing human brain and pediatric diseases. During her postdoctoral research, she joined a lab focused on pediatric disorders. She found her time working in this lab to be enlightening and attributes this experience as the primary reason that solidified her decision to continue exploring the field. Currently, her lab investigates non-neuronal cells and the role they play in neurodevelopmental disorders. Her lab utilizes cutting-edge tools such as patient-derived induced pluripotent stem cells (iPSCs), assembloids, and induced neurons/neural crest models. By reprogramming iPSCs to form three-dimensional brain organoids, her team can model human brain development, a powerful method that allows for detailed study of neurodevelopmental processes and disease mechanisms.

Dr. Wang's lab, located in the Center for Craniofacial and Molecular Biology (CCMB), explores the elaborate cellular mechanisms behind the developing human brain and analyzes the ways that the development of these systems can be compromised through environmental factors or genetic alterations. This approach allows the team to delve into how non-neuronal cells, such as astrocytes and pericytes, contribute to brain development as well as the onset of neurodevelopmental disorders when things go awry. Brain development is an extremely complex process involving billions of neuronal and non-neuronal cells; therefore, studying brain development under both normal and stressed conditions is crucial for understanding brain physiology and for addressing the root causes of neurodevelopmental disorders.

One of the primary interests of Dr. Wang's lab is how environmental factors, such as low oxygen levels and fetal drug exposures, interact with genetic mutations to facilitate disease pathogenesis. While significant progress has been made in genetic diagnostics, many neurodevelopmental disorders still lack clear genetic explanations. Dr. Wang aims to bridge this gap, providing a more comprehensive understanding of disease mechanisms and potential avenues for therapy.

Dr. Wang is also looking to expand

our understanding of the nervous system's role in pediatric tumors, particularly medulloblastomas—an embryonic brain tumor that originates in the cerebellum. Through stem cell-based models and animal studies, her lab investigates the interplay between the nervous system and tumor development, to advance diagnostic and therapeutic strategies.

While modeling human brain development in vitro has been accompanied by significant obstacles, Dr. Wang remains increasingly optimistic about the advancement of iPSC technology. Her research highlights the unique challenges of brain modeling. In addition to replicating species-specific characteristics in her models, she also stresses the sheer complexity of the human brain as a significant hurdle she must account for. Dr. Wang emphasized that while significant strides have been made over recent years, there's still a lot left to be uncovered before we can achieve a complete, functional model of the human brain.

Clinically, Dr. Wang's work holds immense promise. By directly integrating patients' imaging data and genomic sequences along with iPSC-based models, Dr. Wang's lab hopes to improve our understanding of pediatric brain disorders, as well as our ability to accurately diagnose and treat them. This research has direct clinical applications, as it offers insight into how the developing brain responds to environmental stressors such as viral infections or hypoxia. Dr. Wang's lab is also expanding its focus to adult neurodegeneration, demonstrating the broad relevance of their research across developmental and aging-related conditions.



*Dr. Lu Wang*

While research is at the core of what Dr. Wang does, one of the most important findings she has come across did not come from a test tube. Rather, it came from a culmination of life experiences that led her to realize the importance of finding what you are truly passionate about in life. She reflects on the dullness and monotony of tasks like daily Western blotting, which prompted her to seek more fulfilling, captivating roles. She also emphasizes the importance of attaining proper work-life balance, sharing her enjoyment of swimming, a hobby she pursued competitively during junior high and high school. This outlet helps her manage stress and maintain focus.

Dr. Wang epitomizes the success one can attain when they pursue a career that brings them joy. She notes that genuine curiosity and fulfillment are essential for making meaningful progress. This applied even to our interview, in which she wondered how we think dentistry is related to neuroscience - to which we responded that orofacial pain is directly related to the pain response mitigated by the brain. A hallmark of Dr. Wang's lab is its collaborative, supportive, and positive culture. Her lab prioritizes cultivating a joyful and healthy atmosphere, believing that such spaces are vital for fostering creativity and impactful research.

Dr. Wang's journey is one of resilience, growth, and openness to new ideas, which has been shaped by mentorship, personal experiences, and an enduring commitment to advancing our understanding of the brain. She hopes her lab's work will not only make meaningful contributions to science but also inspire others to engage with and appreciate the research they conduct.

Herman Ostrow School of Dentistry of USC

# From Brain to Bone: Dr. Jianfu Chen's Pioneering Insights into Craniofacial Development

By Ghazal Ardalan & Daniel Hakimi

Dr. Jianfu (Jeff) Chen, an Associate Professor at the Center for Craniofacial Molecular Biology (CCMB) at the Herman Ostrow School of Dentistry of USC, is redefining interdisciplinary research by merging neuroscience and craniofacial biology. Through his innovative studies, Dr. Chen aims to uncover the intricate connections between the brain and craniofacial structures, providing groundbreaking insights into developmental disorders and potential therapies. By creating a unique interdisciplinary framework, Dr. Chen has built a bridge between fundamental biological mechanisms and their clinical relevance, enabling transformative discoveries that impact healthcare. His work addresses both foundational scientific questions and practical applications, ensuring a comprehensive approach to research challenges. His ability to synthesize complex scientific concepts from diverse disciplines exemplifies how collaboration can lead to discoveries that transform science, clinical care, and patient outcomes.

Dr. Chen's academic journey began with a bachelor's degree in microbiology from China Agricultural University. Fascinated by biological sciences and driven by curiosity, he pursued a PhD at the University of North Carolina at Chapel Hill. There, he shifted his focus from microbiology to cardiovascular research, contributing to groundbreaking studies on vascular biology and cardiovascular diseases. However, it was during his postdoctoral training at the University of Colorado, Denver that Dr. Chen became captivated by the intricacies of neuroscience. This transition marked a pivotal moment, as he realized that the brain's complexity surpassed the relatively mechanical nature of cardiovascular systems. This shift not only broadened his academic horizons but also laid the groundwork for his future interdisciplinary pursuits, blending insights from various fields to address complex biological questions with far-reaching implications.

In 2014, Dr. Chen accepted a faculty position at the University of Georgia, where he began exploring brain development and developmental brain disorders. In 2017, he joined the Center for Craniofacial Molecular Biology under the mentorship of Dr. Yang Chai. During his tenure, he delved deeper into the connection between craniofacial biology and neuroscience, developing innovative approaches to address long-standing scientific questions. At USC, Dr. Chen embarked on a series of groundbreaking studies that have illuminated previously unexplored intersections between craniofacial and brain development. By investigating how these structures communicate and influence one another, he has advanced our understanding of developmental disorders. His ability to merge advanced molecular techniques, bioengineering approaches, and clinical insights has distinguished him as a trailblazer in his field.
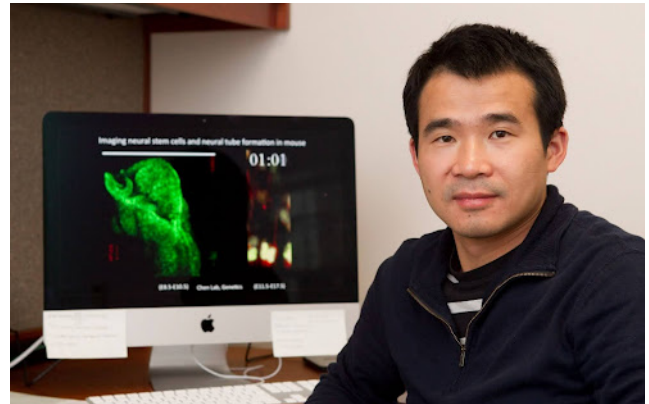


*Dr. Jianfu (Jeff) Chen*

Dr. Chen's research program is guided by two primary themes that reflect his dedication to addressing both foundational and clinical challenges in craniofacial biology and neuroscience:

### 1. Skull-Brain Interaction:
Dr. Chen's lab investigates the dynamic interaction between craniofacial structures and the brain, focusing on how abnormalities in cranial sutures can impact brain development. One of the team's significant contributions has been elucidating the brain effects of premature suture fusion, as seen in craniosynostosis. This condition generates intracranial pressure that disrupts the brain's lymphatic system, impairing the removal of waste products and leading to neurocognitive dysfunctions. By studying these mechanisms, Dr. Chen aims to develop targeted therapies that address both structural abnormalities and their functional consequences. His focus on the lymphatic system underscores its critical role in maintaining neurological health, offering a previously underappreciated perspective on disease pathology and potential treatment avenues. Furthermore, his work emphasizes the importance of early diagnosis and intervention to mitigate long-term impacts on brain function.
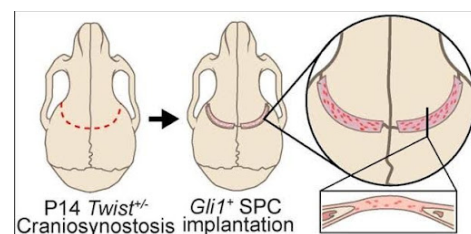


### 2. Temporomandibular Joint (TMJ) Disorders:
TMJ disorders represent a complex interplay between musculoskeletal and neurological systems. Dr. Chen's research addresses the multifactorial nature of these disorders, which are influenced by factors ranging from joint degeneration to

psychosocial conditions such as stress and anxiety. His lab established animal models of TMJ osteoarthritis (TMJOA) followed by mechanistic studies and therapeutic target identification. He collaborates with clinicians and researchers nationwide aiming to develop evidence-based diagnostic criteria and treatment strategies. Leveraging USC's extensive TMJ patient database, Dr. Chen integrates patient-centered data with experimental models, bridging the gap between basic research and clinical application. This translational approach ensures that his findings not only enhance scientific understanding but also have a direct and meaningful impact on patient care.



(Intra-articular injection)     TMJOA model
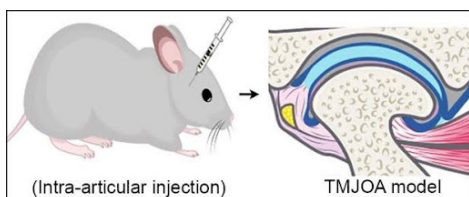
### Stem Cell Technology and Regenerative Medicine:

One of Dr. Chen's most innovative research areas involves using stem cell technology to address developmental brain and craniofacial disorders. His lab employs cutting-edge tools such as human induced pluripotent stem cells (iPSCs) and CRISPR/Cas9 gene-editing technology to generate brain organoids and model diseases like macrocephaly and intellectual disabilities. By differentiating these stem cells into various specialized cell types, including suture stem cells (SuSCs) and neural progenitor cells, Dr. Chen's team uncovers novel therapeutic strategies and contributes to advancements in regenerative medicine. These innovative methods position Dr. Chen's lab at the forefront of biomedical research, enabling breakthroughs in modeling and treating complex conditions.

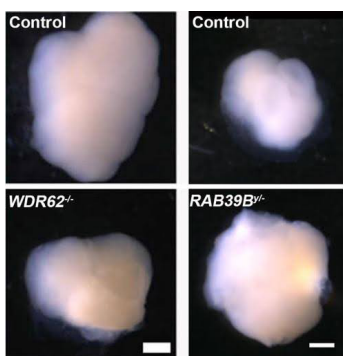Dr. Chen is particularly focused on developing "off-the-shelf" stem cell-based products for treating craniofacial abnormalities. For instance, his lab aims to produce uniform PSC-derived SuSCs to repair and regenerate damaged cranial sutures, offering a promising avenue for clinical application. Additionally, his collaboration with tissue engineering experts has led to the integration of stem cell technology with bioengineered scaffolds, enhancing the precision and effectiveness of craniofacial reconstruction. This work bridges the gap between laboratory research and clinical application, bringing innovative therapies closer to widespread adoption. By addressing the practical challenges of scalability and affordability, Dr. Chen ensures that these advanced therapies are accessible to a broader patient population, reflecting his commitment to equitable healthcare solutions.



### Ribosome Biogenesis and Its Impact on Development:

A standout aspect of Dr. Chen's research is his investigation into ribosome biogenesis and its unexpected connections to cranio-

facial development and brain function. His team has demonstrated how disruptions in ribosomal machinery, often linked to genetic mutations, affect cranial suture development and the complement pathway, a system traditionally studied in immune responses. These findings reveal how ribosomal disruptions selectively regulate pathways critical for tissue development. This novel approach not only expands our understanding of cellular processes but also identifies new molecular targets for therapeutic intervention, exemplifying the integration of basic and applied science.

One groundbreaking discovery from Dr. Chen's lab is the role of ribosome biogenesis in activating the complement pathway within cranial sutures. While the complement pathway is widely recognized for its role in innate immunity, his team has uncovered its significant contributions to bone regeneration and suture maintenance. Ribosomal mutations disrupt complement signaling, leading to premature cranial suture fusion, a hallmark of craniosynostosis. These disruptions exacerbate neurocognitive issues by increasing intracranial pressure and impairing the brain's waste removal processes. By combining molecular precision with structural rehabilitation, Dr. Chen's research offers holistic treatment strategies for addressing these disorders.

Additionally, Dr. Chen's lab discovered that knocking out the C3a receptor in the complement pathway exacerbates suture defects in mutated mouse models. This finding underscores the intricate relationship between molecular pathways and craniofacial development, offering new avenues for targeted therapeutic interventions. Dr. Chen's ability to translate these discoveries into potential clinical applications exemplifies his commitment to improving patient outcomes through rigorous and innovative research.

### Translational Potential and Collaborative Initiatives:

Dr. Chen's work is characterized by its translational potential, aiming to bridge the gap between basic research and clinical application. His lab employs advanced techniques such as CRISPR/Cas9, organoid models, and high-throughput screening to simulate human conditions and test therapeutic strategies. A key focus is the development of scalable, off-the-shelf stem cell-based products to address the unmet needs of patients with craniofacial disorders.

In addition to his contributions, Dr. Chen is spearheading multi-institutional projects to address significant gaps in craniofacial and neurological research. For instance, he is collaborating with Drs. Yang Chai, Glenn Clark, and Anette Vistoso to establish a comprehensive Center for Temporomandibular Disorder (TMD) research. This initiative brings together clinicians, scientists, and regulatory experts to advance diagnostic methods, treatment options, and research training in TMD. By leveraging USC's extensive patient base and fostering nationwide collaborations, Dr. Chen aims to tackle the multifaceted challenges of TMJ disorders. These efforts reflect his dedication to advancing scientific understanding while improving patient outcomes.

Through his visionary leadership and interdisciplinary approach, Dr. Chen continues to push the boundaries of craniofacial biology and neuroscience, ensuring that his work has a lasting impact on both science and society.

# Advocating for Change and Creating a Legacy in Dental Anesthesiology

By Hana Hemkat & Nathalie Von Klaveren

## Breaking Barriers: A Leader in Patient-Centered Dental Care

Born in Toronto, Canada, and raised in San Fernando Valley of Los Angeles, Dr. Daniel Kohanchi (USC DDS '19) is an Adjunct Assistant Professor of Clinical Dentistry in the Department of Diagnostic Sciences, Anesthesia, and Emergency Medicine at the Herman Ostrow School of Dentistry of USC. His story of becoming a dental anesthesiologist is one of exploration and dedication that is rooted in a passion for patient-centered care. He is currently one of the leading voices in the profession, advocating for better safety protocols and standard use of dental anesthesiology in day-to-day dental practice to increase access to care.

Dr. Kohanchi began his academic venture at UC Irvine, where he completed his undergraduate studies and engaged in dental-focused research and externships. A turning point in his undergraduate career was when he joined a research group focusing on the use of optical coherence tomography (OCT) imaging and Doppler imaging to detect precancerous lesions in the oral cavity. This experience allowed him to develop an interest in the connection between oral health and systemic health. He remembers spending 12 to 15 hours weekly in the lab as a senior, which further solidified his decision to become a dentist.

Inspired by his interest in holistic health, Dr. Kohanchi took a gap year to pursue a Master of Public Health with a focus in dentistry. This period allowed him to deepen his understanding of how oral care fits into public health initiatives, especially for underserved populations. He started his DDS program at USC's Herman Ostrow School of Dentistry in 2015, where he contin-ued his involvement in research while under the guidance of Dr. Yang Chai, the esteemed Director of the Center for Craniofacial Molecular Biology and Associate Dean of Research at the Ostrow School. He studied adenomatoid odontogenic tumors (AOT), which originate from the odontogenic epithelium. This experience, combined with his dental education, inspired him to explore avenues beyond the confines of traditional dentistry.

Following dental school, he started a rigorous dental anesthesia residency at the University of Pittsburgh Medical Center, where he did more than 2,000 cases ranging from pediatric and special needs patients to geriatric care. The residency consisted of rotations in cardiology, internal medicine, and ICU care, which provided a holistic view of the systemic factors that may affect anesthesia. "Our training is a holistic approach to patient care, where we ensure that we look at every patient from head to toe, and based on their entire medical history," he notes. This foundation has been important in allowing him to safely administer anesthesia to diverse patient populations.

## Advocating for Safety in Anesthesia

As a dentist and dental anesthesiologist, safety is the number one priority for Dr. Kohanchi. He is committed to carefully analyzing each patient's medical profile to provide personalized care. "Every patient is different. Their age, weight, medical history, and even their psychological state can greatly determine how they will react to the anesthesia," he points out. This individualized approach is particularly important for people with ongoing medical conditions or those who fear the dentist.

A strong advocate for safety standards, he also collaborates with his peers to design emergency protocols for dental practice regarding conditions from allergic reactions to cardiac events. He also stresses the need for continuous professional development of dental practitioners regarding the new developments in sedation and anesthesia techniques. He says there is a disturbing trend: Some practitioners are trying to do sedation procedures beyond their training, with the possibility of tragic results. "There's a reason dental anesthesiology is a specialized field," he asserts. "Our education and training go far beyond basic sedation protocols, equipping us to handle complex cases and emergencies with precision." Dr. Kohanchi believes that increased awareness of the role and expertise of dental anesthesiologists could prevent such incidents and enhance patient outcomes.

## Breaking Barriers in Access to Care

Equity in dental care is the heart of his profession as a dental anesthesiologist. "There are some patients, especially those with complex health conditions or fear of dentists, for instance, that sedation specialists are vital to," he explains. He offers mobile anesthesia services to dental offices, thus offering a solution to patients who may otherwise be unable to receive proper care due to limitations. They include children, including those with disabilities. "Some kids," he says, "will become uncooperative and anxious and may need sedation for even the most basic things, like X-rays or cleaning." He also deals with elderly patients with complex medical histories to ensure that they are comfortable during their dental treatment.

Dr. Kohanchi also highlights that dental anesthesiology is not only important in clinical practice but also in the public health context. As he notes, oral health is related to general health. "We are not only giving patients beautiful smiles when we allow them to get dental care when they need it, but we are also preventing complications that could involve their hearts, lungs, and other vital systems." By addressing barriers to dental care, dental anesthesiology makes it possible for diverse patients to receive the care they need, while avoiding systemic complications, thereby enhancing their quality of life.

## A Day in the Life

Dr. Kohanchi's day-to-day life is a mix of clinical practice, education, and spending time with his family. He now works two to three days a week at his mobile anesthesia practice, visiting dental offices in the region.

On the remaining days of the week, he works at his private practice in Westlake Village, which he runs in partnership with his wife. The practice offers comprehensive care to patients requiring advanced sedation, including young children and medically compromised adults. Their goal is to provide patient-centered care that prioritizes comfort and safety. "We have created an environment where the patient feels safe and supported," he shares.

As an educator at USC, he takes pride in mentoring the next generation of dental professionals. He shares that teaching allows him to convey to his students the significance of safety and patient-centered care, further reflecting his contribution to the profession. Even with such a tight schedule, Dr. Kohanchi prioritizes spending quality time with his family. Together, they enjoy country shopping, trying new restaurants, and going on hikes. A spontaneous dance party at home is also a family favorite. "It's about creating moments of joy and connection," he reflects.

## The Future of Dental Anesthesiology

Looking ahead, Dr. Kohanchi can envision a future where dental anesthesiology becomes an expected part of standard dental practice. "Comfort and patient-centered care should be the norm, not the exception," he asserts. Increasing education for both patients and practitioners about the benefits and safety of dental anesthesia will carry the day for wider acceptance and accessibility, he believes.

Technological advancements, he sees, could also boost the field. Improved monitoring systems, for instance, could further ensure safety and efficiency in dental anesthesiology. "The ultimate goal is to create an environment where every patient feels at ease and receives the care they deserve," he says.

Dr. Kohanchi's vision is not limited to the clinical aspect. He is devoted to building stronger connections within the dental community and breaking down barriers between specialties to enhance patient care. Through education, advocacy, and innovation, he aims to leave a lasting impact on the profession.

## A Legacy of Care

Dr. Kohanchi's journey from a curious undergraduate researcher to a respected dental anesthesiologist is a credit to his dedication to patient care. Through his clinical work, educational contributions, and advocacy efforts, he is continuing to do what has always characterized the profession—pushing what is possible in dentistry.

"Nobody should have to decide between their oral health and their comfort," he states. With his unwavering commitment to safety, accessibility, and innovation, Dr. Kohanchi is helping to redefine the patient experience, one procedure at a time.



*Dr. Daniel Kohanchi*

Herman Ostrow School of Dentistry of USC

# A Legacy of Passion and Precision: *Dr. Emad Bassali's Journey in Endodontics and Education*

### By Edward Kim & Ryan Neydavood

Dr. Emad Bassali, an esteemed endodontics clinician and educator, has dedicated his life to treating patients with compassion, shaping future dental professionals, and advancing the field through innovation and service. Renowned for his engaging teaching methods and commitment to his students, Dr. Bassali's career is a testament to perseverance, lifelong learning, and a passion for giving back to the community. Over the decades, his work has bridged continents, enriched institutions, and inspired countless individuals to reach their fullest potential.

**From Alexandria to America: A Global Journey**
Dr. Bassali's dental journey began in Alexandria, Egypt, where he graduated from dental school in 1980 at the age of 22. In the years following his graduation, he pursued an internship and a one-year prosthodontic residency. These early experiences were brief but laid a solid foundation for his technical skills and professional outlook. He spent several years in private practice in Alexandria, perfecting his craft while exploring his growing interest in specialized dentistry.

In search of professional growth, Dr. Bassali relocated to Kuwait, where he had previously lived throughout his teens. He worked as a government dentist for over four years in a period that was pivotal in shaping his career. Despite limited resources, he developed a deep fascination with endodontics and began exploring innovative ways to overcome practical challenges.

"Kuwait didn't have X-rays in many clinics at the time," Dr. Bassali explained. "I had to rely on my instincts and makeshift solutions, opening root canals and then sending patients elsewhere for X-rays before completing the treatment. It was a challenge, but it helped me realize how much I enjoyed the intricacies of endodontics." The Gulf War in 1990 brought an abrupt end to Dr. Bassali's time in Kuwait. After the invasion, he made the life-changing decision to relocate to the United States. Starting over in a new country was no small feat, but Dr. Bassali embraced the challenge. He enrolled in the Advanced Standing Program at USC Dental School, graduating in 1994. During this time, he cemented his passion for endodontics and reminisces of his time assisting residents and learning under the likes of faculty members. He later graduated from Tufts University endodontics residency in 1997.

Armed with cutting-edge knowledge and skills, he was ready to make his mark in the world of dentistry.

**A Passion for Teaching**
Dr. Bassali's teaching career began in 1999 at the Herman Ostrow School of Dentistry of USC. Initially volunteering at the night clinic, he found immense satisfaction in mentoring students and sharing his expertise. What began as a part-time role soon evolved into a full-time commitment, as his passion for teaching became a cornerstone of his professional identity.

"I love teaching. It's not just about imparting knowledge; it's about inspiring students to be the best they can be," he explained. "I want my students to leave here feeling confident, skilled, and ready to face the real world."

Dr. Bassali begins guiding students through the intricacies of endodontics through their second year in the sim lab, to the student doctor clinic floor, and finally up to the graduate endodontics clinic. His teaching philosophy is rooted in empathy and accessibility, prioritizing creating a supportive environment where students feel comfortable asking questions and learning from mistakes. "I don't see myself as above them. I want to be a friend and mentor, guiding them through this journey," he said. His dedication has not gone unnoticed. Over the years, Dr. Bassali has become a beloved figure among students, many of whom credit him with their professional growth and success. "The most rewarding part of teaching is seeing my students achieve their goals, whether it's getting into a specialty program or excelling in private practice," he shared.

**Advancing Endodontics: Tools and Techniques**
As a clinician and educator, Dr. Bassali has always embraced innovation. He is a strong advocate for the use of advanced technologies like CBCT (cone beam computed tomography) and microscopes, which he describes as transformative tools for modern dentistry.

"CBCT is like a GPS for endodontics," he said. "It allows us to navigate complex root anatomies with precision, ensuring better outcomes for our patients. Why guess when you can see more before you even begin?"

Microscopes, too, have revolutionized the field, offering unparalleled magnification and lighting. Dr. Bassali emphasized that these tools are not just optional luxuries but essential components of high-quality care. "The more you see, the more you can treat," he noted. "With a microscope, you can identify issues that would otherwise go unnoticed, improving accuracy and patient outcomes."

Dr. Bassali is passionate about integrating these technologies into dental education, ensuring that future practitioners are well-equipped to meet the demands of a rapidly evolving field. He also believes in instilling a mindset of lifelong learning among his students, encouraging them to stay curious and adaptable throughout their careers.

## Service Beyond the Clinic

Dr. Bassali's commitment to service extends far beyond the classroom. Through USC's extensive oral health community clinics such as the Dental Humanitarian Outreach Program (DHOP) mobile clinics, he has dedicated countless hours to providing free dental care to underserved populations. One of his most memorable experiences involved a veteran whose root canal treatment began at a mobile clinic. "We couldn't finish the procedure on-site, but after the timely process of getting the patient enrolled in USC's clinic, the patient's treatment was successfully completed," Dr. Bassali recalled. "It was a collaborative effort that highlighted the power of teamwork and dedication."

Dr. Bassali has also participated in international service trips to countries like Ecuador and Panama, where he witnessed firsthand the transformative impact of dental care in resource-limited settings. "These trips are life-changing, not just for the patients but for the students and faculty as well. They teach resilience, teamwork, and a deep appreciation for the privilege of serving others."

## A Family Legacy

Dr. Bassali's dedication to education and service is mirrored in his personal life. His father, an esteemed mathematics professor in Alexandria and Kuwait, illustrated this through his lifelong service to education and uplifting the community. Dr. Bassali is the proud father of four daughters, each pursuing their unique passions. His eldest daughter is a nurse, his second a public defender, his third a marine biology graduate, and his youngest is currently pre-med at USC.

Reflecting on his role as a father, Dr. Bassali shared, "Raising my daughters has been one of the most fulfilling parts of my life. Supporting them as they navigate their own paths has taught me patience, empathy, and the importance of family."

## A Life of Balance: "Work Hard, Play Hard"

For Dr. Bassali, balance is the key to a fulfilling life. An avid tennis player and basketball fan, he enjoys spending time at his beach house, capturing sunsets and finding peace by the ocean. His motto, "work hard, play harder," is not just a mantra but a way of life. "Tennis keeps me active, and the ocean keeps me grounded," he said. "I believe in working hard to achieve your goals, but it's equally important to enjoy the fruits of your labor."

This philosophy is one he actively shares with his students. "Dental school is tough, but it's worth it. Stay motivated, work hard, and never give up. The rewards are there if you push through."

## Inspiring the Next Generation

As Dr. Bassali reflects on his career, he remains focused on inspiring the next generation of dental professionals. His ultimate goal is to instill a sense of integrity, curiosity, and passion in his students.

"Education is about more than knowledge," he emphasized. "It's about shaping character and inspiring others to be their best selves. I want my students to leave here not just as skilled dentists but as compassionate, ethical individuals ready to make a positive impact."

For Dr. Bassali, the true measure of success is seeing his students thrive. "When I hear from alumni who've gone on to achieve great things, it reaffirms why I do this. Knowing I played a small part in their journey is incredibly fulfilling."

## Looking Ahead

Dr. Bassali's career is a testament to resilience, dedication, and a deep commitment to service. From his early days in Alexandria to his current role at USC, he has consistently pursued excellence in both his craft and his teaching. His impact on the field of endodontics and the countless students he has mentored is profound and enduring.

As he continues to teach, mentor, and inspire, Dr. Bassali embodies the values of perseverance, passion, and integrity. His legacy will undoubtedly influence generations of dental professionals to come.

*Dr. Emad Bassali*

# From Underdog to Trailblazer:

## Dr. Jeffrey Hammoudeh's Relentless Pursuit of Excellence and Impact

By Cory Cox & Salony Jassar

Dr. Jeffrey Hammoudeh, a trailblazing oral & plastic surgeon and advocate for self-improvement, exemplifies a relentless pursuit of excellence and a passion for empowering others. His journey from modest beginnings to becoming a leading figure in his field serves as a testament to the power of resilience, passion, and an unwavering refusal to settle for mediocrity.

This past year, Northern Illinois stunned the sports world with one of the most shocking upsets in recent college football history, defeating the powerhouse Notre Dame football team. Notre Dame, with its storied legacy, national rankings, and a roster stacked with blue-chip recruits, was heavily favored. Pundits and fans alike saw the matchup as a mere formality, predicting a blowout in Notre Dame's favor. Yet, against all odds, the Northern Illinois Huskies—a team with far fewer resources, a less heralded history, and a roster comprised mostly of underdog athletes—rose to the occasion. The upset sent shockwaves across the sports community, making headlines and sparking conversations about the power of determination and belief. For Dr. Hammoudeh, a proud Northern Illinois Huskie Football alumnus under Coach Pettibone, this victory wasn't just a game; it was a vivid symbol of resilience and the potential of the underdog, reflecting his journey of defying expectations. The moment became even more poignant when it was revealed that, days before the game, former Ohio State University coach, Jim Tressel, offered ND head coach, Marcus Freeman, a piece of advice: "The biggest danger is the illusion that all is well, when indeed, all isn't well." This wisdom, a favorite quote of Dr. Hammoudeh, underscores his belief in staying vigilant, prepared, and relentless in the face of challenges.

Dr. Hammoudeh's path to success was far from smooth, marked by numerous obstacles and moments of doubt beginning with the challenges he had to face as a zero-generation immigrant through college and graduate school. As the first in his family to attend college, he ventured into uncharted territory with no roadmap to guide him. Skepticism from peers and even mentors added to the difficulty. Early in his bumpy college career, he vividly recalls telling his professor, "I'd like to go to dental school and then I want to go to medical school!" Instead of encouragement, the professor scoffed at the idea, dismissively suggesting that he consider a less strenuous academic pathway. The doubts of others might have deterred a less determined individual, but Dr. Hammoudeh used these moments as fuel. Rather than letting skepticism shake his resolve, he transformed it into a powerful driving force from lessons he learned on the football field as a Huskie Dawg! #TheHardWay. Drawing upon his inner resilience and determination, he pushed harder, adopting a mindset of tenacity, perseverance, and personal growth that became the cornerstone of his eventual success.

Dr. Hammoudeh advocates for the mindset that "you have to wake up every day and never be complacent," a philosophy that has shaped his approach to life and success. He finds strength in embracing the role of the underdog and proving doubters wrong, drawing on the power of perseverance and self-belief. A defining source of his inspiration comes from one of the greatest athletes of all time: Michael Jordan. Known not only for his extraordinary talent but also for his relentless dedication to his craft, Jordan epitomized what it means to strive for excellence.

Dr. Hammoudeh vividly recalls a pivotal moment during dental school when he attended a game and witnessed Jordan score over 50 points in a losing effort. For many, such a performance would have been cause for celebration, but Jordan's post-game response revealed a different mindset: "This is still a failure because we lost." That statement left a profound impact on Dr. Hammoudeh. It reflected Jordan's unwavering commitment to team success and his refusal to settle for personal achievements in the face of collective setbacks.

For Dr. Hammoudeh, this moment underscored the importance of never being satisfied with mediocrity, regardless of external praise or individual milestones. Jordan's greatness wasn't just about his skill but also his tireless pursuit of improvement and his unwillingness to compromise on his standards. This philosophy mirrors Dr. Hammoudeh's journey, inspiring him to continue pushing boundaries, overcome obstacles, and aim for greatness in every endeavor.

Dr. Hammoudeh's commitment to self-improvement and excellence extends beyond his professional life. As a father, he instills these values in his children, emphasizing the importance of finding a passion and becoming the best in that field. His nonprofit organization, Children of War, reflects his dedication to making a difference.

Through this initiative, he has traveled to many war-torn countries to provide life-changing surgeries and to help those in need. These experiences not only demonstrate his commitment to humanitarian work but also serve as powerful life lessons for his children.

Among Dr. Hammoudeh's specialties is early cleft lip repair, a procedure that profoundly impacts the lives of children born with this condition. He is particularly excited about advancements in stem cell regeneration and artificial intelligence (AI), which he believes are poised to revolutionize the field. Stem cell technology offers the potential for more effective and less invasive treatments, while AI promises to enhance surgical precision and patient outcomes. His forward-thinking approach highlights his dedication to staying at the forefront of innovation and science.

Dr. Hammoudeh's embrace of innovation and technology sets him apart as a visionary in his field. He views advancements in stem cell regeneration and AI not only as tools to improve surgical outcomes but also as opportunities to redefine the possibilities of modern medicine. By staying ahead of emerging trends and integrating cutting-edge techniques into his practice, he demonstrates a commitment to excellence that inspires both his peers and the patients he serves.

For Dr. Hammoudeh, the ultimate goal is freedom—freedom to shape his career and life on his own terms, decoupling financial dependence from his professional



*Dr. Jeffrey Hammoudeh*

responsibilities. Achieving financial independence has allowed him to perform surgeries not out of necessity or obligation but out of genuine love for the craft and passion for helping others. This independence has given him the flexibility to focus on honing his skills, investing in his personal growth, and prioritizing the quality of care he provides to his patients without the pressures of financial strain.

Dr. Hammoudeh believes that independence is not just about accumulating financial stability but about creating opportunities to pursue excellence and live a life aligned with one's values. By removing financial barriers, he has been able to dedicate himself wholeheartedly to his work, explore innovative approaches in surgery, and find joy in his craft without compromise. He encourages others to adopt a similar mindset: identify what you love, commit to it with unwavering dedication, and strive to be the absolute best at it. This perspective has driven him to set high standards for himself and continuously push the

boundaries of what is possible, proving that true success lies in the intersection of passion, excellence, and freedom. Despite his many achievements, Dr. Hammoudeh remains humble and grounded. He acknowledges his failures and views them as opportunities for growth. "The most successful people fail," he often says. "What sets them apart is their ability to pick themselves back up and keep going." His journey is a testament to the power of perseverance and the importance of embracing challenges as stepping stones to success.

In addition to his professional endeavors, Dr. Hammoudeh values the role of mentorship and community. He recognizes the impact his mentors and supporters had on his journey and strives to pay it forward by guiding the next generation of aspiring professionals. Whether through sharing his experiences, offering advice, or demonstrating the importance of perseverance, he hopes to inspire others to pursue their dreams with determination and passion.

Ultimately, Dr. Hammoudeh's story is one of perseverance, passion, and purpose. He has overcome significant obstacles, faced countless doubters, and achieved success through sheer determination and a commitment to his values. He earned a double doctorate from Northwestern University and then did his residencies at Harvard followed by another residency at the University of Miami, then a fellowship at USC. He is board-certified in Oral and Maxillofacial Surgery and Plastic/Reconstructive Surgery. His journey serves as a powerful reminder that success is not measured solely by accolades or achievements but by the impact made on the lives of others. Through his work, humanitarian efforts, and dedication to inspiring the next generation, he exemplifies what it means to lead a life of purpose and excellence.

As Dr. Hammoudeh continues to push the boundaries of his field, he remains guided by his love for his wife and two children and his core philosophy: never be complacent, always strive for greatness, and use your talents to make a positive difference. His story offers a blueprint for anyone seeking to overcome challenges and pursue their dreams with passion and determination. Just as Northern Illinois triumphed over Notre Dame, Dr. Hammoudeh's journey proves that the underdog can achieve the extraordinary by never giving up. #TheHardWay #FightON

# Revolutionizing TMJ Disorders Using an AI App-Based Approach

By Sheiva Hodjati & Talar Kevorkian

Originally from Palestine, Dr. Mohammad Khalifeh began his journey in dentistry while studying at the University of Baghdad. He was drawn to the field because of its multifaceted nature, combining elements of art, medicine, surgery, and engineering. Excelling in his studies, he graduated as the top student in his class. His expertise extends to various areas of dentistry, including restorative dentistry, implantology, oral medicine, and orofacial pain. In addition to his weekly work at the USC Orofacial Pain Clinic, he also runs a private practice in Wilshire, where he utilizes his extensive knowledge and skills to deliver high-quality patient care.

Dr. Khalifeh is a board-certified Orofacial Pain and Temporomandibular Joint (TMJ) specialist. Orofacial pain is the newest specialty after Oral Medicine recognized by the American Dental Association in 2020. Dr. Khalifeh identified a critical shortage of orofacial pain specialists and recognized the need for innovative solutions to address this gap. To tackle this issue, he developed myTMJ, a free app-based AI-powered Health Solution tool designed to help patients, dentists, and dental students recognize orofacial pain conditions. The app aims to support initial assessments and provide accurate differential diagnoses by leveraging reputable research and evidence-based predictions.

**myTMJ App**
Over the past three years, Dr. Khalifeh has been refining myTMJ, incorporating expert knowledge and insights from published research across multiple databases (Image C). The app strategically differentiates various orofacial pain conditions based on parameters such as frequency, demographics, symptoms, and clinical signs. Additional filters help prioritize one condition over another, ensuring that two patients with the same condition can receive different diagnoses based on individual factors such as age and gender. While currently in its initial stages of artificial intelligence (AI), myTMJ is built on Dr. Khalifeh's extensive research, including two years of data collected from his patients and contributions from other orofacial pain specialists.

**Benefits of myTMJ**
One significant benefit of the app is its ability to narrow down potential diagnoses to three possible causes (Image B). This feature directs dentists' focus to specific conditions, enabling them to review data, analyze results, and confirm findings with clinical examination and additional necessary tests. Given the complexity of differential diagnoses in this field, the app has demonstrated its ability to detect uncommon findings—such as pain associated with intracranial conditions—that might otherwise be overlooked by general

dentists or students.

Dr. Khalifeh believes this app empowers patients to take charge of their health by helping them better address their concerns. By using the app regularly, patients and clinicians can better understand whether an issue is persistent or transient. The goal is to facilitate understanding and guide patients to seek appropriate care from the right



*Dr. Mohammad Khalifeh*

specialists. He emphasizes that the myTMJ app is not intended to replace clinicians but to educate and empower patients and practitioners alike. The app will never be 100% accurate, but utilizes information to make predictions. The final diagnosis must always be made by a licensed dentist to meet legal and professional responsibilities.

Beyond providing differential diagnoses, myTMJ educates users about potential conditions linked to their symptoms and offers self-management strategies through video tutorials for temporomandibular disorders (TMD). Additional features of myTMJ include appointment reminders, guidance on avoiding harmful habits like poor posture, and a symptom tracker to monitor progress over time. Dr. Khalifeh's innovative approach seeks to transform how orofacial pain is assessed, managed, and understood, making expert knowledge accessible to anyone who registers with a valid email and a secure password.

Notably, myTMJ has achieved a 90% success rate in identifying patients' chief complaints about orofacial pain. The app can analyze over 1,000 symptoms and their potential causes, performing a level of data analysis that would be challenging for clinicians to compute instantly. Furthermore, the app's findings align with established demographics and statistical studies. For example, 70% of users experiencing orofacial pain who utilized the app for symptom evaluation are women, while 30% are men.

Dr. Khalifeh underscores that, as professionals, what we know is vastly outweighed by what we have yet to understand. This recognition drives the importance of involving patients in tools like the myTMJ app, which can significantly enhance the monitoring and understanding of their conditions. By

gathering and analyzing a broader spectrum of data, the app builds a universal repository of information, facilitating more accurate and well-informed treatment decisions. This approach ensures a comprehensive understanding of the patient's condition, moving beyond the limited scope of abnormalities observed during a single office visit.

### Optimizing Diagnostic Efficiency

With more data, AI could streamline the diagnostic process, reducing the need for time-consuming patient forms and enabling quicker diagnoses based on just a few key questions. This approach also allows for shorter, more efficient interactions with the patient, optimizing patient engagement and compliance. Additionally, asking targeted questions about neuromuscular and motor disorders can help identify potential correlations stemming from shared neurological centers, such as the link between bruxism and periodic leg movement.

The myTMJ app incorporates an innovative picture-based diagnostic feature designed to assist patients with oral lesions in identifying possible conditions. This technique empowers patients to understand their symptoms better and seek timely evaluation and treatment from a qualified healthcare professional, enhancing early detection and management of oral health issues.

A key challenge in developing the app has been determining which data to prioritize while ensuring the accuracy of user-provided information. To refine the diagnostic process, the app employs a technique that includes consistency checks, such as repetitive questions, to detect conflicting responses. If inconsistencies are identified, the case is excluded, ensuring that only reliable data informs the diagnostic outcomes.

### The Future of myTMJ

Dr. Khalifeh envisions further expanding the app's functionality to include features such as connecting patients to specialized providers, enabling dentists to log clinical notes—including vitals and medications—and serving as a comprehensive digital documentation tool.

Dr. Khalifeh envisions the app as a valuable tool for medical and dental professionals, as well as for patients. He expresses hope that it can help address the shortage of specialists in the field of orofacial pain by providing a partial yet impactful solution to bridge this critical gap in care.

Dr. Khalifeh and his team recognize the potential for

the myTMJ app to evolve continually, enhancing its utility in patient assessments. While current features are grounded in extensive research and clinical data, advancements in AI and broader data collection could further refine its accuracy and reliability. By empowering users and integrating innovative functionalities, the app aims to provide comprehensive support for managing orofacial pain and related conditions.

### Bruxism from an Orofacial Pain Specialist's Perspective

Dr. Khalifeh explains that bruxism can be diagnosed through patient reports of teeth clenching or grinding or by examining facial and intra-oral structures. Scientifically, electromyography is used to measure muscle activity during sleep or daily activities to distinguish bruxism from normal behavior. While bruxism is not considered a disease, it is a common physiological occurrence, and its impact depends on the frequency and intensity of muscle activity.

Symptoms associated with bruxism can arise due to the excessive strain placed on the jaw muscles and temporomandibular joints during clenching or grinding. This repetitive muscle activity can lead to inflammation, soreness, and fatigue in the jaw, as well as referred pain in the head, neck, or ears.

Botulinum Toxin for Treating TMD and Myofascial Pain Dr. Khalifeh, an author of a systematic review published in 2016 on the use of botulinum toxin for chronic myofascial pain, shares his experience with Botox in treating advanced muscle pain. His research highlighted that Botox's effectiveness relies on proper dosage, technique, and patient selection. By applying these factors, Dr. Khalifeh has achieved a predictable success rate in relieving orofacial pain and headaches in patients who had not responded to other treatments.

### In Conclusion

Dr. Khalifeh is a dedicated professional and a husband and father of four, skilfully balancing his profession with family life. Currently, Dr. Khalifeh is collaborating with Dr. Chai on several projects with the medical school, aiming to enhance coordination and integration between dentistry and medicine. Outside of his professional pursuits, he enjoys cycling, photography, and videography, including editing, as creative outlets. His journey exemplifies the profound impact one can have in their field, and his dedication to patient care, research, and education serves as an inspiration to aspiring dental professionals.
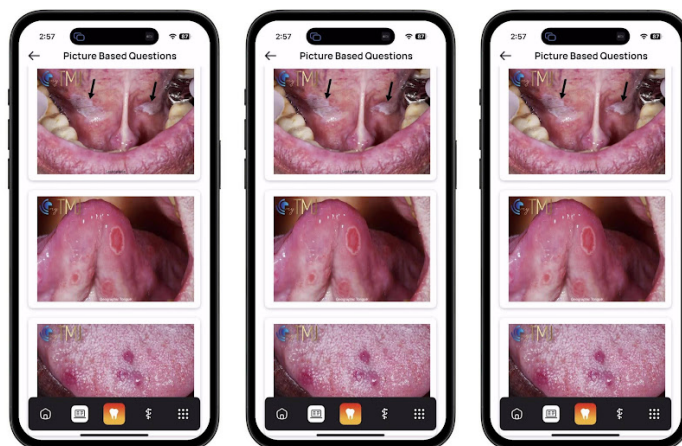


*Images A, B, C: Screenshots from the myTMJ application.*

# The Power of Collaboration in Advancing the Fields of Orofacial Pain and Oral Medicine

By Kaveh Mahdavi & Melody Yazdani

Dr. Anette Vistoso Monreal, Director of the Distance Learning and Oral Care Precancer and Pain Clinic, is a renowned Assistant Professor at the Orofacial Pain and Oral Medicine (OFPOM) Center at the Herman Ostrow School of Dentistry of University of Southern California (USC). A native of Chile, her journey into dentistry and research is a testament to her resilience, adaptability, and passion for advancing oral health.

Dr. Vistoso Monreal began her academic path in biotechnology, but when a spot opened in her dream DDS program less than a month into her studies, she jumped at the opportunity to earn her DDS. During her graduate studies, she recognized a lack of research opportunities at her dental school, so she took the initiative and founded a student association for research in dental school. This organization hosted conferences and poster presentations, bringing together over 500 students from across the country and expanding to other dental schools in Chile. This legacy continues today with Dr. Vistoso Monreal still involved.

One of her most notable achievements during dental school was her thesis project, which tackled Chile's high incidence of caries in young children. Dr. Vistoso Monreal conducted a clinical trial in which she developed a probiotic to reduce caries and distributed it in milk to 4–5 schools. Over 1.5 years, she monitored the children's bacterial environment through saliva tests, demonstrating a significant decrease in caries rates. This innovative project, funded by the Chilean government, required navigating extensive approvals to ensure the safety of pediatric participants. Beyond its academic success—her work was published in the Journal of Dental Research—the project became a public health intervention in Chile, with her probiotic now being widely implemented. Dr. Vistoso Monreal considers this project one of her proudest accomplishments, as it continues to improve oral health outcomes for children in her home country.

Following her DDS training in 2013, she completed a prosthodontics program in 2015. Her love for collaboration and intellectual curiosity drew her to research. She later immigrated to the United States with her husband and pursued advanced training in orofacial pain and oral medicine, earning her master's degree at USC and completing a residency. She further honed her expertise

with a year and a half of oral medicine training at UCSF before returning to USC, where she now leads multiple clinical, research, and educational initiatives.

Dr. Vistoso Monreal's research focuses on leveraging big data, clinical phenotyping, and artificial intelligence to revolutionize orofacial pain and oral medicine. As a board-certified orofacial pain specialist, she serves on the Board of Directors and chairs the Recertification Committee for the American Board of Orofacial Pain. Beyond academia, she is deeply committed to patient advocacy. As President of the Patient Advocacy Group (PAG) for TMD Connect, she collaborates with the Patient Leadership Council to enhance patient engagement and drive meaningful advancements in care.

One of her key research projects, in collaboration with Dr. Glenn Clark, Dr. Gerald Loeb, and Nicolas Veas, is developing an electronic medical record platform that implements artificial intelligence called SmartNote. The orofacial pain and oral medicine specialty requires extensive history-taking and conversation with patients. Patients often have an extensive history of pain or diminished function that may have been misdiagnosed or neglected in previous medical encounters. The orofacial pain and oral medicine specialist must be able to collect this history and document it thoroughly to make the correct diagnosis and treat it accordingly. SmartNote uses an algorithm with predictable behavior. The algorithm identifies the features most essential to making specific diagnoses. It then predicts the most likely diagnosis or diagnoses based on the notes. Many patients with orofacial pain have a complex disease history and may have multiple diseases occurring concurrently. This software takes this into account and uses key characteristics to make multiple diagnoses when appropriate.

This platform impacts patient care, patient education, and provider education. The goal of Dr. Vistoso Monreal's project is not to replace the doctor. Rather, the goal is to facilitate the provider's ability to take thorough notes, make an appropriate diagnosis, and ensure diagnoses are not missed. This platform also includes educational aspects, such as a teaching EMR, that help educate providers and students on diseases and their diagnostic process. As Director of the Distance Learning office, where she oversees five postgraduate programs

and teaches more than 10 different courses, one of her focuses is to develop educational tools to improve and facilitate the teaching process in health care. In addition to the academic resources, this teaching EMR will help provide more data to clarify the diagnostic process for many diseases commonly encountered in orofacial pain and oral medicine clinics and dental offices, such as temporomandibular disorders.

An offshoot of this project is an app that Dr. Vistoso Monreal is developing to track treatment outcomes and improve patient education. The app allows patients to report the experience so providers can more closely follow their patients' condition. This app is part of the Temporomandibular Disorder (TMD) IMPACT grant application that involves tremendous team collaboration within the Herman Ostrow School of Dentistry. Dr. Vistoso Monreal is one of the co-principal investigators. She is also partnered with 15 clinics throughout the United States to have additional recruitment sites for her app, starting a pilot project this year with 6 sites nationwide.

Dr. Vistoso Monreal is also collaborating with other faculty here at USC to study oral leukoplakias and precancerous oral lesions. In May 2024, she founded the Oral Care Precancer and Pain Clinic at Ostrow. Through this clinic, Dr. Vistoso does research on precancerous lesions, and her team works with the head and neck department of Keck Medicine. One of the researchers she is working with here at Ostrow is Dr. Dechen Lin. Together they are building a biobank for leukoplakias samples to allow for analysis of risk factors, treatment options, and demographics to better understand the cause of these lesions. The biobank they are developing is the only one specific to the Southern California area. A recent concerning health finding has been an increase in leukoplakia and oropharyngeal cancer in younger adults without the traditional risk factors of smoking and alcohol use. Dr. Vistoso aims to use this biobank to better understand demographics, risk factors, and the phenotype of disease to improve diagnosis and treatment for patients.

One treatment option she is exploring is imiquimod cream 5%. This medication has been historically used as an antiviral and antitumor medication. Dr. Vistoso Monreal's research on this medication has been promising. There is potential that this medication can be used to cause regression of these white lesions and prevent progression or transformation into a cancerous lesion. She is now submitting a potential study to the university's Institutional Review Board to more thoroughly test her hypothesis that imiquimod cream 5% can be an effective treatment for precancerous oral lesions such as leukoplakia. If her hypothesis is supported by her research, she will pioneer a new treatment protocol for precancerous lesions to prevent potential future cases of oral cancer.

Dr. Vistoso Monreal's journey has made her an advocate for student engagement in research. She emphasizes that collaboration is key for dental students aspiring to make an impact in the field. Her advice is to team up with others because "you cannot do anything alone." By organizing conferences, meetings, or initiatives that bring together students and professionals across schools, students can create opportunities to network, collaborate, and gain respect from professors and institutions. She recalls her time in dental school, traveling to different schools every month to build connections and ensure her research conferences featured strong speakers, which gained the respect and support of both schools and faculty. Importantly, Dr. Vistoso advises keeping research initiatives independent from corporate or political organizations, emphasizing that research should remain purely about advancing science and collaboration without external influences that might compromise its integrity.



*Dr. Anette Vistoso Monreal*

Dr. Vistoso Monreal's career exemplifies the power of teamwork, innovation, and persistence, serving as a source of inspiration for dental students and professionals alike. Her research has the power to improve note-taking, the diagnostic process, patient tracking, patient education, student education, and the understanding and treatment of precancerous oral lesions. In her many research endeavors, Dr. Vistoso Monreal is improving the experience of clinicians, students, and patients, both now and in the future. Her unique path—from biotechnology in Chile to becoming a leading expert in orofacial pain and oral medicine in the U.S.—reflects her unwavering commitment to improving the quality of life for patients worldwide.

# *A Lifetime of Homework:*
# The Life of an Orthodontist

By Haeseong Lee & Austin Nahouray

In the vast realm of medical research, Dr. Stanley Miyawaki's journey to becoming an orthodontist is a testament to adaptability, passion, and a continuous pursuit of excellence. Raised in Culver City, California, he attended high school at Venice High and later pursued his undergraduate studies at the University of Southern California (USC), graduating in 1978. Initially, he enrolled as an electrical engineering major, drawn by the booming interest in computers during the 1970s. However, his career trajectory shifted after just one semester, inspired by his cousin—who was a pre-dental student a year ahead of him at USC—and his own deep-rooted interest in biology and chemistry, perhaps influenced by his father, a pharmacist. By his freshman spring semester, Dr. Miyawaki switched his major to biology, setting him on the path toward dentistry.

Despite his aspirations to stay local, the competitive nature of dental school admissions in the 1970s led him to the Washington University School of Dental Medicine in St. Louis, Missouri. One of his dental school classmates, Mike, was also a USC graduate, and the two became friends. By his senior year, Dr. Miyawaki realized that general dentistry did not align with his long-term goals. His classmate, Mike, had always wanted to become an orthodontist, and their relationship was the catalyst that inspired Dr. Miyawaki to consider specializing in orthodontics. The structured, detail-oriented nature of orthodontics seemed to fit his personality and career aspirations.

Following his dental school graduation, Dr. Miyawaki returned to California and practiced for a year before gaining acceptance to Northwestern University's two-year orthodontic residency program in Chicago. He completed his residency in 1985 and began teaching pre-doctoral orthodontics at USC the following year. His belief that being a good teacher is integral to being a good doctor fueled his passion for education. Dr. Miyawaki recognized that teaching not only benefited students, but also enhanced his ability to effectively communicate with and educate his patients and staff.

In 1986, he joined an orthodontic study club with fellow orthodontists, several of whom also taught at USC. This experience motivated him to continue teaching, fostering an environment of collaboration and mutual growth. He also appreciated the numerous networking opportunities the study club provided, particularly for a newly practicing orthodontist. Over the course of his 40-year teaching career, Dr. Miyawaki's philosophy has evolved. Today, he emphasizes the complexity of orthodontic diagnosis and treatment planning to pre-doctoral students, urging them to recognize the challenges and responsibilities inherent in the field. While orthodontists often make treatment appear simple, Dr. Miyawaki underscores that the process can be far more complex. He cautions students that general practitioners must be aware of the limitations of their orthodontic diagnostic skills and their understanding of orthodontic biomechanics when incorporating orthodontics into their practices.

Dr. Miyawaki draws attention to the distinct mindset required for different dental specialties. Orthodontics tend to require extensive planning since treatment can often take 1 to 3 years to complete. The ability to meticulously plan and foresee treatment outcomes is crucial to orthodontics, as orthodontists are often treating patients who are actively growing with dentitions that are transitioning from deciduous to permanent. Dr. Miyawaki thinks that orthodontists engage in "a lifetime of homework" dedicating time outside of clinical hours to analyze diagnostic records and devise treatment plans free from the distractions of running a practice. Dr. Miyawaki personally arrives at his office about two and a half hours early each morning prior to seeing patients to diagnose and create treatment plans for cases. Although every orthodontist has their own system, diligent treatment planning is a critical universal component of practicing orthodontics, especially today when clear aligner treatment requires digital treatment planning, and the course of treatment is dictated from the very beginning. In teaching second-year dental students, he finds that students are often discouraged from orthodontics due to the perception that they will need good wire-bending skills. He advises students to not be deterred from the specialty because of this. Proficient wire-bending skills can be taught and improved with practice.

He believes that students should focus on the specific mindset the specialty requires.

The advent of clear aligner treatment (Invisalign) has significantly influenced Dr. Miyawaki's practice over the past two decades. Recognizing Invisalign's potential in the year 2000, he embraced the technology early, distinguishing himself from peers who were slower to adopt. His foresight proved to be one of the best decisions of his career, enabling him to stay ahead of industry trends. Although Dr. Miyawaki is not a researcher, he frequently attends orthodontic seminars and conferences. When asked what he thought is an area of orthodontics that might be an area of future innovation, he mentioned that he had attended a presentation at the American Association of Orthodontists Annual Session in Los Angeles about 5 years ago where research from the University of Michigan was presented on the possibility of employing drug therapeutics to attenuate orthodontic tooth movement. He believes that this is an area of research that eventually could find its way into clinical practice since orthodontic tooth movement is such a physiologically dynamic process.

Reflecting on his achievements, Dr. Miyawaki values professionalism, continuous learning, and open-mindedness. His most significant professional achievement is having successfully practiced orthodontics for forty years. He advises dental students to excel academically, remain adaptable, and seek mentorship. He believes that successful clinicians must be open-minded and sometimes find unique ways to solve the challenges they are faced with. Orthodontists can have cases that require unique

treatment plans that are not explicitly outlined in traditional textbooks. Dr. Miyawaki finds that a doctor's life is all about "practicing" and one must occasionally fail in order to succeed.



*Dr. Stanley Miyawaki*

Recalling his orthodontic residency, Dr. Miyawaki was especially influenced by two of his instructors. One was Dr. Sheldon Rosenstein, who imparted much foundational knowledge about orthodontic diagnosis and treatment planning, cleft lip and palate treatment, and orthodontic history. Dr. Miyawaki believes that it is advantageous for healthcare providers to be familiar with the history of their discipline as it enables practitioners to understand why their field is the way it is, and how it has evolved. Dr. Rosenstein's teaching also inspired Dr. Miyawaki to join the cleft lip and palate team at Providence St. John's Hospital in Santa Monica. Over the years, his relationship with this team has provided one of the most rewarding aspects of his career since the role of orthodontics in cleft care can have

profound and life-changing benefits for these patients.

Dr. Miyawaki also recognizes another orthodontist from his Northwestern University residency as a mentor. Dr. Mike Gannon was an instructor who was a self-described "maverick". His instruction about orthodontic diagnosis and treatment was very different from the other faculty. He provided the counter-culture foil to the traditionalists' thinking. Dr. Miyawaki believes that Dr. Gannon's influence shaped the open-mindedness of his career. And, although following what is the accepted thinking is a foundation for day-to-day practice, occasionally straying from the norm is sometimes required.

For Dr. Miyawaki, photography serves as both a hobby and a professional parallel. His appreciation for capturing details photographically mirrors the precision required in orthodontics, where subtle adjustments can significantly impact treatment outcomes. Photography also challenges the mind to be creative, and he believes that creativity is an often overlooked aspect in healthcare. This dual perspective enriches his personal and professional life, reinforcing his belief that hobbies and diverse interests contribute to well-rounded, insightful practitioners. Dr. Miyawaki also enjoys following sports, particularly baseball as he is a lifelong Los Angeles Dodgers fan.

Dr. Miyawaki's enduring legacy lies in his commitment to education, his adaptability to evolving technologies, and his dedication to his patients and students. His story exemplifies how passion, resilience, and openness to change can shape a fulfilling and impactful career in orthodontics.

# Little Teeth:
# Big Impact

By Naghmeh Aminzadeh & Ryan Tran

### Meet Dr. Philip Yoong

Dr. Philip Yoong is a man of many roles—pediatric dentist, professor, mentor, and advocate for children's oral health. His journey into dentistry and teaching is as unique and inspiring as the lessons he shares with his students and patients. From a childhood spent adapting to new environments to a career defined by compassion and mentorship, Dr. Yoong's story is a testament to perseverance, adaptability, and the profound impact of dentistry.

Growing up, Dr. Yoong moved frequently, attending a total of 15 different schools in his lifetime. Moving every two years made him the "new kid," a challenging role that ultimately taught him how to connect with people quickly and build trust. Little did he know that these skills would one day serve him well in pediatric dentistry, a field where creating comfort and rapport is essential.

### A Journey of Discovery

Dr. Yoong's academic journey began at the University of California, San Diego (UCSD), where he initially planned to enter the medical field. Coming from a family with strong roots in medicine, it seemed like a natural choice. However, his plans took a surprising turn during a volunteer trip to Tanzania.

While preparing for the trip as a pre-medicine volunteer, the organizers informed him that more pre-dental volunteers were needed. Despite having little familiarity with dentistry, he volunteered to step into the role, assisting with dental care in underserved communities. What he encountered there changed his life.

"The patients were in visible pain, and their gratitude after receiving care was unlike anything I'd experienced in other healthcare settings," Dr. Yoong recalls. "It made me realize the immediate and life-changing impact dentistry can have."

Inspired, Dr. Yoong joined the UCSD Pre-Dental Society and began managing student-run clinics. One clinic located in downtown San Diego provided free care to uninsured and homeless populations, relying on donated supplies and volunteer dentists. Another clinic, established inside a local elementary school, focused on preventative care. There, pre-dental students transformed a classroom into a working clinic, conducting screenings and educating children about oral hygiene.

Managing those clinics was eye-opening, because he and his team not only provided care to those who needed it most, but also fostered connections with the community and became mentors. It was a transformative experience that



*Dr. Philip Yoong*

showed him how much impact dentistry could have beyond the patient chair.

### Finding His Calling in Pediatric Dentistry

Dr. Yoong went on to earn his dental degree from the University of Michigan. During his early years in dental school, he was intrigued by oral surgery, even shadowing residents and attending 4 a.m. rounds. However, his perspective shifted during a pediatric dentistry course in his second year.

His pediatric dentistry instructor spoke about the importance of advocating for children and families, sparking memories of his time managing the elementary school clinic. The idea of combining mentorship, advocacy, and humor to make a difference in children's lives resonated deeply within him.

"Everything started to fall into place," Dr. Yoong says. "Pediatric dentistry felt like a natural fit. It allowed me to help people, build trust with children, and even be a bit silly to reduce dental anxiety."

In pediatric dentistry, Dr. Yoong discovered the power of behavior guidance—techniques like "Tell-Show-Do", voice control, and distraction that help children feel at ease during dental visits. He emphasizes that behavior guidance is what sets pediatric dentistry apart as a specialty.

"It's not just about fixing teeth," he explains. "It's about creating a positive experience that shapes how children view dentistry for the rest of their lives. That's an incredible responsibility and privilege."

## The Role of Prevention in Pediatric Dentistry

Dr. Yoong is a strong advocate for preventative care, emphasizing that educating parents is as important as treating children. He believes that early intervention, such as establishing a dental home and using fluoride, can have a lifelong impact on oral health.

"Prevention goes a long way," he says. "By educating parents and creating positive experiences for children, we're not just addressing immediate needs but setting the foundation for a lifetime of healthy habits."

He finds joy in working with anxious children, transforming their fear into trust and even excitement. "Even if I've had a tough day with several screaming Frankl 1 kids, that one moment when an anxious and nervous child who was crying in the beginning but smiles at the end of their appointment makes it all worthwhile," he says.

## A Passion for Mentorship

Since 2021, Dr. Yoong has been a part-time faculty member at the Herman Ostrow School of Dentistry. Teaching, for him, is a natural extension of his passion for mentorship.

"In private practice, you might see 20 patients a day," he explains. "But in academia, you're shaping the next generation of dentists. The lessons you teach can ripple outward, impacting countless patients through your students."

Dr. Yoong often goes above and beyond for his students, holding extra sessions to mentor students interested in pediatric dentistry, even without compensation. He views it as an investment in the future of the profession and a way to give back.

"Teaching keeps me young and forces me to stay up-to-date with the latest research and techniques," he says. "It's a rewarding way to grow alongside my students and stay connected to the evolving field of dentistry."

## Life Beyond Dentistry

Outside of his professional roles, Dr. Yoong has taken up several hobbies, including tennis, a sport that has kept him active and grounded since the age of four. His interests and hobbies reflect his philosophy on happiness—that it is deeply personal and unique to each individual. "Find out what makes you happy without compromising your ethics," he advises. "For some, happiness might be a peaceful moment sitting on a rocking chair in a log cabin by the fire with a cup of coffee. For others, it might be living in a mansion in Beverly Hills. The key is to define it for yourself and work toward it."

The Rewards of Pediatric Dentistry
For Dr. Yoong, the most rewarding part of his job is the lasting impact he has on his young patients. He sees every appointment as an opportunity to create positive, lifelong impressions about oral health and dentistry.

"Decisions and actions at a young age are incredibly impressionable," he says. "What we do as pediatric dentists can shape how children view healthcare and dentistry for the rest of their lives. That's a responsibility I take very seriously."

Even on challenging days, Dr. Yoong finds joy in the small victories—a scared child leaving the office with a smile, a parent expressing gratitude for their child's positive experience, or a student gaining confidence in their skills.

## Looking Ahead

As Dr. Yoong continues to balance his roles as a dentist, educator, and mentor, he remains focused on the future. He is considering opening his own practice and starting a family, milestones that reflect his commitment to both personal and professional growth.

Dr. Philip Yoong's journey is a testament to the power of adaptability, passion, and mentorship. From his early experiences managing free clinics to his current roles as a pediatric dentist and professor, he has dedicated his career to improving the lives of children and inspiring the next generation of dental professionals.

Through his work, Dr. Yoong demonstrates that dentistry is more than a profession—it's an opportunity to make a difference. One child, one student, and one smile at a time.

# A Clinician-Scientist Advancing Periodontics Through Research and Education

By Gursimran Toor & Andrea Woywitka

Dr. Mirali Pandya, Assistant Professor of Clinical Dentistry in the Department of Endodontics and Periodontics at the Herman Ostrow School of Dentistry of USC, is the embodiment of the spirit of discovery and innovative reasoning. Dr. Pandya approaches each research and clinical project with creativity, sincerity, and a commitment to advancing the field of periodontal care.

**Education & Early Career**

Dr. Pandya embarked on her journey in dentistry by earning a Bachelor of Dental Surgery from Mauras College of Dentistry in 2012. Practicing general dentistry further reinforced her conviction that a career focused solely on restorative dentistry did not align with her vision and aspirations, prompting a pivot toward research. The passion for scientific inquiry led her into the field of tissue engineering and stem-cell-focused regeneration at the National University of Singapore College of Dentistry. Thereafter, Dr. Pandya relocated to the United States to pursue a PhD in Oral Biology at Texas A&M College of Dentistry.

During her doctoral studies, Dr. Pandya integrated her clinical foundation with advanced research, focusing on the mechanisms of enamel prism formation and mineral ion transport during amelogenesis. Following her PhD, she further honed her expertise by completing a residency in periodontics and earning a Master of Science degree at Texas A&M. Today, Dr. Pandya brings her extensive academic and clinical experience to the Herman Ostrow School of Dentistry at USC, where she is contributing significantly as an educator, researcher and a practitioner.

**Contributions to the Field of Dentistry**

As Dr. Pandya began her research career, she quickly recognized a disconnect between basic science and clinical practice and developed a strong desire to bridge this gap. "I strongly believe that the conversations between scientists and clinicians should be built on a common and simplified code of scientific language and translational objectives." This philosophy laid the foundation for her PhD at Texas A&M University, where she published her findings and conclusions in high-impact journals—a pursuit that reflected both her scientific curiosity and clinical perspective.

Dr. Pandya's research focused on enamel, the strongest mineralized tissue in the human body. She was particularly intrigued by the specialized cells called ameloblasts, which secrete the enamel matrix but undergo apoptosis after tooth eruption, leaving enamel without regenerative capabilities. "Isn't it amazing that the ameloblasts disappear after tooth eruption, and is there a way to keep them alive in an in vitro environment? And if so, can we regenerate enamel?" she asked. An investigation into these fascinating challenges took her on a journey to discover how ameloblasts manage to transport high concentrations of calcium and phosphate ions to the enamel matrix without succumbing to the acidic environment created by these ions.

Central to Dr. Pandya's work is the hypothesis that ameloblasts utilize a vesicular protein called clathrin, known for its triskelion structure, to transport ions like osteoblasts during bone formation. However, a major challenge emerged: there was no existing mouse model to test this hypothesis. Clathrin is an essential protein and its complete knockout results in embryonic lethality of the mice. Undeterred, Dr. Pandya's team proceeded to develop a conditional knockout model using an amelogenin-Cre driver to specifically target clathrin in ameloblasts. This groundbreaking model was deposited at the Mutant Mouse Resource and Research Center (MMRRC), making it available to researchers worldwide. "My mentor and I submitted this novel model so that any researcher who wants to study the Clathrin gene and its function can acquire it and build on it," she shared.

Simultaneously, Dr. Pandya faced another significant hurdle: growing ameloblasts in vitro. Unlike osteoblasts, which can be cultivated on cell culture plates, ameloblasts are incapable of surviving in a two-dimensional cell culture environment. Drawing inspiration from bioreactors initially developed by NASA for growing cells in microgravity, Dr. Pandya devised a novel approach. She combined scaffolds and a constantly rotating environment to provide the cells with the necessary nutrients and a three-dimensional microenvironment conducive to ameloblast cell growth. By introducing mesenchymal cells to facilitate dynamic real-life epithelial-mesenchymal interactions, her team successfully developed a viable model for the long-term culture of ameloblasts. This model, supported by a UG3 grant from the NIH and a part of a collaboration involving teams based at USC, University of Michigan, UCSF, and Texas A&M, is now accessible through FaceBase, a USC-led repository for craniofacial research. "All the data and

protocols that were developed for this project are available online for anyone to use in their labs," she noted, adding that she published a detailed video protocol in the Journal of Visualized Experiments (JOVE).

Dr. Pandya's contributions extend beyond enamel biology. During her PhD, she explored the Hippo pathway, a relatively recent discovery, to understand its role in alveolar bone formation, craniofacial development, and cancer. In addition, she investigated the presence of titanium particles in peri-implantitis patients, collaborating with periodontics residents to examine tissue samples surrounding failed implants. Her findings raised important questions about the biocompatibility of titanium and its potential systemic effects, highlighting the broader implications of her work for both dentistry and medicine.

Reflecting on her diverse research endeavors, Dr. Pandya emphasized the importance of curiosity and open dialogue in scientific advancement. "If you don't challenge the existing notions, how can you create a new path for the future?" she remarked. Her dedication to addressing fundamental challenges in enamel biology, coupled with her innovative approaches, has left an indelible mark on the field and provided a robust foundation for future research.

## Current Work

At USC, Dr. Pandya continues her contribution to research, partnering with Dr. Casey Chen (Chair, Department of Endodontics and Periodontics at Herman Ostrow School of Dentistry of USC) to explore non-invasive imaging techniques to monitor the progression of periodontitis. Traditional radiographs and CBCT scans, while effective for assessing inter-proximal bone levels, do not provide a clear picture of buccal or lingual bone. They also expose patients to radiation, which in turn reduces the frequency of these scans, making it difficult for clinicians to closely monitor changes in periodontal health. Seeking an innovative solution to this problem, Dr. Pandya and her team hypothesize that ultrasound technology offers a radiation-free alternative to track changes in the alveolar bone, potentially transforming how clinicians treat patients suffering from periodontitis and intercept disease at an earlier stage. Following approval from the IRB, and in partnership with UCSD, a custom ultrasound probe has been developed for this study. Dr. Pandya and the first-year periodontics residents will begin testing this technology on patients in January 2025, assessing its accuracy and practicality, with hopes of it becoming a

*Dr. Mirali Pandya*

standard tool in dental offices.

Simultaneously, taking her research further in the field of periodontal diseases, Dr. Pandya hopes to develop her research path, investigating why a small percentage of periodontitis patients experience progressive tissue breakdown despite optimal treatment, being deemed "downhill patients." While bacterial involvement in periodontitis is well-documented, Dr. Pandya is exploring whether other factors, such as viral infections, contribute to this persistent issue. With aging being a significant focus in healthcare research, and with over 50% of people over the age of 60 having periodontitis, her work aligns with broader NIH initiatives to improve the quality of life for our aging population.

## Future Goals & Aspirations

Dr. Pandya is a dynamic clinician-scientist committed to lifelong learning and professional growth. As she navigates the dual responsibilities of research and clinical practice, she actively seeks guidance from her mentors, Dr. Chen, Dr. Kian Kar (Professor of Clinical Dentistry, Department of Endodontics and Periodontics at Herman Ostrow School of Dentistry of USC), and Dr. Pinghui Feng (Chair, Section of infection and immunity at Herman Ostrow School of Dentistry of USC). "Mentorship is the core foundation for personal and professional growth," she states, emphasizing how pivotal her mentors have been in shaping her career trajectory. She is particularly excited about applying for a K-award NIH training grant, which supports early-career clinicians who aspire to integrate research with patient care. "Research teaches you to keep an open mind and consider all options," she explains, acknowledging the complexity of her chosen field.

Dr. Pandya hopes to complement her research ambitions with board certification from the American Academy of Periodontology, which would be another significant milestone in her professional journey. Balancing these goals with her commitment to fostering critical thinking among students, she remains dedicated to creating an engaging and supportive learning environment. "The journey of research and education," she reflects, "is about patience, persistence, and the willingness to learn from challenges." Through these endeavors, Dr. Pandya exemplifies a profound dedication to advancing both her personal expertise and the broader field of periodontology.
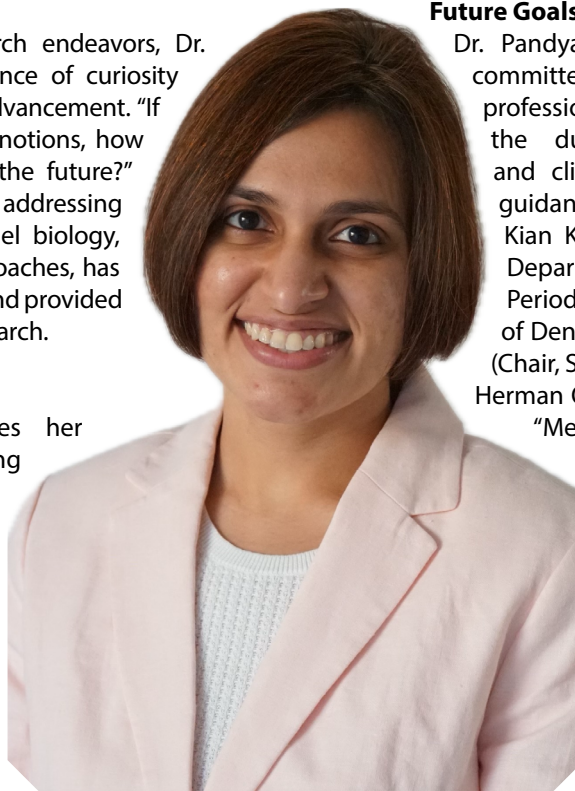
# *Bridging Science, Art, and Education:*
# The Journey of a Prosthodontics Resident

By Bryan Fedchun & Cloris Yidan Zhang

Stepping into the world of prosthodontics with curiosity, compassion, and a relentless pursuit of knowledge, Dr. Samantha Chiang, a third-year resident at the Herman Ostrow School of Dentistry of USC, exemplifies the harmonious blend of clinical practice, research, and teaching. From early aspirations in dentistry to research on oral biology and advanced prosthodontics training, Dr. Chiang's journey is as inspiring as it is impactful.

**Early Inspiration and Education**
Dr. Chiang's interest in dentistry was sparked during high school from positive experiences as a patient. Dr. Chiang graduated with an undergraduate degree in Chemical Biology at UC Berkeley. Then she pursued a DDS-PhD program at UCLA School of Dentistry. Her PhD research focused on oral biology, specifically the early diagnosis of Sjögren's syndrome using saliva biomarkers. Her work involved developing assays to detect salivary autoantibodies responsible for Sjögren's syndrome.

During her PhD program, Dr. Chiang maintained her clinical skills by practicing part-time on weekends and some evenings in Monterey Park and Culver City. Serving different populations and diverse communities enriched her understanding of patient needs and cultural nuances in dental care. These experiences enabled her to address a wide range of clinical challenges and deepened her commitment to improving patient outcomes.

**Transitioning to Prosthodontics**
During her four years of practicing general dentistry, Dr. Chiang encountered patients who presented with complex prostheses that posed unique challenges and sparked her intellectual curiosity. She realized that she needed additional training to provide her patients with more comprehensive treatment planning and innovative solutions.

Driven by her desire to improve patient outcomes through evidence-based and cohesive treatment planning, Dr. Chiang decided to pursue specialized training in prosthodontics at Ostrow. This advanced education provided her with the tools to analyze cases critically, consider multiple treatment options, and execute solutions tailored to individual patient needs.

"Prosthodontics is like building with Legos," she explains, "but without a manual. You can make what you want without a predefined manual because you are taught all these tools available and the ability to create and utilize these tools." Dr. Chiang emphasized the importance of creativity in prosthodontics as each clinical case is different and to achieve the best outcomes, you must creatively use your tools and knowledge. The training also involves an artistic aspect as in aesthetic cases, it's important to train your eyes and see patients as a whole and know dental materials to achieve natural aesthetic outcomes.

**Research on Complex Clinical Cases**
One of Dr. Chiang's most notable projects involves a patient with a severely misaligned anterior implant. This implant—shallow, poorly positioned, and initially cement-retained—posed significant challenges for designing a cohesive full-arch prosthesis. The patient's existing implant was flared buccally at an extreme angle, creating functional and aesthetic limitations. Additionally, the shallow depth prevented the use of standard multi-unit abutments, further complicating the restorative plan.

Dr. Chiang's innovative solution centered on the development of a screw-retained telescopic custom abutment system. By leveraging this design, her team ensured both the stability and longevity of the prosthesis while preserving the integrity of the adjacent oral structures. This approach combined advanced digital workflows and meticulous treatment planning.

*Dr. Samantha Chiang*

"This was one of the most challenging cases I've worked on," Dr. Chiang reflects. "The existing implant posed significant constraints, requiring us to think beyond conventional methods and integrate advanced milling techniques to create a functional and aesthetically pleasing outcome."

Using 5-axis digital milling technology, her team addressed the severe angulation by designing a custom abutment that allowed the prosthesis to align cohesively with the patient's other teeth. The telescopic design enabled the attachment of a full-arch prosthesis without the need for cement, thereby reducing the risk of peri-implant inflammation caused by residual cement. Furthermore, the abutment system incorporated a dynamic axis correction feature, ensuring precise insertion paths and optimal biomechanics.

Dr. Chiang's efforts extended beyond fabrication. She collaborated with periodontists to place adjacent implants in a way that incorporated the existing malpositioned implant and permitted the fabrication of a screw-retained telescopic full-arch prosthesis. This interdisciplinary approach allowed for a final prosthesis that not only restored function but also achieved aesthetics, ensuring the patient's confidence in her smile.

Her case planning extended to addressing quadrant versus full-arch considerations. This approach minimized the need for redundant procedures and avoided future complications by ensuring that treatment plans were cohesive and restoratively driven from the outset. Additionally, Dr. Chiang emphasized the importance of case selection in prosthodontics, noting that not every complex case can or should be undertaken if the clinical outcome may be compromised.

**Exploring Broader Research Horizons**
In addition to her clinical achievements, Dr. Chiang has delved into research that addresses critical challenges in oral health. Her work on Sjögren's syndrome, which focused on identifying biomarkers in saliva, paved the way for early diagnostic tools that could transform patient outcomes. Her contributions during the COVID-19 pandemic, where she co-developed antibody assays, demonstrated her ability to adapt her expertise to pressing global issues.

Her current research interests include expanding the use of saliva-based diagnostics to detect other autoimmune conditions, exploring biocompatible dental materials, and refining digital workflows for enhanced precision in prosthetic design. These pursuits align with her goal of bridging the gap between research and clinical application.

Dr. Chiang also highlighted the importance of prosthetically driven implant placement to minimize complications. By emphasizing collaborative planning between surgeons and prosthodontists, her work ensures that the placement of implants aligns with the overarching restorative goals, addressing long-term challenges for both patients and clinicians.

**Teaching in Dentistry**
"Patient care helps people in an immediate way, research impacts population in the long run, and teaching helps shape the future generation of dentists." Dr. Chiang's passion for teaching and mentoring began to take shape during her PhD program, where she discovered the joy of sharing knowledge and guiding others.

Dr. Chiang provides mentorship to students at USC, encouraging them to approach dentistry with creativity and critical thinking. Her advice for aspiring prosthodontic residents highlights the importance of clinical experience, time management, and an open mind. "Prosthodontics cases are complex and often long-term. Patient management skills and the ability to navigate challenges, such as unexpected implant failures, are crucial," she notes. She also emphasizes the need for a balance of dental, lab, and office management skills to learn from the program.

**Recognized Contributions and Future Goals**
Dr. Chiang's dedication to prosthodontics has been recognized through her numerous awards and presentations at national conferences. She recently presented her work on managing malpositioned implants for complete-arch zirconia prostheses at the International Academy of Gnathology.

She also addressed some misconceptions in the field. One common misunderstanding she highlights is the perception that all surgically placed implants can be utilized. Dr. Chiang stresses that prosthetically driven implant placement minimizes complications, ensuring long-term success for patients. Her approach underscores the necessity of integrating critical thinking and advanced technology to achieve optimal results.

Looking ahead, Dr. Chiang envisions a future where prosthodontics integrates seamlessly with digital technologies to deliver patient-centered care. Her ongoing research on saliva-based diagnostics and restorative materials promises to drive innovation in both preventive and rehabilitative dentistry. Additionally, she hopes to inspire future dentists by continuing her work in academia, combining her love for teaching, research, and clinical practice.

For practitioners and researchers alike, her dedication to innovation serves as an inspiring example of how science and art converge in prosthodontics—ultimately transforming lives one smile at a time.

To unwind outside of her professional life, Dr. Chiang enjoys exploring culinary arts, particularly baking, which she likens to the precision and creativity required in prosthodontics. If not in dentistry, she imagines herself thriving in a teaching role or within the realms of scientific research, reinforcing her love for mentorship and discovery.

# A Life of Service and Dedication:
## Dr. Robert Peters, DMD, MS

By Nicholas Hy & Jasmine Shafa

Dr. Robert Peters, an Associate Professor of Clinical Dentistry at the Herman Ostrow School of Dentistry of USC, exemplifies the blend of expertise, dedication, and compassion that defines a truly exceptional dental professional. With an illustrious career spanning over three decades in the U.S. Navy and a robust academic presence at USC, Dr. Peters has made significant contributions to dentistry and the care of underserved populations.

### A Path Forged by Family and Service

Dr. Peters' journey into dentistry began with inspiration from his late uncle, Robert Novotny, D.D.S., a skilled dentist who graduated from Loyola University in the golden era of dentistry in 1964. As a child, Dr. Peters witnessed his uncle's impressive skillfulness in performing dental procedures, including intricate gold work and lab work for complex restorations. These experiences, combined with Dr. Peters' positive interactions with orthodontics and dental care solidified his desire to enter the profession.

His military career was sparked by a strong sense of duty and patriotism. Initially committing to three years of service during dental school, his tenure in the Navy extended to 36 years, encompassing roles as a clinician, leader, and advocate for patient-centered care. His family's strong ties to the Navy also influenced his path—he met his wife during his service, and his son who recently graduated from USC has followed in his footsteps, serving in the Navy and training to become a pilot. These personal and professional experiences have instilled in Dr. Peters a profound respect for the sacrifices of military families and the importance of giving back.

### Shaped by Military Excellence

Dr. Peters' military career was marked by a commitment to operational excellence and innovation. As a Clinic Director and Comprehensive Dentist at the Naval Dental Center in Camp Pendleton, he oversaw dental operations for thousands of Marines and sailors, achieving an unprecedented 95% operational dental readiness. His leadership extended to supervising budgets, managing clinic inventory, and mentoring a multidisciplinary team of dental officers, corpsmen, and civilian staff.

One of his most fulfilling roles involved participating in humanitarian missions through the Navy's Dental Civic Action Program. Deployments to Kenya and Oman allowed him to provide essential dental care to underserved populations, addressing severe oral health challenges in communities with limited access to healthcare. These experiences reinforced his belief in the transformative power of dentistry and the importance of connecting with patients on a personal level.

Dr. Peters also served as Force Dental Officer for Commander Naval Surface Force and Commander Naval Air Force, U.S. Pacific Fleet, overseeing dental operations for 23 ships. His efforts included streamlining supply procurement, reducing costs, and maintaining high dental readiness through inspections and training. His initiatives ensured that all dental departments under his purview achieved outstanding operational scores, reflecting his dedication to excellence.

### A Focus on Special Patient Populations

At USC, Dr. Peters plays a vital role in the Special Patients Clinic (SPC) within the Department of Geriatrics, Special Needs, and Behavioral Sciences. His passion for serving special patient populations was shaped by early exposure to individuals with unique needs and his experiences treating medically complex patients at the Naval Postgraduate Dental School, Bethesda, Maryland. Dr. Peters takes pride in advocating for patients who face barriers to care, ensuring they feel heard, valued, and respected.

In the SPC, he mentors dental students as they navigate complex cases involving medically compromised and special needs patients. Each session begins with a comprehensive review of patient histories, social determinants of health, and treatment plans. By emphasizing patient-centered care and building trust, Dr. Peters fosters a supportive environment where both students and patients thrive.

His contributions extend beyond the clinic to mobile dental units serving veterans and underserved communities in West Los Angeles, Monrovia, and Pasadena. Dr. Peters finds these outreach programs particularly rewarding, as they provide students with hands-on experience while addressing critical gaps in care.

## Mentorship and Teaching at USC

Dr. Peters approaches teaching with meticulous preparation and a passion for sharing knowledge. He sees mentorship as a responsibility to pay forward the guidance he received from mentors during his career. A graduate of Southern Illinois University School of Dental Medicine, Dr. Peters completed a two-year Comprehensive Dentistry Residency at the Naval Postgraduate Dental School, which he credits with shaping his holistic understanding of dentistry. He encourages aspiring dentists to pursue advanced training to refine their skills and broaden their perspectives.

At USC, Dr. Peters ensures his students are well-prepared by thoroughly reviewing patient cases before pre-session meetings. He provides expert guidance on oral medicine, treatment planning, anesthetic techniques, restorative dentistry, and prosthodontics. His dedication to student success reflects his belief that every patient deserves thoughtful, high-quality care.

## Contributions to Research

In 1998, Dr. Peters co-authored a seminal study on heat generation during ultrasonic scaling, which demonstrated the importance of effective cooling methods to prevent tissue damage. The study compared ultrasonic handpiece water irrigation, bulb syringe irrigation, and no irrigation, revealing that both continuous and bulb irrigation effectively minimized heat generation, keeping temperatures within physiologically tolerable limits. This research has practical implications for clinical practice, particularly in surgical settings where sterile cooling is required.

Currently enrolled in the Geriatric Dentistry Master's program at USC, Dr. Peters is combining clinical and didactic learning to further his expertise in this field. He sees this advanced education as a way to enhance his knowledge and skill set, which he aims to share with his D.D.S. students and apply in his daily practice. Dr. Peters believes that understanding geriatric dentistry is not just a professional pursuit but a vital contribution to society. By acquiring new insights and techniques, he strives to provide better care for aging populations while inspiring the next generation of dental professionals. His commitment to learning underscores his broader mission to give back to the community and serve the world with compassion and expertise.

## Advocacy for Veterans' Oral Health

Dr. Peters is a passionate advocate for improving veterans' access to dental care, drawing on his firsthand knowledge of the challenges faced by this population. He has presented on VA dental benefits, oral health disparities between veterans and non-veterans, and barriers to care. His goal is to develop outreach programs that provide comprehensive dental services to veterans, many of whom lack access to affordable care after leaving the military.

Through his involvement with the Village for Vets initiative, Dr. Peters has treated veterans with significant dental needs, emphasizing the importance of understanding their medical and personal histories. He believes these efforts are vital to addressing systemic inequities and ensuring that those who have served receive the care they deserve.

## Looking Ahead

Dr. Peters remains committed to advancing dentistry through innovation and advocacy. He envisions a future where new materials, digital technologies, and minimally invasive techniques enhance patient care, particularly for special populations. His dedication to education and service underscores his belief that dentistry is a powerful tool for improving lives.

## A Legacy of Service and Compassion

For Dr. Robert Peters, dentistry is more than a profession; it is a lifelong commitment to making a difference. While mentoring students and caring for underserved populations, he approaches every endeavor with empathy and excellence. As a husband, father, and leader, Dr. Peters inspires those around him to embrace the values of service, integrity, and compassion, leaving an indelible mark on the dental community and beyond.



*Dr. Robert Peters*

# Improving the Quality and Diversity of Dental Prostheses

By Isabelle Mollicone & Daniel Rouel

Dr. Fabiana M. Varjao is an accomplished dental professional with extensive teaching and research expertise in prosthodontics, dental materials, and oral rehabilitation. Her passion for dentistry originated from a lifelong love of hands-on activities such as crafting, drawing, and painting, combined with a deep interest in the health sciences. During her first year of dental school, she became involved in research through a funded program, exploring different departments before focusing on prosthodontics and complete dentures. This early research experience ignited her academic curiosity, leading her to pursue a master's degree in the same field, where she expanded upon her initial research projects. This dedication set the foundation for her future career in academia, research, and clinical practice.

Originally from Brazil, she earned her DDS, MS, and PhD from São Paulo State University, followed by fellowships in implant-retained dentures, fixed prosthodontics, and dental emergencies. Currently a Clinical Associate Professor at the Herman Ostrow School of Dentistry at USC, she has previously held faculty positions at Case Western Reserve University and other esteemed institutions. Dr. Varjao has authored numerous peer-reviewed articles, books, and book chapters on topics ranging from denture aesthetics to dental material durability. She has secured significant research funding and received multiple teaching awards, including "Teacher of the Year" and Excellence in Teaching awards at

USC. Dr. Varjao has developed and taught various courses, including Removable Prosthodontics, Partial Denture Diagnosis and Design, and Masticatory Dynamics, all while mentoring students and postdoctoral fellows. Her career reflects a strong commitment to clinical excellence, research innovation, and mentorship.

Dr. Varjao's research has focused on denture teeth, evolving from traditional selection methods to material properties and digital advancements. Early in her career, she identified a gap in the literature, noting that most studies on denture tooth selection were based on Caucasian populations, with limited data on other racial groups. This led her to expand her research during her Master's and PhD studies, comparing denture tooth proportions across different ethnicities. Her extensive data collection resulted in multiple publications offering insights into measurement-based guidelines for denture teeth selection. Her results challenged long-standing universal guidelines for denture tooth selection, many of which were developed in the early 1900s based on anthropological measurements, often by non-dentists. Dr. Varjao's studies revealed significant differences among ethnic groups, showing that widely used methods—such as measuring the nose width or the corners of the mouth—often resulted in inaccurate tooth proportions for African American patients. She also discovered that while the 80% width-to-length ratio for central incisors holds true for Caucasians and Asians, African

Americans typically have a 90% ratio. Notably, her findings have already influenced the industry, particularly in Brazil, where a local manufacturer used her research to create larger denture molds to better match natural variations in tooth size. This demonstrates how her work is making prosthetic dentistry more accurate and patient-centered.

Conducting this type of research presented complex social implications, particularly in defining and categorizing race for scientific purposes. Drawing on universally accepted anthropological guidelines, Dr. Varjao combined physical trait analysis with participant interviews about ancestry to ensure careful and accurate categorization.

Over time, her research expanded beyond aesthetics to include material properties, such as the bonding strength between denture teeth and bases. She has tested various commercial brands, evaluating adhesion treatments and material composition. Currently, she is investigating the properties of digital denture teeth, including printed and milled versions, though these studies are still in progress. Despite technological advancements, her work remains essential, focusing on enhancing denture tooth selection, aesthetics, and functionality.

Dr. Varjao is currently focused on laboratory and literature-based research rather than clinical studies, as her primary commitment is teaching. Her ongoing research also builds on her past work comparing denture teeth available on the

market with real population data. With advancements in dental materials such as composite and new-generation denture teeth, she sees an opportunity to assess whether the current market better reflects population diversity or if discrepancies still exist.

She notes that digital dentures, unlike CAD/CAM crowns, limit the level of customization possible, reducing the ability to individualize tooth shapes based on racial or ethnic differences. Digital systems rely on standardized templates, which may not accurately reflect natural variations in dentition. Her research found that Asians, for example, have a more balanced distribution of triangular, square, and oval-shaped teeth, whereas Caucasians predominantly have square or combination-shaped teeth. Since digital denture software generally follows predefined shapes, many Asian patients may receive dentures that do not match their natural tooth characteristics. While minor adjustments can be made, the fundamental shapes are dictated by the software, making it difficult to achieve the level of personalization needed for diverse populations. This limitation highlights a gap in digital dentistry, where current technology may not fully accommodate natural variation in dentition across racial groups.

Her advice to students pursuing dentistry and research is to genuinely love their work, as passion is essential for overcoming the challenges of scientific research. Enthusiasm has motivated her through obstacles like strict inclusion criteria and difficulty finding participants. In studies involving African American populations in Brazil, she traveled to remote quilombo communities, crossed rivers by canoe, and worked under difficult conditions to ensure an accurate representation of her data. While conducting research in a Brazilian quilombo, she also observed the area's oral health limitations. This inspired her to go beyond data

collection, initiating social projects focused on oral hygiene education, testing fluoride levels in the river water (which were nonexistent), engaging with local authorities, and developing a program to fluoridate the community's salt supply. She sees research as more than a lab-based endeavor—it is a commitment that extends into real-world impact.

Dr. Fabiana M. Varjao's career exemplifies the intersection of research, education, and real-world application. Her dedication to improving denture aesthetics, materials, and inclusivity in prosthetic dentistry has influenced both academia and industry. Through her research, teaching, and advocacy, she continues to shape the future of dental prosthetics, ensuring that advancements in the field better serve diverse patient populations.



*Dr. Fabiana M. Varjao*

Herman Ostrow School of Dentistry of USC

# A Path to Impact: Dr. Amirali Mirenayat's Journey in Dentistry and Research

By Claire Bholé & Emanuel Harouni



*Dr. Amirali Mirenayat*

In the world of dentistry, where patients come seeking both aesthetic improvements and functional care, there exists a distinct and often overlooked group that requires attention: the underserved, especially the unhoused populations. For Dr. Amirali Mirenayat, this focus on underserved populations became not just a career path, but a calling. His journey, shaped by a combination of experiences and a desire to serve the most vulnerable members of society, showcases the unique challenges and rewarding experiences of dentistry.

Dr. Mirenayat's journey began in Iran, where he graduated in 2009 with a degree in dentistry. Following his education, he made the pivotal decision to migrate to the United States, seeking more opportunities for professional growth and personal fulfillment. Upon arriving in the U.S., he applied for international programs and was accepted into the University of Southern California in 2010. It was here that his understanding of dentistry expanded, not just from a clinical perspective, but also through exposure to the broader societal implications of healthcare.

He completed two years in USC's Advanced Standing Program before moving to Rochester, New York, for a one-year residency in an Advanced Education in General Dentistry (AEGD) program. It was during this time that he was first exposed to Federally Qualified Health Centers (FQHCs) and the crucial role they play in public health. His residency, which also helped him achieve licensure in the United States, provided him with invaluable insights into how dentistry serves underprivileged communities. He explains that his time in these health centers solidified his career goals, recognizing the profound impact dentistry could have on vulnerable populations.

After completing his residency in New York, Dr. Mirenayat moved back to California in search of a warmer climate. Though he explored different private practices, he quickly realized that traditional settings, including Dental Service Organizations (DSOs), were not the right fit for him. Instead, he sought a place where he could make a real difference in people's lives by directly serving underserved communities.

His work over the next nine years would be predominantly in the Central Valley of California, specifically in the area south of Fresno, which includes the city of Visalia. Here, he worked in various roles within an FQHC system, treating underserved populations and focusing on the oral health needs of those who otherwise had little access to care. Despite the challenges, he found immense satisfaction in the work, noting the unique connection he formed with his patients. For Dr. Mirenayat, working in these communities was about more than just dental procedures—it was about building trust and making a meaningful difference in people's lives.

In 2023, after nearly a decade of hands-on clinical work, he transitioned into academia, returning to Los Angeles to teach. He describes this shift as a natural progression. Now, he is at the forefront of shaping the next generation of dental professionals, with the added responsibility of integrating research into his work. His position at a university provides him with access to

resources such as data, library archives, and other tools that can help him conduct impactful research.

While his previous focus had been on clinical work, Dr. Mirenayat now finds himself delving into research,

a necessary facet of his academic position. Though his research experience had been limited before this, he is determined to expand his involvement, and his current project reflects his long-standing dedication to underserved populations.

His research centers on understanding the unique needs of the unhoused population in dental care. He is currently working on submitting a proposal for a study that will examine the utilization of care among the unhoused, comparing it with other underserved groups, such as farmworkers. The aim is to identify gaps in care and suggest ways to better support these individuals, who are often overlooked in larger health policies.

While the data collection is still in its early stages, Dr. Mirenayat is hopeful that his findings will contribute to tailoring healthcare services—particularly dental care—to better suit the needs of these populations. He notes that, while FQHCs typically focus on farmworkers and other underserved groups, the unhoused are often neglected despite facing substantial health challenges. His goal is to encourage healthcare systems to more effectively address the specific needs of the unhoused, particularly by providing more accessible, responsive care.

When asked about what motivated him to pursue dentistry in underserved areas, his response is clear: it's about making a genuine impact on people's lives. His decision was influenced by the experiences he had during his residency in Rochester, where he first worked with underserved populations.

He reflects on how rewarding it is to improve not just the aesthetics of a patient's smile, but their overall quality of life. Working with the unhoused, for example, presents a unique opportunity to help individuals regain basic functions, such as the ability to chew food without pain. For many of these individuals, something as simple as improving oral hygiene can significantly enhance their health and daily experience. He explains that these interactions often lead to deeper connections with patients, who are deeply appreciative of the care they receive in a way that patients seeking cosmetic treatments might not be.

"I think it has this different kind of satisfaction," he shares, describing the fulfillment he gets from restoring functional oral health rather than focusing solely on aesthetics. "It's a different way that you affect people's lives."

While his research is still in its early stages, Dr. Mirenayat is optimistic that his work can lead to tangible changes. He envisions a future where more funding is allocated to FQHC-like systems and other organizations that serve the unhoused population, potentially leading to expanded outreach programs and a stronger connection between healthcare institutions and shelters. By involving educational institutions in community outreach, such as USC's robust program, he hopes to inspire more schools to take part in providing care to underserved communities. Ultimately, Dr. Mirenayat sees research as a means to amplify the impact of his work, creating long-lasting change not only in the clinical environment but also at the policy level. He believes that if more resources are allocated to these vulnerable populations, and if dental care systems can be tailored to their unique needs, the entire community will benefit.

His work is also influenced by his understanding of how technology can improve patient care in underserved settings. However, he acknowledges that high-tech solutions may not always be the best fit for community outreach environments, where patients often face barriers such as limited internet access. Despite this, he sees potential for tools that can quickly assess patients' needs, like 3D printers, which could provide immediate results and enhance the speed of treatment. In community-based settings, where patients may only have a limited time to receive care, being able to offer quick, efficient treatments is crucial.

Above all, he emphasizes the importance of compassion when working with underserved populations. In his experience, these patients often have more complex issues to deal with than just their dental problems. Many are struggling with homelessness, addiction, or other challenges that can impact their health. Therefore, his approach to patient care in these settings is more personal, focusing on building a relationship with the patient and addressing their immediate concerns holistically.

"It's not just their teeth that are the concern," he explains, recognizing that dental care is often one piece of a larger puzzle that involves physical, emotional, and social healing.

For Dr. Mirenayat, his career has always been about making a difference. Whether in private practice or community health, his passion lies in helping those who need it most—one patient, one smile at a time. His work not only impacts individuals but also has the potential to influence broader healthcare systems, ensuring that the most vulnerable populations have access to the care they deserve.

As he continues his research and teaching, his journey serves as an inspiration for future generations of dental professionals. His story reminds us that the true value of healthcare, particularly in dentistry, goes beyond the technical aspects of the job. It's about compassion, dedication, and the unwavering belief that everyone deserves a chance at a healthy and fulfilling life.

# Advancing Human Movement: Innovations of the Locomotor Control Laboratory

By Salony Jassar & Talar Kevorkian

**Introduction: What are your earlier experiences that got you to this point?**

For Dr. James Finley, the journey into rehabilitation science is more than just a profession—it's deeply personal. During his college years, Dr. Finley suffered a cartilage tear in the shoulder, an injury that actually traced back to high school cheerleading. "I know exactly when it happened," he recalls. "I was a senior in high school, and I continued weightlifting in college, which only made it worse."

Eventually, the pain led to a visit with an orthopedic surgeon, who immediately suggested surgery as a solution. However, Dr. Finley's father questioned why surgery was the first option, prompting a discussion about trying physical therapy first. "The surgeon told me I could try PT, but if it didn't work, I'd need surgery," he explained. "Long story short—I went to physical therapy, and I never needed surgery. PT literally saved me from going under the knife." This experience was the eye-opening moment that revealed the power of rehabilitation and its ability to prevent invasive procedures.

Beyond his personal injury, Dr. Finley has a strong connection to the field through family history. His work with post-stroke patients feels especially meaningful, as cardiovascular disease runs in his family. "I see firsthand why rehabilitation is important—not just for the patients in our studies but for their families as well." The culmination of personal experience and professional passion drives Dr. Finley's commitment to improving rehabilitation strategies and patient outcomes.

As an undergraduate student studying mechanical engineering, Dr. Finley completed an internship at Medtronic, a medical device company, where he was introduced to biomedical engineering. This experience opened his eyes to how engineering can be applied to improve health—something he hadn't previously considered as a career path. Inspired by his curiosity for asking "why" questions, as well as his interest in teaching at the university level, he decided to pursue a PhD. It was during this time that Dr. Finley gained a particular interest in the study of movement science and locomotor control.

As an engineer, he always enjoyed understanding how complex systems function. He noticed that there were many parallels between the way humans and animals operate and the way problems are approached in robotic system design.

Seeing these connections between engineered systems, human movement, and problem-solving in locomotion was particularly rewarding. Before joining USC, Dr. Finley completed a postdoctoral fellowship in neuroscience at Johns Hopkins University and is now affiliated with USC's Division of Biokinesiology and Physical Therapy. His career path is quite unique, yet his core interests—understanding systems and movement—have remained consistent since childhood.

Dr. Finley directs the Locomotor Control Laboratory, which focuses on understanding fundamental principles of movement and exploring how technology can improve mobility and help complete accurate assessments. A lot of the work examines changes in people's walking patterns based on effort, stability, and fall risk. Dr. Finley highlighted three main topics that are being studied in the Locomotor Control Laboratory.

**1)** *Why We Move the Way that We Do*: The lab has sought to address ways to improve the mobility of individuals who have had previous history of neurologic disorders (e.g., stroke). The impact of asymmetry during walking on overall mobility is a key focus of their research. Attempting to correct walking asymmetry and promote an improved walking pattern may present several challenges for individuals recently recovering from a stroke. To analyze this, the lab employs biofeedback techniques, which provide real-time feedback to help individuals adjust their movement. Researchers then measure their energy expenditure using a metabolic cart. The lab employs motion capture technology to analyze recovery strategies and assess changes in walking patterns. The lab also explores how modifications in gait affect both energy costs and the ability to recover effectively. By identifying the most critical impairments in individuals with mobility challenges, the research aims to reduce the effort required for walking, ultimately enabling individuals to engage more fully in their daily activities.

**2)** *Virtual Reality (VR)*: Another focus of the lab is the development of virtual reality-based games to study and analyze people's walking patterns. For example, people walk in complex virtual environments, which helps assess how their walking is affected by the complexity of their virtual world. In effect, the lab uses virtual reality to understand how they process visual information to change their walking pattern.

**3)** *Decision-Making in the Context of Mobility*: The lab aims

to understand how people make movement-related decisions—considering factors such as time, effort, and potential for fall risk—through experiments and computational models that explain these behaviors.

**What inspired you to pursue research in locomotor control?**

Dr. Finley has always been fascinated by movement. His particular interest in locomotor control began when he attended a lecture by Reggie Edgerton, a world-renowned researcher in the neurophysiology of locomotion. As a first-year PhD student at the time, this lecture introduced Dr. Finley to the concept of central pattern generators: networks of neurons in the spinal cord that produce rhythmic patterns during steady-state walking. It was this deeper understanding of the neuroscience behind movement that truly captured his interest.

**What are the biggest challenges in developing effective rehabilitation strategies for individuals with nervous system injuries?**

When it comes to designing effective interventions for individuals with nervous system injuries, Dr. Finley highlights two major challenges that researchers and clinicians face.

The first challenge is the complexity of human behavior. While behaviors can be observed and described effectively in a lab setting, many factors influence movement and recovery. These factors can be physiological, such as the body's natural response to injury, psychological, including personal motivations and preferences, and environmental, which encompasses community structures and social interactions. "Understanding cause and effect in such a complex system is difficult," Dr. Finley explains. "That's why collaboration is crucial—none of us have expertise in every area, so by working together, we can address blind spots and develop better interventions." This requires a level of humility, as experts from fields like physical therapy, neuroscience, biomedical engineering, and public health must collaborate to form a more comprehensive understanding of rehabilitation.

The second major challenge is translation and generalization—ensuring that improvements made in therapy actually translate to real-world benefits. For example, a patient might walk faster in a controlled physical therapy session, but that doesn't necessarily mean their walking habits or mobility will improve outside the clinic. "This is a hard problem to solve because our field doesn't typically intervene at the level of a person's environment or home." A key focus in rehabilitation is figuring out how patients can take advantage of their newly developed capabilities and integrate them into daily life to improve functional mobility. This challenge remains a critical area of study for researchers working to bridge the gap between clinical progress and real-world application.

Through collaboration and continued innovation, Dr. Finley and his colleagues are striving to develop interventions that not only improve movement in controlled settings but also empower individuals to regain mobility and independence in their everyday lives.

**Inspiring the Next Generation of Scientists:**

Dr. Finley and his team in the Division of Biokinesiology and Physical Therapy have been actively working on a data science learning module for high school juniors from Bravo Medical Magnet High School. Through this program, students gain exposure to the fundamental questions driving scientific research, engage in hands-on learning, and even participate in an interactive online game where they collect and analyze data. "What I tell students is that science is an exciting space that exists at the intersection of many different disciplines. If you have a natural curiosity about how the world works, I highly encourage you to explore a career in science," Dr. Finley explains.

For undergraduate students contemplating a PhD or individuals looking to transition into this field, Dr. Finley emphasizes the importance of creativity, continuous learning, and thinking beyond conventional boundaries. "It's essential to stay informed, read extensively, and be aware of advancements in your field," he noted. "There are still countless discoveries to be made. With technology evolving every day, there are powerful new applications waiting to be explored."

**Dr. Finley on Personal Challenges and the Impact of Physical Therapy**

Outside of work, Dr. Finley is a dedicated soccer parent, with three children who all play the sport. "I've coached all three of them at some point," he shared. His passion for the game even led him to sports photography, capturing moments on the field. Beyond that, he loves staying active—running, cycling, and being outdoors.

Dr. Finley also had an unexpected Netflix debut. During COVID, he was contacted by someone working on a children's science show, and through that connection, a few segments about the labs were recorded. Those segments are now featured on Ada Twist, Scientist on Netflix, giving young audiences a chance to learn about research in a fun and engaging way. Dr. Finley hopes to inspire the next generation of scientists, encouraging them to push boundaries and contribute to the ever-changing landscape of scientific discovery.



*Dr. James Finley*

# Can "social architecture" reverse the loneliness epidemic?

*In the heart of Hollywood, USC Chan's Joy Agner is studying how the built and social environment can better connect people to each other through occupation.*

By Mike McNulty

Feeling lonely? You're not alone.

Recent surveys show that approximately half of adults in the United States experience loneliness, with some of the highest rates occurring among young adults. By these estimates, loneliness and isolation are more widespread than many health issues including smoking, diabetes and obesity.

The phenomena of loneliness and isolation have proliferated in contemporary American life to such an extent that, in 2023, the U.S. Surgeon General labeled them a joint "epidemic" with profound consequences to the health and well-being of individuals and communities. Research shows that lon eliness and isolation are associated with increased risks of heart disease, stroke, depression, anxiety and early mortality.

Because there is no single source of isolation and loneliness, ending this epidemic will require a constellation of strategies to help strengthen social relationships and support community-wide efforts for making meaningful connections. For example, the first plank in the Surgeon General's six-part "national strategy" for advancing social connection is to develop communities' social infrastructure — defined as a community's physical assets such as libraries and green spaces, the programs available to a community such as volunteer organizations and member associations, and local policies like transportation and housing that impact social connections. The logic is that people will better connect when they have more places to go and more things to do once they get there, while encountering relatively fewer barriers on their way.

For occupational therapists like Joy Agner, assistant professor at the USC Chan Division of Occupational Science and Occupational Therapy, working at this intersection between people, environment and occupation is second nature.

"Occupations are the building blocks of community," Agner says. "Occupational therapists and occupational scientists have a unique role to play in ending the loneliness epidemic because meaningful relationships are developed by working side-by-side towards a shared goal."

A first-generation college student from a small rural community in Oregon, Agner earned her master's degree in occupational science and therapy from the University of North Carolina at Chapel Hill, and her PhD degree in community and cultural psychology from the University of Hawai'i at Mānoa. Her scholarship has been recognized with numerous awards, including two NIH-funded Career Development awards, a Fulbright Research Grant and a six-year Ford Family Foundation Ford Scholar award.

At USC Chan, Agner directs the Health Equity Action Lab (HEAL), which uses community-based participatory research (CBPR) approaches to improve health systems and services for underserved populations, including racial minorities, people in poverty and individuals with chronic disability or severe mental illness (SMI). Some current HEAL projects include: examining the impact of care coordination and integrated care on health and quality of life for individuals with multiple, complex health needs; understanding how peer support networks impact health literacy, health outcomes and quality of life; and advancing theory on cultural humility in occupational science by using culturally-informed models to promote health equity among racial minorities, such as Native Hawaiians and Pacific Islanders.

"An overarching theme of my work is to use collaborative community-engaged research processes that center community partners' ideas, priorities, and lived experiences."

**Putting down roots**
Just a half block south of the Hollywood Boulevard Walk of Fame is The Mark Twain, a one-time inn that now operates as an interim housing facility for adults and transitional age youth who have experienced chronic homelessness. There, 56 residents have a safe private room, access to 24/7 on-site clinical care and, just as importantly, newfound levels of stability, safety and dignity.

Facing the concurrent epidemics of social isolation, mental illness and homelessness, the Los Angeles County Department of Mental Health (LACDMH) has embarked upon a $116 million pilot project to transform the mental health care system in Hollywood focused on people, place and purpose. Launched in 2022, Hollywood 2.0 is a five-year pilot project funded by the California Mental Health Services Oversight and Accountability Commission, in collaboration with multiple community partners. Hollywood 2.0 — H20 for short — aims to provide comprehensive, community-based "wraparound" care services to people living with SMI in Hollywood. The Mark Twain is one of three housing assets made possible by the project thus far.

In 2024, Agner's lab began collaborating with the nonprofit Heart Forward LA (HFLA) to develop social architecture theory and practice to better design physical spaces, rules and norms — the "architecture" — in order to optimize human activity and interaction that occurs within them — the "social."

As The Mark Twain came online, Agner, along with occupational science doctoral student Heldevam Pereira PhD '28, and the HFLA team, understood the need to modify its social architecture in order to increase residents' engagement and social interactions. Together with The Mark Twain residents, throughout the past year they have collectively spent more than 600 hours on-site in order to co-design a social architecture intervention: a community garden space.

"By eliciting resident's input and then following their lead, we wanted to see if we could turn a dead zone — an empty, lifeless common area with barbed wire and cigarette butts — into an inviting space that people actually want to spend time in," Agner says. "Could we create a space that gave people a reason for spending time there, either to be with others

or because there is something worthwhile to do?"

Ultimately, the participants and researchers together identified a narrow breezeway alongside the building that was ripe for renovation. During the summer of 2024, they together built and planted a new urban garden. Where there was once cold and nondescript concrete, flowers and grasses are now in bloom. Their co-occupations revolve around the garden, but also involve arts-based projects, cooking, celebrating holidays and all of the sub-tasks to collaboratively plan and carry out activities.

The researchers and HFLA were meticulous all along the way, engaging in critical reflections, taking field notes, and discussing and interpreting their findings to ensure they were engaging with residents in a way that fostered shared decision-making, egalitarianism and purpose.

"There were doubts when we first started, but overall it has been a great success, and the staff and residents have been essential partners in this process," Agner says.

### Radical hospitality and the mental health system

From Agner's scholarly perspective, the process of co-designing and -delivering the social architecture intervention was as critical as its outcome. Consistent with the HEAL lab's ethos, Agner and the researcher team served as co-designers and interventionists, positioned as horizontal partners rather than as vertical experts or uninvested observers. Working with HFLA fostered opportunities to co-develop a novel intervention with potential for impact, which enhanced creativity, established sustainable relationships at The Mark Twain and directly influenced the lives of residents who participated in the design process.

"The process was infused throughout with what HFLA calls radical hospitality, an alternative approach to the status quo of American mental health care," Agner says. "When projects and partners enact radical hospitality, people are seen, heard, valued and appreciated for who they are as human beings. They are a part of the decision-making process — not passive recipients of advice or care; we couldn't do this without them."

That concept of radical hospitality, which defines HFLA's vision for the American mental health system, is based on what's called the Trieste model of mental health care. In the city of Trieste, Italy, thanks in part to the public funding sources that enable it, social architecture includes an interconnected network of community-based mental health centers, clubs, civic associations and social cooperatives that enable people with SMI to continue working and participating fully in community life. Occupation is at the center of the Trieste model, as are values of mutual trust between system users and providers, and the right to a meaningful life.

The model has been widely lauded for its focus on rights-oriented, collaborative treatment and recovery and prevention, with a range of positive outcomes demonstrating its effectiveness.

Last October, Agner traveled to Trieste with HFLA and a delegation of two dozen prominent U.S. mental health policy leaders to see the Trieste model firsthand as part of a larger, year-long initiative funded by The Hilton Foundation. Her co-delegates included policy experts, former and current government officials, national leaders of peer-health services and mental health administrators in high-ranking positions. All are dedicated to advancing a more humane and holistic mental health care system, realizing that the status quo contributes directly to suffering, homelessness and incarceration.

"Seeing the system of care in Trieste has transformed my vision of community-based mental health care and what is possible in the U.S.," Agner says. "We have to hold an ambitious, long-term vision of transformative change, while advancing more humane, rights-oriented, occupation-centered approaches to mental health care within our spheres of influence today."

### Making a difference, together

Looking ahead, Agner hopes to refine the theory of change underlying the approach combining social architecture and radical hospitality: What are its basic elements and principles for effecting sustainable change? Then, she wants to manualize it using a multi-phase refinement model, and implement the manualized intervention to test its short- and long-term outcomes in a comparative pilot study in permanent supportive housing (PSH) settings.

The process of transitioning from homelessness into PSH — a housing model typically funded by public agencies that also offers residents an array of services related to their physical and psychosocial health needs — comes with an elevated risk of social isolation and loneliness. Many residents are housed away from their original neighborhoods and, once they arrive, stay isolated in their rooms. As PSH becomes an increasingly frequent care model, there is an urgent need to work alongside formerly homeless individuals to develop evidence-based interventions that improve social connection in PSH. Occupational therapists and scientists are well positioned to be part of this work, partnered with forward-thinking community organizations such as HFLA.

Agner's latest grant award will surely accelerate her toward those goals. Last year, she received a K01 Mentored Research Scientist Career Development Award from the NIH National Institute of Mental Health. The award, "Designing belonging: Advancing science on environmental modifications to foster activity engagement and social connection among individuals with serious mental illness," provides Agner with protected time to advance her research on socio-spatial research methods, theory development and co-design of environmental interventions based on CBPR principles.

But for now, Agner says she is grateful and optimistic for the ways that occupational scientists can partner with community organizations to address some of the most consequential health issues of our time.

"I'm so excited for the promise that social architecture and radical hospitality holds across multiple settings," Agner says. "We've shown how researchers and community partners can together design and deliver occupation-based and people-first interventions that make a real difference in individual and community life."



Herman Ostrow School of Dentistry of USC

# **Schedule of** Events

**08:00 AM**
**Registration** (Presenters & Judges)

**08:30 AM – 11:30 AM**
**Poster Presentation Judging**

**11:30 AM – 12:00 PM**
**General Registration & Lunch**

**12:00 PM – 12:15 PM**
**Opening Remarks**

| Ishwar Puri, PhD | Yang Chai, DDS, PhD | Amy E. Merrill, PhD |
|---|---|---|
| Senior Vice President | Interim Dean | Acting Associate Dean of Research |
| USC Office of | Herman Ostrow School of | Herman Ostrow School of |
| Research & Innovation | Dentistry of USC | Dentistry of USC |

**12:15 PM – 12:55 PM**
**Keynote Speaker**

Jose-Luis Ambite, PhD
Research Associate Professor of Computer Science
Principal Scientist at USC Information Sciences Institute
USC Viterbi School of Engineering

**01:00 PM – 01:40 PM**
**Keynote Speaker**

Glenn Clark, DDS, MS
Professor
Associate Dean of Distance Learning & Telehealth
Herman Ostrow School of Dentistry of USC

**01:45 PM – 02:25 PM**
**Keynote Speaker**

Lisa Aziz-Zadeh, PhD
Professor
Chan Division of Occupational Science & Occupational Therapy
Department of Psychology
Dornsife College of Letters, Arts & Sciences

**02:30 PM – 03:30 PM**
**Student/Trainee Presentations**

**03:30 PM – 04:15 PM**
**Award Presentations**

**04:30 PM – 05:30 PM**
**Poster Viewing & Reception**

# Keynote Speakers

### Jose-Luis
### AMBITE
PhD

**Associate Professor**
USC Viterbi
School of Engineering

**12:15 PM – 12:55 PM**

Dr. Jose-Luis Ambite is a Research Associate Professor of Computer Science and a Principal Scientist at the Information Sciences Institute, both at the University of Southern California. He is an expert in data integration, including query rewriting under constraints, learning schema mappings, entity linkage, and information extraction. His research interests include databases, knowledge representation, semantic web, biomedical informatics and genetics, and federated learning. He received the Best Research Paper award at the International Semantic Web Conference in 2012. In the "L2K2R2: Learn to Read to Know, Know to Learn to Read" project, funded under the DARPA Big Mechanism program, he developed neural entity extraction and normalization methods from biomedical literature. For the NIH Big Data to Knowledge (BD2K) Training Coordination Center, he developed information retrieval, natural language processing, and machine learning methods to automatically discover, model, and organize learning resources on the open web, which resulted in the creation of the educational resource discovery index, a compendium of ~12,000 data science training resources.

### Glenn
### CLARK
DDS, MS

**Professor**
USC Herman Ostrow
School of Dentistry

**01:00 PM – 01:40 PM**

Dr. Glenn Clark is currently a Professor at the Ostrow School of Dentistry of USC and Associate Dean of Distance Education. He is Director of the Orofacial Pain and Oral Medicine Center, and Director of the Orofacial Pain and Oral Medicine 3-year Master's Degree. Dr. Clark is the President-Elect of the American Board of Orofacial Pain. Dr. Clark's academic career began at UCLA and he held various administrative posts including Director of the Clinical Research Center, Director of the Dental Research Institute and Associate Dean of Research. Dr. Clark began his research work focusing on both temporomandibular disorders and trigeminal motor function and dysfunction including bruxism, dystonia, and chronic myofascial pain disorders of the jaw system. In 1986 Dr. Clark's expanded his research work to include studies on the diagnosis and treatment of Obstructive Sleep Apnea. This work has involved him as Principal Investigator on several National Institute of Dental and Craniofacial Research (previously known as the National Institute of Dental Research) grants. Dr. Clark has written over 225 research articles, review papers, or chapters in textbooks. He has served as editor or co-editor of five books on Temporomandibular Problems and on Diagnostic and Surgical Arthroscopy. His most recent book is titled *Orofacial Pain: A guide to medications and management* and is published by Wiley-Blackwell Inc. He was voted alumnus of the Year of the UCLA School of Dentistry (1990). Dr. Clark was given the Pierre Robin Award for Academic Excellence (2001) by the Academy of Dental Sleep Medicine and in 2004 he was awarded honorary fellowship in the American Academy of Oral Medicine. In 2005 he was given a lifetime achievement award by the American Academy of Orofacial Pain. Finally, he was given the USC Mentoring Award by the University Provost in 2018.

### Lisa
### AZIZ–ZADEH
PhD

**Professor**
USC Chan Division of
Occupational Science and
Occupational Therapy

**01:45 PM – 02:25 PM**

Lisa Aziz-Zadeh is a Professor at the USC Chan Division of Occupational Science and Occupational Therapy as well as in the USC Department of Psychology and USC Brain and Creativity Institute. She directs the USC Center for the Neuroscience of Embodied Cognition. Her work focuses on exploring how the brain processes social cognition in typically developing populations, as well as with autism, dyspraxia, stroke, and congenital amputees. Her work has been published in many high impact journals, such as Nature Communications and Current Biology. She has served as PI of numerous grants, including grants from the National Institute of Health, Department of Defense, Google, the Intelligence Advanced Research Project Activity, the American Heart Association, and the Dana Foundation.

# RESEARCH DAY
# POSTER ABSTRACTS

## ADVANCED SPECIALTY PROGRAM RESIDENTS

### Poster #1

**Title**: Facial Growth Atlas of *Macaca fascicularis* using vital stains

**Authors**: Abigail Nolan, Sareen Ayvazian, Stephen Yen, and Peter Kai-Jen Yen

**Faculty Advisor**: Stephen Yen

**Background**: The rhesus monkey, Macacca fascicularis, is an animal model for studying post-natal facial and cranial growth due to anatomic similarities to the human skull. Vital stains are used to define regions of active mineralization. **Purpose**: To digitize photomicrographs of osseous samples stained with lead acetate stains and group the digital data into an atlas organized by anatomic parts of the monkey skull. **Methods**: Three rhesus monkeys (mixed dentition, age 8-10 in human years) were injected weekly with lead acetate for a total of four to five injections. The bone samples were fixed in 10% formalin and demineralized in 0,4% HCl with H2S gas. Coronal blocks of bone were embedded in gelatin and immersed in a gold chloride solution to reveal sharp lead sulfite lines. Bone blocks were frozen with liquid nitrogen and sectioned with a Zeiss table cryostat. Bone blocks were separated and sectioned according to the cranium, femur, mid-ramus, supraorbital ridges, nasal septum, and skull base. These slices were then photographed under a Zeiss light photomicroscope. Each Ektachrome 100 slide was scanned using the Nikon COOLSCAN 5000 ED to digitize the images and organize them into corresponding digital folders. **Results**: Digitized scans were organized into digital folders corresponding to each bone block origin. Each region was described according to the location and gap distance between incremental lead sulfide lines. **Conclusion**: The goal is to make this atlas accessible to researchers and clinicians interested in postnatal skull growth.

### Poster #2

**Title**: Impact of Implantoplasty on Peri-Implantitis Outcomes: A Systematic Review

**Authors**: Alexandra Rutwind, Mirali Pandya, and Kian Kar

**Faculty advisor**: Mirali Pandya

**Background**: With the growing prevalence of dental implants, managing peri-implantitis has become a pivotal focus in implant dentistry. Implantoplasty has demonstrated potential as an adjunctive treatment option. However, the variability in outcomes associated with peri-implantitis management, including implantoplasty, underscores the need for robust, high-quality research to establish its efficacy and safety. **Purpose**: Evaluate the impact of implantoplasty with or without resection on treatment outcomes of peri-implantitis. **Methods**: This systematic review and meta-analysis employed a comprehensive search strategy to identify relevant studies using the electronic databases MEDLINE (PubMed), EMBASE, and the Cochrane Library. The implant survival rate and clinical parameters (probing depth [PD], bleeding on probing [BOP], marginal bone loss [MBL]) at baseline and follow-ups were extracted from original articles for qualitative and quantitative analysis. Random effects meta-analysis was used to estimate pooled effect sizes, including risk ratio (RR), standardized mean difference (SMD), and their associated 95% confidence intervals. **Results**: Eleven articles were included. Studies demonstrated that implantoplasty significantly improved peri-implant conditions, including implant survival (RR=0.91[0.82; 0.96]) and probing depth reduction (SMD=-3.08[-4.34; -1.81]). Soft tissue recession was also significant (SMD=1.08[0.60;1.56]). When comparing resective therapy with implantoplasty to resective therapy without implantoplasty, no significant difference was found for implant survival, probing depth reduction, and marginal bone loss on the mesial or distal. **Conclusion**: Within the limitations of this study, implantoplasty has been shown to improve clinical parameters in the management of peri-implantitis; however, when compared to resective treatment alone, the differences in outcomes are not statistically significant.

### Poster #3

**Title**: Cleft-lip and palate treated with surgery vs. protraction: esthetic assessment

**Authors**: Alma A. Garay Romero and Stephen Yen

**Faculty Advisor**: Stephen Yen

**Background**: Class III malocclusion is a common problem in adolescent patients with cleft lip and palate due to growth disturbances of cleft lip and palate surgeries. **Purpose**: To assess perceptions of clinicians and laypersons when evaluating facial esthetics of cleft lip and palate patients with Class III malocclusions treated with LeFort I surgery or late maxillary protraction. **Methods**: Randomized, standardized, deidentified pre- and post-treatment photograph sets were taken of 36 patients (18 corrected by orthognathic surgery and 18 by late maxillary protraction). The photograph sets were presented to 59 clinicians and 59 laypeople through a web-based survey. The subjects rated facial esthetics of the photographs on a 10-point scale (1 being less esthetic and 10 being more esthetic). **Results**: The overall mean of clinicians and laypersons showed an improvement between pre- and post-treatment photographs. The mean esthetic values of clinician ratings increased in surgical cases and protraction cases. Laypeople's mean esthetic values increased in surgical cases and in protraction cases. Post-treatment, protraction cases had a higher rating than surgical cases. Overall, the average rating of laypeople was higher than that of the clinicians' average ratings. **Conclusion**: Improvement of facial esthetics was perceived by both clinicians and laypeople after both surgery and protraction treatment for class III malocclusions of cleft lip and palate patients. When compared to clinicians, laypeople had higher ratings for pre-treatment and post-treatment photographs. Results post-treatment for both clinicians and laypeople were similar when comparing protraction vs. surgery.

### Poster #4

**Title**: Endodontic micro-resurgery

**Authors**: Ani Alexander and Rafael Roges

**Faculty Advisor**: Rafael Roges

**Background**: Apiosurgery is an advanced endodontic microsurgical procedure designed to treat persistent periapical lesions that do not heal after conventional root canal therapy or retreatments. Apical surgery entails precise root-end resection, removal of infected periapical tissues, and the use of biocompatible materials such as mineral trioxide aggregate (MTA) for root-end filling. Enhanced magnification and microsurgical techniques improve accuracy, minimize trauma, and promote superior healing outcomes. Endodontic re-surgery is often required due to complications such as root perforations, unset sealers, or other procedural errors.

Root perforations, defined as pathological communications between the root canal system and external tooth surfaces, can result from endodontic procedures, resorptive processes, or caries, leading to structural damage and potential periodontal tissue destruction. Unset or inadequately set sealers further compromise treatment success by failing to provide an effective seal, increasing the risk of reinfection and procedural difficulties. A study by Minju Song et al. reported a 92.9% success rate for endodontic re-surgery over a two-year follow-up, demonstrating the effectiveness of microsurgical techniques. Another retrospective study found an 87.6% five-year success rate, indicating that re-surgery can achieve outcomes comparable to primary endodontic microsurgery. These findings highlight the importance of addressing complications promptly and utilizing modern microsurgical approaches for optimal treatment success.

### Poster #5

**Title**: Case Report - Intentional Replantation of Maxillary and Mandibular Molars

**Authors**: Brittney Brown, Maram Alnaffaie, and Rafael Roges

**Faculty Advisor**: Rafael Roges

**Background**: Intentional replantation (IR) is a last-resort endodontic procedure involving tooth extraction, extraoral root resection, retrograde preparation and filling, followed by reinsertion into the socket. It is indicated when conventional retreatment or apical surgery is not feasible. IR offers advantages such as preserving natural dentition, maintaining occlusion, and avoiding prosthetic replacements. Success depends on careful case selection, atraumatic extraction, minimal extra-oral time, and optimal post-replantation care. **Purpose**: This report highlights the clinical success of IR, demonstrating its effectiveness in preserving teeth that would otherwise be extracted. By presenting successful cases, we aim to reinforce IR as a minimally invasive alternative and encour-

age its consideration in cases with anatomical, medical, or financial constraints. **Methods**: Cases were selected based on failed root canal treatment or inaccessible apical pathology. Atraumatic extractions were performed using periotomes and forceps under local anesthesia. The teeth were handled extra-orally for 15 minutes in Hanks' Balanced Salt Solution (HBSS), ensuring PDL viability. Apicoectomy and retrograde filling with MTA or BC sealer and putty were performed before reinsertion into the socket. The tooth was stabilized with sutures and composite splinting, followed by postoperative monitoring. **Results**: Successful outcomes were observed, with patients exhibiting absence of pain, normal function, periodontal stability, and no pathological resorption or ankylosis. **Conclusion**: IR is a predictable and conservative treatment option when performed correctly. These cases provide further evidence supporting its integration into endodontic decision-making for complex cases.

### Poster #6

**Title**: Tracing the Path: Understanding the Sources of Our Orofacial Pain Patients

**Authors**: Chinmayee Patil, Sang Chun, Areeg Elmusrati, Kanvara Virojsakulchai, Mariela Padilla, and Douglas Wall

**Faculty Advisor**: Douglas Wall

**Background**: Orofacial pain (OFP) management involves collaboration among healthcare specialties, making the referral process an integral part of clinical care. **Purpose**: This study aims to understand the referral dynamics in the incoming patients at OFP clinic, with implications for improving clinic efficiency and patient care. **Methods**: Retrospective study to analyze the sources of referrals received by the OFP Clinic. Descriptive statistics were utilized for data analysis. **Results**: The sample comprised 200 new patients, with data collected up to December 2024, including 51 males and 149 females, with an average age of 40.5 years (range: 12-89). Twenty-six percent of patients did not have a referral

form, as is not required. Among the remaining 74%, 54.5% were referred by dental professionals, 19.5% by medical centers, and 10% by the USC system. Only 37 referrals used the template available on the clinical webpage. The most common consultation reason was temporomandibular disorders (50%), followed by persistent pain (15.5%). This aligns with the most common primary diagnosis, which was musculoskeletal disorders (86%), followed by neurogenic pain (8.67%). **Conclusion**: The OFP clinic is a resource for both dental clinics and medical centers, offering specialized care for complex orofacial pain. The clinic collaborates with various healthcare providers, ensuring comprehensive care. There is potential to improve the referral dynamics, particularly within USC's internal services. Streamlining the referral process and enhancing communication between dental and medical departments could lead to more efficient and effective patient care.

### Poster #7

**Title**: Material conversion of fractured implant supported prostheses: a case report

**Authors**: Christman Henderer and Cheryl Park

**Faculty Advisor**: Cheryl Park

**Background**: Titanium/acrylic fixed implant-supported prostheses are often used when there is a large cantilever or excessive space from implant platform to occlusal plane. Sometimes these prostheses are indicated for patients with nocturnal or diurnal bruxism. This prosthesis provides a predictable, cost-effective means of failure via gradual wear of the acrylic over time. Conventionally, titanium/acrylic prostheses are made by processing denture teeth in denture base acrylic on the titanium bar. With this method, individual tooth displacement from the prosthesis was common. To mitigate this, once-piece complete arches of milled acrylic teeth were designed and luted to titanium frameworks. Unfortunately, in high-function patients early fracture of the

milled acrylic is possible, even with proper acrylic thickness. **Purpose**: Describe a case in which adequate thickness of milled acrylic teeth displayed early fracture failure, and present an alternative solution: framework design modification for zirconia restorations in the posterior functional areas. **Methods**: An advanced prosthodontics patient was treated with a full arch titanium/acrylic hybrid with milled acrylic teeth. An early fracture of the posterior acrylic was detected during follow-up despite adequate thickness. Posterior modification of metal framework was carried out to receive a stronger material, zirconia. Seven-month follow-up confirmed no complications to the mandibular prostheses. **Results**: The restoration was delivered successfully, and as of seven months post-treatment the patient has not reported complications and reports that his quality of life has improved. **Conclusion**: Cementation of zirconia molar restorations to a titanium bar after repeated acrylic de-lamination is an effective treatment alternative after multiple early fractures.

### Poster #8

**Title**: Factor's Influencing Dental Practice's Transition to Green Dentistry

**Authors**: Cortney McCoy, Hiba Daifi, Tarenjit Verraich, and Mina Habibian

**Faculty Advisor**: Mina Habibian

**Background**: The dental industry contributes to environmental degradation through energy-intensive processes, waste generation, and reliance on single-use materials. Despite growing awareness of climate change, sustainable practices in dentistry remain underutilized due to a lack of education and standardized protocols. **Purpose**: This project aimed to explore the barriers to adopting eco-friendly practices in dentistry and how integrating sustainability education can address these challenges. **Methods**: A literature review was conducted using PubMed, USC Libraries, and other relevant databases

**Abstracts**

to analyze existing research on sustainability in dental practices. Key barriers were identified, including gaps in education, cost concerns, and lack of awareness. **Results**: Preliminary findings revealed a significant knowledge gap among dental professionals regarding sustainable practices. Many expressed interest in learning more but lacked the resources or guidance to implement eco-friendly changes in their offices. **Conclusion**: Integrating sustainability education into dentistry is critical for reducing the industry's environmental impact and carbon footprint. Equally important is the availability of practical resources to guide dental professionals in implementing sustainable practices. This project highlights the need for targeted educational initiatives and actionable tools to overcome barriers, empower dental professionals, and foster widespread adoption of sustainable methods. These efforts align with broader public health goals of combating climate change and promoting environmental stewardship.

**Title**: The Reproducibility af Measurements Within a Virtual Reality Environment

**Author**: Darien Lam, Glenn Jou, and Glenn Sameshima

**Faculty Advisors**: Glenn Jou and Glenn Sameshima

**Background**: 3D modeling on a computer screen has revolutionized workflow, and its use has increased greatly. A virtual reality environment grants the operator a more immersive experience whilst using digital models. **Purpose**: This pilot study benefits those in a clinical or academic orthodontics setting who may be considering the application of VR into the workflow. This study evaluates the measurement capabilities of a virtual reality environment, and its limitations compared with conventional cast analysis and digital model measurements on a 2D screen. **Methods**: 10 sets of stone models were selected and scanned ex-vivo into a digital format using iTero Element Plus Scanner. Conven-

tional cast measurements of tooth size arch length discrepancy (TSALD) and transverse width were recorded using a divider and caliper. Measurements were conducted directly on the physical model by hand. Digital model on a 2D screen measurements were recorded using the application, Dolphin Software. Virtual reality environment measurements were recorded using Sentio VR, an architecture-based application. Measurements were recorded at two time points to evaluate intraoperator reliability. **Results**: Measurements amongst time point 1 and time point 2 for transverse measurements were reliable and in agreement. There is no statistically significant difference in accuracy of tooth size arch length discrepancy (p-value= .937) nor transverse width (p-value= .139) amongst conventional cast analysis, 3D modeling on a screen and measurements within a VR environment. **Conclusion**: VR measurement capabilities of a virtual reality environment may be applied as an alternative to conventional cast analysis and 3D modeling on a 2D screen.

**Title**: Retrospective radiographic analysis of implant platform to BIC after bone augmentation

**Authors**: David Zhang, Justin Matian, Daniel Kruk-Leahy, and Kian Kar

**Faculty Advisor**: Kian Kar

**Background**: One of the crucial measures of dental implant health and success is the amount of bone that is in contact with the implant (BIC). BIC is a key indicator of successful osseointegration of the implant where the bone tissue creates a bond by growing directly onto the implant surface. Several factors can influence the BIC level such as implant dimensions, implant placement location and level, and restorative design. Few studies though have looked at those factors in human subjects where GBR procedures were also performed prior to implant placement. **Purpose**: The present retrospective clinical study aims to evaluate

changes in the Bone-to-Implant-Contact (BIC) level relative to the restorative platform of implants placed in sites that had received guided bone regeneration (GBR) and further explore the effects that implant restoration design may have on the BIC. **Methods**: A retrospective radiographic analysis was done for patients who had guided bone regeneration procedures done between 2015 and 2022 at the Ostrow School of Dentistry utilizing previous clinical radiographs and records. **Results**: The study has found that while there is remodeling of the alveolar bone after GBR and implant placement there is no difference between the method of grafting used with an increase in bone loss when implant restorations are placed. **Conclusion**: The results can guide practitioners in the selection of bone grafting methods and implant characteristics in patients where the placement of an implant requires prior GBR procedures.

**Title**: A Systematic Review and Meta-Analysis of Regenerative Materials in Peri-Implantitis

**Authors**: Edward Lee, Kian Kar, and Mirali Pandya

**Faculty Advisor**: Mirali Pandya

**Background**: The prevalence of peri-implantitis has been increasing over the year as implants have become a predictable treatment option. Management of peri-implantitis poses a challenge to all clinicians as there's lack of evidence for ideal treatment. This systematic review aimed to assess the available literature on the efficacy of regenerative therapy of peri-implantitis in comparison to non-regenerative therapy. **Methods**: Electronic databases including USC libraries, PubMed, and Cochrane from 1990 to 2025 were searched. Parameters evaluated include implant survival, probing depth (PD) reduction, marginal bone level (MBL), bleeding on probing (BOP) reduction, and mucosal recession (REC). **Results**: A total of 148 were initially identified through reviewing titles and abstracts. After reviewing the eligibility criteria, 16 articles including prospective clinical studies, longitudinal studies and randomized controlled studies were selected for the systematic review. Five treatment groups were identified: 1) autogenous bone graft; 2) xenograft; 3) porous titanium granules (PTG); 4) Algipore; 5) composite graft. The meta-analysis showed that there was no statistical differences between the treatment groups for implant survival rate, bleeding on probing, and mucosal recession. The mean probing depth reduction of circumferential bony defect was statistically significant in comparison to treatment groups for DBBM and composite graft. Marginal bone level reduction was significant when comparing autogenous graft to composite graft. **Conclusion**: Within the limitation of this systematic review, regenerative treatment of peri-implantitis seems to have predictable implant survival rate. However, due to heterogeneity in treatment variability, there is lack of high-quality comparative analysis to support this statement.

**Title**: Treatment of Aggressive Periodontitis with Full-Mouth Disinfection Protocol

**Authors**: Eric Madsen and Kian Kar

**Faculty Advisor**: Kian Kar

**Background**: Aggressive Periodontitis (Grade C, Molar-Incisor Pattern) is a variant of periodontitis characterized by rapid bone loss, early age of onset, preferential targeting of molars and incisors, and excessive destruction relative to biofilm levels. Several bacterial pathogens such as *Aggregatibacter actinomycetemcomitans* as well as certain viral pathogens such as human cytomegalovirus and Epstein-Barr virus are associated with this condition. **Purpose**: Determine if the full-mouth disinfection protocol in combination with systemic antibiotics and antivirals is effective in the treatment of aggressive periodontitis. **Methods**: A 30-year-old female patient presented to the USC Periodontology Clinic

with aggressive periodontitis (Grade C, Molar-Incisor Pattern). Four quadrants of non-surgical periodontal therapy were performed over two different sessions within a 24-hour time period. At the conclusion of each session, subgingival irrigation with povidone-iodine was completed. The patient was prescribed ciprofloxacin 250 mg TID, metronidazole 250 mg TID, and valacyclovir 500 mg BID for 8 days and was instructed to start taking the medication the day before starting non-surgical therapy. Chlorhexidine gluconate 0.12% mouthrinse was also prescribed for rinsing twice a day for 2 weeks. The patient was re-evaluated 8 weeks post-therapy. **Results**: The overall average reduction in probing depths was 1.78 mm with the greatest improvement in the maxillary canines (2.75 mm). The number of pockets of 5 mm or greater was reduced from 124 pre-treatment to 36 post-treatment. The bleeding index improved from 57.81% to 29.17%. **Conclusion**: The full-mouth disinfection protocol in combination with systemic antibiotics/antivirals can be effective for treating aggressive periodontitis.

**Title**: Knowledge and Utilization of Sensory-Based Modifications in Pediatric Dentistry

**Authors**: Jamie Chang, Lily Shkhyan, Shannon Roux, Jose Polido, and Leah I. Stein Duker

**Faculty Advisor**: Leah I. Stein Duker

**Background**: Children with special health care needs (CSHCNs) experience challenges during dental care that have been linked to sensory over-responsivity, but little is known about the use of sensory-based modifications (SBMs) in dentistry. **Purpose**: To examine the familiarity, utilization, and perceived effectiveness of SBMs during pediatric dental care. **Methods**: A national online survey (46 items presented to all respondents, up to 98 additional items presented based on preceding answers) was sent to dental professionals treating children, utilizing convenience and snowball sampling. **Results**: Dental professional respondents (n=550) were predominantly

White, pediatric dentists, who treated CSHCNs often/very often (all ≥70%), with a mean age of 45 years. Over 66% of respondents were familiar with SBMs across all modalities (i.e., visual, auditory, gustatory, olfactory, tactile, vestibular), with ≥63% reporting use of at least one strategy when treating CSHCNs. Fewer participants reported knowledge (40%) or utilization (25%) of a sensory-adapted dental environment intervention. Most respondents stated that SBMs were moderately-extremely helpful (>85%) and compatible with other basic behavior guidance techniques (>98%). Almost 99% of participants agreed it was moderately-extremely important to consider sensory-focused barriers to care for CSHCNs. **Conclusion**: Most dental providers treating children are familiar with and utilize SBMs and perceive that they are effective in dental care. Many SBMs are simple, low-cost, and easily implemented in healthcare settings. Occupational therapists are experts in identifying and integrating SBMs and may be a valuable addition to the interdisciplinary oral care team.

**Title**: Comparative Assessment of Two Preclinical Teaching Models for Periodontal Surgery

**Authors**: Jonathan Wang and Kian Kar

**Faculty Advisor**: Kian Kar

**Background**: Dental schools have preclinical courses designed to assist students with concepts in surgical periodontal therapy for the treatment of advanced periodontitis. Recent advancements in technology, learning methodologies, and widespread availability of online media resources have since enabled students to have access to online surgical videos. As most general dentists do not routinely perform periodontal surgery in clinical practice, it raises the question of whether practicing on models in a laboratory setting is necessary, and whether there are benefits to teaching periodontal surgery on models. **Purpose**: To evaluate the

effectiveness of the preclinical periodontal surgery laboratory component compared to a problem-based learning approach on students' understanding of fundamental concepts in periodontal surgery. **Methods**: 315 dental students were recruited. Moderators for seminars and instructors for simulation labs included clinical faculty and Periodontology residents. Participants were given a questionnaire evaluating their baseline conceptual understanding pertaining to surgical periodontal treatment modalities prior to starting their first preclinical simulation exercise and problem-based learning seminar on periodontal surgery, respectively. Upon course completion, a second questionnaire was given to re-evaluate their levels of understanding. **Results**: There was statically significant improvement in both the laboratory sessions and problem-based learning seminars in all categories of surgical procedures ranging from 1.77 to 3.41 points on visual analog scale. **Conclusion**: Within the limitations of this study, problem-based learning and laboratory surgery appear to be effective for improving students' understanding of fundamental concepts pertaining to surgical periodontal therapy. Laboratory surgery exercise improved students understanding about periodontal surgical procedures.

**Title**: Analysis of clinically failed implant supported complete arch zirconia prostheses

**Authors**: Kanisa Chantarothorn and Cheryl Park

**Faculty Advisor**: Cheryl Park

**Background**: Zirconia restorations offer excellent mechanical strength, biocompatibility, and esthetics in dentistry. Analyzing clinical failures through Scanning Electron Microscopy (SEM) and X-ray Diffraction (XRD) can be utilized for further understanding failure etiology and preventing future complications. **Purpose**: This study aimed to analyze the mode of failure and further characterize the fracture surface morphology and zirconia

phase composition of the failed complete arch zirconia restorations through SEM and XRD analyses. **Methods**: Two fractured restorations were examined: Sample 1 with a lingual fracture after 5 years, and Sample 2 with complete fracture after 5 months. Specimens were analyzed using XRD (Bruker D8 Advance) and SEM (Apreo 2S SEM) at USC's Core Center of Excellence in Nano Imaging. **Results**: Visual inspection revealed Sample 1's failure with vertical fracture line of zirconia surrounding the titanium abutment and absence of cement between the zirconia and abutment, while Sample 2 showed complete fracture at a non-abutment site. Sample 1 demonstrated predominantly tetragonal phase and mixed transgranular-intergranular fracture, whereas Sample 2 exhibited both tetragonal and monoclinic phases with predominantly intergranular fracture, grain pull-out, and interconnected cracks. **Conclusion**: Analysis of early and late failures of complete arch implant supported zirconia prostheses revealed different fracture patterns and zirconia phases along the fractured surfaces. While Sample 1's glazing may have masked phase transformation detection, Sample 2 demonstrated clear tetragonal-to-monoclinic transformation. Further investigation of phase transformation beneath glazing layers and consideration of patient functional factors, cross-sectional thickness of the prostheses, particularly in high-function patients, is necessary to minimize future failures of complete arch zirconia prostheses.

**Title**: Case Report - Endodontic Management and Treatment of Mandibular Mini Molars

**Authors**: Lilian Yousefian, Fatimah Alabsi, and Rafael Roges

**Faculty Advisor**: Rafael Roges

**Background**: Mandibular mini molars are rare dental anomalies with complex root canal morphology, posing significant endodontic challenges. Their

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atypical anatomy complicates canal negotiation, disinfection, and obturation. Advanced imaging such-as CBCT is crucial for preoperative assessment, aiding in effective instrumentation and disinfection to ensure long-term success. **Purpose**: This case report highlights the endodontic management of mandibular mini molars, emphasizing diagnostic and treatment challenges. It provides clinical insights into techniques utilized and outcomes observed, contributing to management of such cases. **Methods**: Two patients presenting with symptomatic mandibular mini molars underwent clinical and radiographic evaluation, including CBCT for detailed morphological assessment. Root canal treatment under local anesthesia and rubber dam isolation were performed using magnification, followed by meticulous irrigation with 8% Sodium Hypochlorite and shaping using rotary files. Passive irrigation and activation were employed for effective disinfection. Obturation was completed using Thermaseal and Gutta Percha using Warm Vertical Condensation. Permanent build-up restoration was completed to seal the access cavity, and patients were scheduled for six-month follow-ups. **Results**: Treatment led to symptom resolution, radiographic evidence of canal obturation, and preservation of the tooth's function. Six-month follow-ups showed satisfactory healing without reinfection or structural compromise. **Conclusion**: Mandibular mini molars present unique endodontic challenges that demand precision, expertise, and advanced techniques due to their variable anatomy. This case highlights the importance of CBCT imaging, magnification, and enhanced irrigation in overcoming anatomical challenges. With meticulous execution and modern endodontic advancements, even complex cases can achieve predictable success, ensuring long-term tooth preservation and optimal patient outcomes.

Poster #17

**Title**: Digital Atlas of Human Fetal Development

**Authors**: Naomi Low, Ashley Mach, and Stephen Yen

**Faculty Advisor**: Stephen Yen

**Background**: Creation of a human fetal development atlas to help clinicians appreciate growth and development occurring during prenatal growth. **Purpose**: To collate a collection of photographs, radiographs and cephalometric tracings of human fetal specimens into an atlas of human development, to evaluate the growth and development of the whole face and individual components of skull face, and to evaluate the linear and angular increments of the cranium in three orientations monitoring development during the gestational period. **Methods**: 445 human fetal specimens (215 male, 230 female) were collected by Dr. Peter Yen, the orthodontic department chairman at Sun Yat-Sen University of Medical Sciences between 1987-1993. Specimens were recorded from 13 weeks to 40 weeks of gestation. All specimens were from the Sun Yat-Sen University Medical Center. The specimens were photographed, radiographed in a lateral orientation, and traced. This data was digitized from Ektachrome slides with a Nikon COOLSCAN LS 5000 ED Film scanner. Photographs were digitized with the Plustek Z3000 Photo and Document scanner. Cephalometric radiographs were hand-traced to evaluate cranial and facial proportions and Bjork's facial polygon. **Results**: Specimens showed a downward growth pattern in the anterior cranial base and an upward growth pattern in the posterior cranial base. The soft tissue grew forward in nearly parallel increments from the frontal region to the chin while the facial height lengthened. **Conclusion**: The photographic data was collated into a digital atlas and organized according to chapters describing different anatomic regions of the face.

Poster #18

**Title**: Eruption Timing in Hispanic Adolescents Compared to Caucasian Standards

**Authors**: Nicole Kawakami, Jenniffer Rojas, David Kennedy, and Glenn Sameshima

**Faculty Advisor**: Glenn Sameshima

**Background**: In California, the most predominant minority is the Hispanic ethnic group comprising 48.7% of the population as of the year 2020. A considerable percentage of patients in any given practice will belong to this group, especially Los Angeles County. Therefore, it is relevant to establish guidelines for the eruption timing of permanent teeth in the Hispanic population. **Purpose**: The purpose of this study is to understand the impact of ethnicity and biologic sex in the eruption timing of permanent dentition as this aids the orthodontist to more effectively time treatment. **Methods**: For this study, the dental records of Hispanic adolescents were compared to Caucasian standards in addition to evaluating for the presence of sexual dimorphism. 257 consecutive records were obtained from a university orthodontic program in Mexico City and 527 records were randomly selected within LA county using established criteria. The eruption of the posterior secondary dentition was recorded for subjects from 8 to 12 years of age and compared between Hispanic and Caucasian ethnicities and male and female sex. **Results**: The findings of this study indicate that the permanent dentition studied (i.e. cuspids, bicuspids, and second molars) erupt significantly ($p < 0.05$) earlier in Hispanics than in Caucasians. A trend for teeth to erupt sooner in females is also evident though not statistically significant. **Conclusion**: In regards to effective diagnosis and treatment planning, patients of Hispanic ethnic background should be evaluated at an earlier age compared to patients of Caucasian ethnicity. Additionally, it was confirmed permanent teeth erupt earlier in females.

Poster #19

**Title**: Radix Entomolaris and Radix Paramolaris - Anatomical Variations

**Authors**: Pratishta Jain, Andrea Ordonez Tello, Rafael Roges, and Stefan Zweig

**Faculty Advisors**: Rafael Roges and Stefan Zweig

**Background**: Radix entomolaris (RE) and radix paramolaris (RP) are anatomical variations in mandibular molars, characterized by the presence of an additional distolingual root (RE) or mesiobuccal root (RP). These variations pose significant clinical challenges in endodontic treatment, particularly in terms of detection, instrumentation, and obturation. Their prevalence varies among populations, making accurate identification crucial for successful endodontic procedures. **Purpose**: This study aims to examine the anatomical characteristics, prevalence, and clinical implications of RE and RP. **Methods**: A comprehensive literature review was conducted to assess their morphology, occurrence rates, and management approaches. **Results**: RE is more frequently observed in Asian and Indigenous populations, with prevalence rates reaching up to 33%, whereas RP is considerably rarer. These variations are often overlooked, leading to persistent pathology and increased retreatment rates. Periapical (PA) radiographs may fail to reveal additional roots due to angulation limitations, whereas cone-beam computed tomography (CBCT) remains the most accurate imaging modality, providing a superior three-dimensional view for identification and treatment planning. Radix roots pose challenges due to their curvature and complex morphology. Severe inclinations increase the risk of ledging, transportation, and instrument separation. Inadequate pre-flaring and failure to establish a glide path can lead to procedural errors. Managing these cases successfully requires early detection, careful instrumentation, and a thorough understanding of root canal anatomy to prevent complications. **Conclusion**: Awareness of these root variations improves diagnosis and treatment success. Incorporating advanced imaging and specialized management techniques enhances precision, reduces procedural risks, and leads to improved endodontic prognosis and patient care.

**Title**: Biaxial Flexural Strength of Novel CAD/CAM Resin-Based Definitive Materials

**Authors**: Reem Aldhafiri, Jin-Ho Phark, and Sillas Duarte

**Faculty Advisor**: Jin-Ho Phark and Sillas Duarte

**Background**: Novel printed resin-ceramic CAD/CAM materials are now available for definitive restorations. However, their performance based on mechanical properties compared to other materials still must be verified. **Purpose**: Evaluate biaxial flexural strength (BFS) of two additively manufactured resin-ceramic materials (VarseoSmile Crown Plus-VCP/ Ceramic Crown-CC) and compare with subtractively manufactured (VITA ENAMIC-VE/Lava Ultimate-LU) and one manually layered resin composite material (Filtek Supreme Ultra-FSU). **Methods**: For all five materials, a total of 210 discs (diameter 12.00 mm/thickness 2.00 mm), divided into 14 groups with n=15, were fabricated. For VCP and CC, additionally two different printing thicknesses (50 $\mu$m and 100 $\mu$m) were used. Half of the groups were aged using thermocycling. All specimens were subjected to BFS. Data were analyzed using parametric tests: two-way and one-way ANOVA with Bonferroni post-hoc test ($\alpha$=0.05). **Results**: BFS values ranged from 230.07 ±17.15 MPa (non-aged CC 50 $\mu$m) to 107.22±26.52 MPa (aged VCP 100 $\mu$m). Milled and layered materials did not differ significantly from each other, while CC was significantly higher and VCP was significantly lower than most other materials. Aging significantly reduced BFS for most groups. Layer thickness of 50 $\mu$m was significantly higher than 100 $\mu$m for Ceramic Crown, but not for VarseoSmile Crown Plus. **Conclusion**: The novel printed resin-ceramic materials exhibit varying BFS performances when compared with each other and with milled and layered materials. Depending on the material, lower printing thickness may improve performance, while all materials deteriorate in strength over time.

**Title**: Usability and acceptance of educational handouts for temporomandibular disorders with AI generated images

**Authors**: Sang Chung, Kanvara Virojsakulchai, Douglas Wall, and Mariela Padilla

**Faculty Advisor**: Mariela Padilla

**Background**: Temporomandibular disorders (TMD) are prevalent orofacial pain conditions in adolescents, characterized by joint and muscle pain, joint noises, and restricted movement. Their multifactorial etiology necessitates patient education and behavioral changes for effective treatment, yet adolescent noncompliance remains a significant barrier. To enhance engagement, narrative tools like comics are increasingly used, as they effectively convey health information. Additionally, AI-generated comics present innovative opportunities, though considerations around copyright, usability, readability, and health literacy are essential. **Purpose**: This study evaluates the usability and acceptance of educational handouts featuring AI-generated images for adolescents with TMDs, with the goal of developing a graphic novel-style tool to encourage patient responsibility for their health. **Methods**: The AI tool (Comic Factory) created a comic about TMJ-related conditions, featuring four diverse characters to represent different ethnicities. The comic was shared with 12 adolescent patients at the Herman Ostrow School of Dentistry Orofacial Pain Clinic, and its usability and acceptance were evaluated using a modified SUS scale. **Results**: The average usability and acceptance scores were 65.83 and 71.25 respectively, acceptance being above average. **Conclusion**: Usability tests indicate that AI-generated handouts can significantly improve adolescents' understanding of TMDs, warranting further investigation into their application in patient education.

**Title**: Management of Delayed Treatment of Traumatized Anterior Teeth: Case Report

**Authors**: Vandan R. Kasar, David Kelliny, Stefan Zweig, and Rafael Roges

**Faculty Advisor**: Rafael Roges

**Background**: Delayed treatment of anterior teeth trauma increases the risk of complications such as pulp necrosis, external and internal root resorption, and infection. Despite advances in endodontic treatment, these cases remain challenging, requiring individualized treatment approaches. **Purpose**: This case report aims to highlight the clinical management of a patient presenting with delayed treatment of trauma to the permanent maxillary anterior teeth, which was complicated by external and inflammatory resorption. **Methods**: A patient with a history of anterior maxillary avulsion of Teeth #8 and 9 presented 10 months post-initial trauma treatment with a chief complaint of mobility on these teeth. **Results**: Clinical and radiographic examination revealed inflammatory and external resorption. Treatment included non-surgical root canal therapy for initial stabilization, followed by surgical root canal treatment to address the resorption. **Conclusion**: This case underscores the importance of timely intervention in anterior dental trauma and the efficacy of combined non-surgical and surgical endodontic approaches in managing resorptive defects. Early assessment, individualized treatment planning, and patient compliance are crucial in improving long-term prognosis.

**Title**: Odontogenic Rhinosinusitis: The Invisible Sinus Tract

**Authors**: Yeonghee Jung and Rafael Roges

**Faculty Advisor**: Rafael Roges

**Background**: Diseases originating from dentoalveolar structures can affect the Schneiderian membrane, leading to pathology in the maxillary sinus. In the context of endodontics, when periapical inflammatory lesions of the maxillary molar teeth take the path of least resistance through the floor of the maxillary sinus, odontogenic rhinosinusitis (ORS) will be established. **Purpose**: The aim of this study is to review cone beam computed tomography (CBCT) taken at the Herman Ostrow School of Dentistry Endodontics department to assess ORS associated with pathology of maxillary posterior teeth. **Methods**: All CBCT of the maxillary first molars taken here at Herman Ostrow School of Dentistry were reviewed to identify odontogenic rhinosinusitis. **Results**: ORS can be associated with all maxillary posterior teeth, with the highest rate of occurence associated with the maxillary first molars. **Conclusion**: Current estimates of odontogenic cause for maxillary rhinosinusitis is 25-40% of cases but the diagnosis is often delayed, resulting in inappropriate treatment. With better understanding of patterns of ORS, we can deliver prompt treatment to address ORS.

**Title**: Immersive 3-Dimensional Virtual Reality Use In Orthodontic Patient Education

**Authors**: Yoo Jin Kim, Mathias Fallis, Glenn Jou, and Glenn Sameshima

**Faculty Advisor**: Glenn Jou and Glenn Sameshima

**Background**: Immersive 3-dimensional virtual reality (3-D VR) has gained attention as a tool for education in academic dentistry; however, there remains a lack of research on its application in orthodontic patient education. **Purpose**: This study aimed to assess patient receptiveness to immersive 3-D VR as an educational tool and gather patient feedback regarding an immersive 3-D VR classroom that was developed. **Methods**: Twenty-eight orthodontic patients, who had previously reviewed their malocclusion and orthodontic treatment using 2-D models, were randomly selected to utilize the Oculus Quest VR headset to explore their malocclusion and orthodontic treatment in an immersive 3-D VR classroom. Each patient completed a survey after the session, and the results were analyzed to evaluate their perceptions of the platform. **Results**: Although

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more than half of the patients (57%) had no prior exposure to immersive 3-D VR, the majority (86%) believed it could enhance their understanding of their malocclusion and orthodontic treatment. Preference for immersive 3-D VR was higher (68%) than for 2-D models in the current setup, rising to 89% with improvements in the setup. Preference for immersive 3-D VR over 2-D models was also greater among patients under 25 years of age (77%) compared to those over 25 years of age (33%). **Conclusion**: This study indicates that patients exhibit enthusiasm and interest in the potential applications of immersive 3-D VR to optimize their orthodontic educational experiences. Utilizing this platform demonstrates potential to improve patient engagement and compliance, underscoring the importance of integrating such platforms into orthodontic patient education.

<div style="background:#e8b0ad; text-align:right">Poster #25</div>

**Title**: Predictors of Reoperation after Cleft Orthognathic Surgery

**Authors**: Armen Agahi, Asli Pekcan, Marvee Turk, Raina Patel, Melanie Bakovic, Valeria Mejia, Medha Vallurupalli, William P. Magee, Pasha Shakoori, Jeffrey Hammoudeh, and Mark Urata

**Faculty Advisor**: Mark Urata

**Background**: Orthognathic surgery represents a critical intervention within the continuum of care for patients with cleft lip and palate (CLP). Post-operative relapse is a significant complication and often necessitates reoperation. **Purpose**: This study assesses risk factors for reoperation due to relapse following cleft orthognathic surgery. **Methods**: A retrospective review was conducted of patients with CLP who underwent orthognathic surgery for correction of class III malocclusion between 2005-2024, excluding those with under six months of follow-up. Maxillary advancement techniques included surgically-assisted maxillary protraction (SAMP), LeFort I advancement (LF1), and distraction osteogenesis (DO). The outcome

of interest was reoperation for late relapse. **Results**: Overall, 133 patients met inclusion criteria. Median age at surgery was 18.4 years and median follow-up was 2.1 years. Sixteen patients (12.0%) underwent SAMP, 101 (76.9%) LF1, 7 (5.3%) DO, and 9 (6.8%) staged DO followed by LF1. Bilateral sagittal split osteotomy (BSSO) for mandibular setback was performed in 48.4%. The incidence of reoperation was 13.5%. Maxillary advancements >8.5 mm were 6.3 times more likely to require reoperation (p<0.001). Multivariable regression identified bilateral CLP (p=0.038) and multiple prior maxillary operations (p=0.009) as significant predictors of reoperation, while BSSO was associated with decreased odds of reoperation (p=0.027). **Conclusion**: Patients with bilateral CLP and multiple prior maxillary operations were significantly more likely to require reoperation for late relapse. Limiting sagittal movements to less than 8.5 mm or performing concurrent BSSO may mitigate the risk of reoperation.

<div style="background:#e8b0ad; text-align:right">Poster #26</div>

**Title**: Early Mandibular Distraction Osteogenesis Improves Airway, Feeding, and Speech Management

**Authors**: Armen Agahi, Valeria Mejia, Asli Pekcan, Raina K. Patel, Melanie Bakovic, Marvee Turk, Erin M. Wolfe, Pasha Shakoori, Mark Urata, and Jeffrey Hammoudeh

**Faculty Advisor**: Jeffrey Hammoudeh

**Background**: Mandibular distraction osteogenesis (MDO) is a key treatment for Robin Sequence (RS), though the ideal timing to optimize outcomes remains unclear. **Purpose**: This study examines the impact of timing of MDO intervention on respiratory, nutritional, and speech outcomes. **Methods**: A retrospective review was conducted of patients with RS who underwent MDO at a tertiary children's hospital from 2004 to 2023. A sensitivity analysis determined the age at which MDO optimized outcomes including obstructive sleep apnea (OSA),

gastrostomy tube placement, nutritional supplementation duration, secondary speech surgery (SCS), and palatal fistula formation. Statistical analyses involved Pearson's chi-square and Student's T-tests. **Results**: Of 115 patients, 58 underwent MDO before four weeks of age and 57 underwent MDO after. The early group showed greater improvements in severe OSA and end-tidal carbon dioxide levels post-MDO [Figure 1]. The early group had lower rates of initial feeding by gastrostomy tube placement (1.7% vs. 29.8%, p<0.001) and similar supplementation durations of 1.3 months. Cleft repair outcomes were better in the early group, with fewer palatal fistulas and lower rates of VPI surgery (4.0% vs. 17.9%, p<0.05). **Conclusion**: MDO within four weeks significantly improved respiratory, nutritional, and speech outcomes, supporting early intervention as optimal for RS patients.

<div style="background:#e8b0ad; text-align:right">Poster #27</div>

**Title**: An Algorithmic Approach to Pediatric Maxillofacial Giant Cell Lesions

**Authors**: Armen Agahi, Asli Pekcan, Raina Patel, Melanie Bakovic, Valeria Mejia, Priyanka Naidu, Pasha Shakoori, Mark Urata, and Jeffrey Hammoudeh

**Faculty Advisor**: Jeffrey Hammoudeh

**Background**: Maxillofacial giant cell lesions (GCLs) are often aggressive, disfiguring tumors in children. With low incidence and variable presentation, consensus on optimal management is lacking. **Purpose**: This study reviews our institutional experience with and presents a management algorithm for pediatric maxillofacial GCLs. **Methods**: A retrospective review of patients with maxillofacial GCLs at a tertiary children's hospital from 2003-2024 was performed, excluding those with less than six months of follow-up. Tumors were classified as aggressive or nonaggressive using Chuong et al.'s criteria. Outcomes included local recurrence and final disease status (remission, progressive, or non-progressive). **Results**:

Twenty-eight patients met inclusion criteria, 16 non-syndromic with unifocal lesions and 12 syndromic, of which 11 had multifocal lesions. Mean age at presentation was 10.7 ± 4.8 years. Overall, 96.4% of lesions were aggressive, with 89.3% exhibiting rapid growth, 100% dental displacement, and 44.0% cortical perforation. Non-syndromic subjects were more frequently treated with adjuvant pharmacologic therapy compared to syndromic subjects (75.0% vs. 25.0%, p=0.020). Recurrence occurred in one non-syndromic subject (6.2%) and 50% of syndromic subjects (p=0.008). Remission was achieved in 100% of the non-syndromic cohort and only 8.3% of the syndromic cohort (p<0.001). **Conclusion**: Maxillofacial GCLs are highly morbid, resulting in significant facial disfigurement and mass effect. Our results showed that syndromic and multifocal cases exhibited the highest recurrence and lowest remission rates, warranting a more aggressive treatment approach and early consideration of a targeted approach with denosumab. We present our institution's management algorithm to guide optimal management of pediatric maxillofacial GCLs.

<div style="background:#e8b0ad; text-align:right">Poster #28</div>

**Title**: Aggressive Cherubism: When is Surgery the Right Choice?

**Authors**: Simon Youn, Asli Pekcan, Valeria Mejia, Melanie Bakovic, Raina Patel, Eloise W. Stanton, Medha Vallurupalli, Alyssa Valenti, Jeffrey Hammoudeh, and Mark Urata

**Faculty Advisor**: Mark Urata

**Background**: Cherubism is a rare genetic disorder characterized by bilateral proliferative lesions of the mandible and maxilla associated with significant deformity. Diagnosis is complex and conservative management is favored, but aggressive cases may require surgical intervention. **Purpose**: This study evaluates surgical strategies to address functional and aesthetic concerns associated with severe cherubism. **Methods**: A retrospective review of patients diagnosed

with cherubism from 2010-2024 was conducted. Clinical presentation, radiographic, histopathologic, genetic correlation, and treatment courses were documented. Patients were graded from I-V using Motamedi's classification. Outcomes included symptom resolution, functional improvement, and aesthetic results. **Results**: Nine patients (seven male, two female) were included. Mean age at consultation was 8.1±3.4 years. All had mandibular involvement; six also had maxillary involvement. Family history was confirmed in 33.3%, and genetic testing identified a SH3BP2 mutation in one patient. Two Grade V patients presented with respiratory and ophthalmic symptoms. Seven patients underwent surgical debulking. The two Grade V patients underwent multiple resections and one received adjuvant denosumab. Complications included V3 anesthesia and mandibular abscess. Surgical outcomes were favorable, with improved facial symmetry in all patients and significant improvement in proptosis and respiratory symptoms in Grade V patients. **Conclusion**: Surgical management is an effective option for patients with aggressive cherubism, particularly in cases involving rapidly expanding lesions, impending pathologic fracture, and severe psychosocial distress. Denosumab is a promising adjuvant therapy for enhancing surgical outcomes. This study highlights the importance and challenges of diagnosis and the need for individualized treatment plans to optimize outcomes in severe cases.

### Poster #29

**Title**: Disparities in Mandibular Distraction Osteogenesis: A Sociodemographic Analysis

**Authors**: Simon Youn, Melanie Bakovic, Raina Patel, Asli Pekcan, Valeria Mejia, Laura Herrera Gomez, Pasha Shakoori, Mark Urata, and Jeffrey Hammoudeh

**Faculty Advisor**: Jeffrey Hammoudeh

**Background**: Mandibular distraction osteogenesis (MDO) is an effective procedure for alleviating upper airway obstruction in infants with micrognathia, yet the role of sociodemographic factors in MDO care and outcomes remains underexplored. **Purpose**: To uncover potential disparities in patient care related to MDO. **Methods**: This retrospective review analyzed patients who underwent MDO at a tertiary children's hospital between 2004 and 2023. This study assessed the Area Deprivation Index (ADI), median household income, unemployment rates, insurance status, race/ethnicity and primary language. Outcome measures included age at surgery, length of hospital stay, readmission rates, and postoperative complications. **Results**: A total of 133 patients underwent MDO. Patients in lower income and higher unemployment cohorts had greater rates of MDO failure and a higher incidence of operative site infections. White/Caucasian patients were the youngest at the time of surgery (3.6 weeks) compared to Hispanic (4.5 weeks), Asian (5.4 weeks), and Black/African American patients (5.6 weeks) (p=0.031). Black/African American patients had the highest readmission rate (75.0%, p = 0.008) and the longest median hospital stay (120.0 days, p = 0.007). No significant differences in outcome variables were observed between cohorts based on ADI, insurance status, or primary language. **Conclusion**: Patients from low socioeconomic neighborhoods experienced higher MDO failure rates and higher postoperative infection rates. Moreover, Black/African American patients were found to undergo surgery later, have higher readmission rates, and face longer hospital stays. Recognizing and addressing these disparities is crucial for providing equitable care.

### CBY/PIBBS GRADUATE STUDENTS

### Poster #30

**Title**: Investigating The Role of LGRs in Mouse and Zebrafish Jaw

**Authors**: Arshia Bhojwani, Audrey C. Nickle, Ryan R. Roberts, Kuo-Chang Tseng, J. Gage Crump, and Amy Merrill

**Faculty Advisor**: J. Gage Crump and Amy Merrill

**Background**: Disruptions in connective tissue development cause impaired jaw movement, temporomandibular joint disorders, and other craniofacial anomalies. While stem cells that generate the skeleton are beginning to be understood, we know little about stem cells generating the non-skeletal connective tissue components of the skull. **Purpose**: This study aims to reveal the identity of connective tissue stem cells (CTSCs) that generate diverse connective tissues in the jaw and face. Leucine-rich repeat-containing G protein-coupled receptors (LGRs) have been established as an epithelial stem/progenitor cell marker in various tissues such as the intestinal epithelium and hair follicle, where they are thought to potentiate WNT signaling. **Methods and Results**: Our single-cell RNAseq analyses of the developing zebrafish and mouse jaw, and spatial transcriptomics, suggest potential roles for the LGR4/5/6 family and WNT signaling in regulating CTSCs. In situ hybridization of Lgr5 in mouse, and lgr6 in zebrafish reveal expression in undifferentiated mesenchyme of the jaw. Lineage tracing with Lgr5:GFP-CreER in mouse shows that Lgr5+ mesenchyme gives rise to jaw tendons and ligaments, but not skeletal components. Further, I find that whole-body loss of Lgr5 and conditional loss of both Lgr4 and Lgr5 in the neural crest lineage disrupts development of the craniofacial complex, which may reflect consequences of defects in tendon/ligament formation. **Conclusion**: In this study, I will use the complementary strengths of mouse and zebrafish models to test the idea that LGR4/5/6 family members maintain CTSCs for alternative non-skeletal fates by locally potentiating WNT signaling.

### Poster #31

**Title**: Investigating Mechanisms of Craniosynostosis in Bent Bone Dyplasia Syndrome

**Authors**: Audrey Nickle and Amy Merrill

**Faculty Advisor**: Amy Merrill

**Background**: Bent Bone Dysplasia Syndrome (BBDS) is a rare skeletal dysplasia caused by mutations to Fibroblast Growth Factor Receptor 2 (FGFR2) which features bent long bones, hypoplasia of the clavicles and pubis, and craniosynostosis, or premature suture fusion. Two unique mutations (M391R and Y381D) are associated with BBDS, causing FGFR2 to relocalize from the plasma membrane to the nucleus where it performs non-canonical functions. Previous work from the Merrill Lab has described the molecular changes nuclear FGFR2 induces in preosteoblasts *in vitro*, but in order to understand how this connects to the patients' symptoms, an animal model is needed. **Purpose**: Our lab has developed a BBDS mouse model featuring a Cre-inducible $Fgfr2^{M391R}$ allele which my project utilizes to understand the pathogenesis of suture fusion in BBDS. **Methods**: Utilizing the *Wnt1-Cre* driver mouse, we generated neural crest-specific BBDS mutants which undergo coronal suture fusion throughout early postnatal development. **Results**: Genetic lineage tracing and sequencing have allowed us to map and characterize cell populations and their signaling intercommunications which are responsible for suture fusion. Cell expansion at the ectocranial domain of the suture drives fusion, with accompanied changes in the FGF and WNT signaling pathways that appear to change cell fate determination towards osteoblasts. **Conclusion**: Furthering our understanding of this disease mechanism will not only inform BBDS treatments, but also expand on our understanding of calvarial development and the role of FGFR2 in directing it.

### Poster #32

**Title**: The Role of Prox1 in Coronal Suture and Craniosynostosis

**Authors**: Dongyi Lan, Qing Chang, and Jianfu Chen

**Faculty Advisor**: Jianfu Chen

**Background**: Craniosynostosis is characterized by the premature fusion of cranial sutures, leading to skull and facial dysmorphology.

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Syndromic cases are often associated with neurocognitive deficits and elevated intracranial pressure (ICP). Prox1 is a key regulator of meningeal lymphatic vessel development and function in the dura mater. *Twist1*^{+/-} mice serve as a well-established model of Saethre-Chotzen syndrome. However, the role of Prox1 in Twist1-mediated craniosynostosis remains largely unexplored. **Purpose**: This study aims to investigate the role of Prox1 in coronal suture and craniosynostosis. **Methods**: We conducted a loss-of-function phenotype study using four mouse groups: WT, *Prox1*^{+/-}, *Twist1*^{+/-}, and *Prox1*^{+/-}; *Twist1*^{+/-}. Each group consisted of twenty mice. At postnatal day 28 (P28), we evaluated coronal suture fusion using micro-CT and categorized fusion outcomes as non-fusion, unilateral fusion, or bilateral fusion. We collected skull samples at P8 and performed immunohistochemistry (IHC) staining on coronal sutures, targeting key markers of osteogenic differentiation bone resorption, and cell proliferation: Runx2, Sp7, Cathepsin K, and Ki67. **Results**: The *Prox1*^{+/-} group exhibited a 100% non-fusion rate, similar to the WT group. *Prox1*^{+/-}; *Twist1*^{+/-} group exhibited a 100% fusion rate, with 26.3% showing unilateral fusion and 73.7% displaying bilateral fusion. *Prox1*^{+/-}; *Twist1*^{+/-} mice demonstrated enhanced osteogenic differentiation, reduced bone resorption, and decreased cellular proliferation in the coronal suture. **Conclusion**: Prox1 loss of function exacerbates coronal suture fusion and influences key biological processes, including osteogenic differentiation, bone resorption, and cellular proliferation. These findings suggest that Prox1 plays a crucial regulatory role in cranial suture patency and craniosynostosis progression.

Poster #33

**Title**: Treating White Spot Lesions and Non-Carious Cervical Lesions with Amelogenin Peptide-Based-Hydrogel

**Authors**: Erika Bauza Nowotny, Jin-Ho Phark, and Janet Moradian-Oldak

**Faculty Advisor**: Janet Moradian-Oldak

**Background**: Peptide-based biomimetic treatments have gained increased attention in the dental field due to their biocompatibility and minimally invasive qualities. **Purpose**: The aim of this study was to examine the biocompatibility and stability of an amelogenin peptide-based chitosan hydrogel (P26-CS) against salivary enzymes. Second, to evaluate its efficacy in biomimetically repairing human dental lesions in situ. **Methods**: Good laboratory practice (GLP) biocompatibility evaluation was performed. High-performance liquid chromatography (HPLC) was used to assess peptide stability when incubated with salivary enzymes in vitro. White spot lesions (WSLs) in enamel and non-carious cervical lesions (NCCLs) in dentin were artificially created and treated with P26-CS. Quantitative light-induced fluorescence (QLF), microcomputed tomography (μCT), scanning electron microscopy (SEM) were used to evaluate P26-CS mediated repair of the lesions. Peptide penetration into the WSL and NCCLs in situ was assessed using confocal microscopy. **Results**: The peptide was not cytotoxic, irritating, or sensitizing as per ISO standards. Chitosan (CS) improved peptide stability while remineralization of enamel sections with P26-CS was not impeded by salivary enzymes. Fluorescently labeled P26-CS penetrated ~300 μm into the enamel of WSLs and ~100 μm into the dentin of NCCLs. After peptide treatment, QLF and μCT indicated a gain in mineral density of WSLs. In NCCLs, SEM showed that the dentin was covered by a mineral layer of needle shaped crystals. **Conclusion**: Our results show that the repair of artificial WSLs and NCCLs was achieved by P26 peptide-guided remineralization and demonstrate its potential to repair dental lesions.

Poster #34

**Title**: ADGRG6 Maintains Mouse Growth Plate Homeostasis through IHH Signaling

**Authors**: Fangzhou Bian, Colleen Feng Hong, Jingyu He, and Zhaoyang Liu

**Faculty Advisor**: Zhaoyang Liu

**Background**: The cartilage growth plate is crucial for skeletal growth, yet the mechanisms regulating its postnatal homeostasis remain unclear. Using molecular genetics and spatial transcriptomics, we reveal that ADGRG6/GPR126, a cartilage-enriched G protein-coupled receptor (GPCR), is vital for maintaining resting zone cells, regulating chondrocyte proliferation and differentiation, and ensuring growth plate homeostasis in mice. **Purpose**: To investigate the signaling pathway and functional role of ADGRG6 in maintaining postnatal growth plate homeostasis in mice. **Methods**: We generated genetic mouse models to ablate *Adgrg6* in osteochondral progenitor cells and postnatal chondrocytes. We employed spatial transcriptomics with the 10x Genomics Visium platform to identify differentially expressed genes. Molecular assays were used to validate the top gene candidates and to assess chondrocyte proliferation, differentiation, and cell death across growth plate zones. **Results**: *Adgrg6* ablation in osteochondral progenitor cells caused shortened resting zones, disorganized proliferative cells, and elongated hypertrophic zones, accompanied by reduced Parathyroid Hormon-related Protein (PTHrP) and ectopic Indian Hedgehog (IHH) signaling. Loss of *Adgrg6* leads to early exhaustion of resting zone cells by inducing premature proliferation and cell death. Attenuation of IHH signaling rescued hypertrophic expansion. Spatial transcriptomics revealed that *Adgrg6* regulates osteogenic and catabolic genes across zones, potentially via SOX9. **Conclusion**: Altogether, our findings elucidate the essential role of a cartilage-enriched adhesion GPCR in regulating cell proliferation and hypertrophic differentiation by regulation of PTHrP/IHH signaling, maintenance of slow-cycle resting zone chondrocytes, and safeguarding chondrocyte homeostasis in postnatal mouse growth plates.

Poster #35

**Title**: Kdm6b is a Key Regulator of Tooth Root Morphogenesis and Neurovascular Bundle Formation

**Authors**: Heliya Ziaei, Tingwei Guo, Mingyi Zhang, Jifan Feng, Lin Meng, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Tooth root development exemplifies complex organogenesis, with epigenetic regulation playing a crucial role. Kdm6b and Ezh2, two epigenetic modifiers, antagonistically modulate H3K27 methylation to maintain developmental homeostasis. **Purpose**: This study investigates Kdm6b's role in tooth root morphogenesis and innervation, aiming to elucidate its broader functions in craniofacial and neuronal development. **Methods**: MicroCT, histology, bulk RNA-sequencing, ChIP-sequencing, RNA *in situ* hybridization, and whole-mount immunostaining were used to investigate morphology, gene expression, and chromatin structure. **Results**: Conditional deletion of Kdm6b in neural crest-derived mesenchymal cells led to shortened, malformed tooth roots with defects in dentin and periodontal ligament differentiation, in *Osr2-Cre;Kdm6b*[f/f] mice (KO). These defects were partially rescued in *Osr2-Cre;Kdm6b*[f/f]*;Ezh2*[f/+] double knockout (DKO) mice. Molecules were antagonistically regulated by Kdm6b and Ezh2, revealed by bulk RNA sequencing of control, KO, and DKO tooth mesenchyme; TGF-β/BMP signaling was significantly disrupted in the KO model, with BMP inhibitors downregulated, but restored in the DKO model. Elevated BMP activity (P-SMAD1/5/9) in the knockout was also rescued in DKO mice. Kdm6b deletion also reduced innervation and vessel formation in the dental mesenchyme due to altered expression of nerve growth factor (NGF), predicted to be regulated by BMP signaling. Restoring BMP signaling in *Osr2-Cre;Kdm6b*[f/f]*;Bmpr1a*[f/+] mice rescued root and innerva-

tion defects. **Conclusion**: These findings suggest that Kdm6b is a critical regulator of tooth root development and innervation through regulating BMP signaling and axonal guidance molecules. This research enhances understanding of epigenetic mechanisms in development from a broader point of view and offers potential therapeutic strategies for dental, craniofacial, and neurodevelopmental disorders.

## Poster #36

**Title**: Functional Investigation of Netrin1/DCC Signaling in Temporomandibular Joint Osteoarthritis Pain

**Authors**: Jingyi Chen, Supawadee Jariyasakulroj, Ziying Lin, Qing Chang, and Jianfu Chen

**Faculty Advisor**: Jianfu Chen

**Background**: Temporomandibular joint osteoarthritis (TMJOA) is a degenerative condition involving joint remodeling, inflammation, and chronic pain. Despite its prevalence, understanding the mechanisms behind TMJOA remains a challenge. Elevated level of Netrin1 has been detected in the synovial fluid of TMJOA patients with chronic pain. Several neurological and GWAS genomic studies have implicated the involvement of Netrin-1/DCC pathway in chronic back pain. However, the function and mechanism of Netrin-1/DCC pathway in painful TMJ remain unknown. **Purpose**: This study aims to explore the roles of Netrin-1 and DCC in painful TMJOA using mouse models, identifying potential therapeutic targets. **Methods**: An inflammatory TMJOA mouse model was created using intra-articular Complete Freund's Adjuvant (CFA) injections. Single-cell RNA sequencing (scRNA-seq) and fibroblast-specific *Netrin-1* conditional knockout (*Netrin-1* cKO) mice were used to study Netrin-1's role. Nociceptive neuron-specific *Dcc* knockout (*Dcc* cKO) mice were generated to assess DCC's function. **Results**: Netrin-1 and DCC expression increased in CFA-induced TMJOA mice. scRNA-seq revealed Netrin-1 enrichment in synovial fibroblasts. *Netrin-1* cKO mice showed reduced macrophage activity in TMJ synovial tissue

and decreased neuronal activity in the trigeminal ganglion (TG) and Spinal Trigeminal Nucleus Caudalis (SpVc), indicating pain reduction. *Dcc* cKO mice mirrored these effects, suggesting DCC mediates Netrin-1's role in TMJOA pain. **Conclusion**: We have identified the critical role of Netrin-1 and DCC in painful TMJ, as shown by less pain-related neuronal activities and synovitis in the cKO mouse lines, providing potential therapeutic targets for TMJOA and pain.

## Poster #37

**Title**: STAT3 Signaling is Required for the Mandibular Condylar Cartilage Homeostasis

**Authors**: Jingyu He, Hong Colleen Feng, Denis Evseenko, and Zhaoyang Liu

**Faculty Advisor**: Zhaoyang Liu

**Background**: The knee joint and temporomandibular joints (TMJ) are two frequently used joints susceptible to degenerative joint diseases like osteoarthritis (OA), leading to joint pain and stiffness secondary to articular cartilage loss. However, the molecular mechanisms that regulate postnatal homeostasis of the mandibular condylar cartilage (MCC) in TMJ remain poorly understood. **Purpose**: Our prior studies highlighted the essential role of STAT3 signaling in the proliferation and homeostasis of the postnatal growth plate and articular chondrocyte in knee joints. This study aims to assess the significance of STAT3 signaling in postnatal TMJ homeostasis in mice. **Methods**: Using a cartilage-specific *Stat3* deletion mouse model (*Acan-Cre$^{ERT2}$; Stat3$^{fl/fl}$*, TAM injection at P2), we collected TMJ at 1 month and 3 months of age and performed histological and gene expression analyses. **Results**: By 3 months of age, *Stat3* deletion in mice resulted in reduced cartilage thickness and altered extracellular matrix (ECM) component expression in the MCC, resembling OA-like cartilage degeneration. The mutant MCC exhibited reduced cellularity in the superficial and intermediate zones, with decreased type II collagen expression. Con-

versely, the hypertrophic zone was expanded with increased expression of type X collagen. In addition, mutant MCC showed decreased expression of Indian hedgehog (Ihh) signaling pathway molecules (IHH, GLI1, and GLI2) in the intermediate and early hypertrophic zones, coupled with reduced SOX9 expression. **Conclusion**: Our study suggests that STAT3 signaling maintains postnatal MCC and TMJ integrity via regulating chondrocyte proliferation and ECM homeostasis.

## Poster #38

**Title**: PRMT1-SFPQ regulates intron retention controlling matrix gene expression during craniofacial development

**Authors**: Julia Raulino Lima, Nicha Ungvijanpunya, Qing Chen, Greg Park, Mohammadreza Vatankhah, Tal Rosen, Yang Chai, Amy Merrill-Brugger, Weiqun Peng, and Jian Xu

**Faculty Advisor**: Jian Xu

**Background**: The craniofacial mesenchyme, essential for facial structure formation, largely originates from Cranial Neural Crest Cells (CNCCs). Mutations affecting CNCC spliceosome elements disrupt pre-mRNA processing, causing facial abnormalities common in spliceosomopathies, which are diseases arising from mutations in spliceosome-related genes. Intron retention (IR), a form of alternative splicing, influences numerous biological processes and diseases. Therefore, this study investigates the regulation of IR in CNCCs, a previously unexplored aspect. **Purpose**: To elucidate the unappreciated role of PRMT1-SFPQ in regulating IR in CNCCs during craniofacial development. **Methods**: CNCC-specific PRMT1 deletion was achieved using *Wnt1-Cre;Prmt1fl/fl* embryos at E13.5. A set of assays, including PLA, immunofluorescence, Western blotting, and FACS analysis were employed to evaluate PRMT1's impact on SFPQ function and intron splicing. RNA-sequencing of primary CNCCs transfected with SFPQ-targeting siRNAs further explored PRMT1-mediated SFPQ methylation in

gene expression. **Results**: PRMT1 regulates IR in CNCCs. *Prmt1*-deficient embryos displayed elevated IR in matrix gene mRNAs, leading to nonsense-mediated decay (NMD) and reduced matrix transcript levels. SFPQ, identified as a PRMT1 substrate, required PRMT1 for arginine methylation and functional expression. SFPQ depletion in CNCCs mirrored PRMT1 loss, increasing IR and decreasing matrix, Wnt signaling, and neuronal gene transcript levels. Notably, SFPQ-regulated genes were characterized by longer gene lengths. **Conclusion**: PRMT1-SFPQ pathway regulates matrix, Wnt signaling, and neuronal gene expression by regulating IR in CNCCs during craniofacial development.

## Poster #39

**Title**: Identifying injury-responsive temporomandibular joint cells

**Authors**: Maria Pacheco Vergara and Amy Merrill

**Faculty Advisor**: Amy Merrill

**Background**: Over 10-15% of the adult population are affected by temporomandibular joint disorders (TMD), in particular women during reproductive years. Articular disc displacement (ADD), where there is derangement of joint connective tissue, is thought to develop arthrogenous TMD. Little is known about the transcriptional and cellular changes within the temporomandibular joint (TMJ) following ADD. **Purpose**: The aims of this study are to characterize the molecular and cellular response that occur in the TMJ following ADD, combining genomics and genetics in a mouse surgical model. **Methods**: For ADD surgery, the masseter muscle is cut between the zygomatic and buccal branches of the facial nerve, exposing the condyle neck. Next, the joint capsule is opened and the articular disc's retrodiscal attachments severed. The ADD response will be characterized by histology (5-10-15-30 days post-surgery), bulk RNA-seq to identify gene expression changes, and scRNA-seq to detect cell composition differences. I will

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use genetic lineage tracing to identify Sox9- and Scx-lineage cells (key sources of condylar and disc cells) following ADD. **Results**: Utilizing lineage tracing, we identified Scx+ and Sox9+ cells in the articular disc and articular surfaces of adult mice, with an increase in both Scx+ and Sox9+ lineage-traced cells following surgical ADD within the TMJ. Preliminary results following ADD surgery show condylar cartilage degeneration and articular disc fibrosis. **Conclusion**: New insights into the molecular and cellular mechanism that underlie arthrogenous TMD can further our understanding of TMD and improve patient outcomes.

**Title**: Inhibition of citrullination alleviate periodontal inflammation and alveolar bone loss

**Authors**: Mehrnaz Zarinfar, Xi Chen, Hongchen Sun, Thach-Vu Ho, Yang Chai, and Jian Xu

**Faculty Advisor**: Jian Xu

**Background**: Periodontal disease (PD) is a chronic inflammatory condition leading to alveolar bone loss, periodontal tissue damage, and tooth loss. Its progression is driven by TLR-NFκB signaling, which is regulated by pro-inflammatory and anti-inflammatory pathways, including the TGFβ family. Post-translational modifications play a crucial role in regulating these pathways. We previously showed that PRMT1-mediated arginine methylation plays a crucial role in inhibiting TLR-NFκB signaling, while citrullination, catalyzed by peptidyl arginine deiminases (PADs), is linked to the progression of inflammatory diseases like rheumatoid arthritis. Elevated PAD levels and citrullinated proteins are observed in PD, but their role in regulating inflammation remains unclear. **Purpose**: In this study, we investigate how PAD-mediated citrullination impacts Smad6 function and its regulation of TLR-NFκB signaling in periodontal inflammation. **Methods**: Biochemical and signaling analysis using keratinized epithelial cells was performed. Furthermore, we implemented translational

and transcriptional analysis using an experimental mouse periodontitis model. **Results**: Our findings indicate that citrullination levels of intracellular proteins were significantly elevated during periodontitis, concurrent with the progressive loss of alveolar bones. Mechanistically, we demonstrate that PADs activation and subsequent Smad6 citrullination antagonize PRMT1-mediated Smad6 methylation, leading to NFκB signaling activation, exacerbated oral inflammation and alveolar bone loss. **Conclusion**: Our findings suggest that the balance between Smad6 methylation and citrullination is a critical determinant of periodontal tissue homeostasis. This study not only elucidates a novel mechanism in the pathogenesis of periodontitis but also proposes the modulation of Smad6 post-translational modifications as a potential therapeutic strategy for managing periodontal inflammation and its systemic consequences.

**Title**: Fgf-Notch signaling promotes tenocyte fate in mouse jaw attachment progenitors

**Authors**: Michaela Ince, Arshia Bhojwani, Ryan Roberts, and Amy Merrill

**Faculty Advisor**: Amy Merrill

**Background**: Precise integration of the tendons, muscles and bone/cartilage is necessary for proper jaw function. These integrations occur at tendon-bone attachments which are organized zones of tendon, fibrocartilage, and bone. Jaw attachment progenitors (APs) can follow tenogenic, osteogenic, or chondrogenic fates. Previous work in our lab showed that loss of Fgfr2 in neural crest cells (NCCs) leads to loss of Notch signaling in jaw APs and promotes skeletogenic components over connective tissue. **Purpose**: In this project, I aim to determine how Fgf-Notch signaling promotes tenocyte fate during jaw attachment progenitor differentiation. **Methods**: Using Wnt1-Cre-mediated recombination, Fgfr2 and Notch pathway members will be knocked out in NCCs.

Histological staining and skeletal preparations will reveal anatomical differences in attachment processes of the jaw. scRNA-sequencing and RNA *in situ* hybridization (ISH) will be used to analyze gene expression changes. **Results**: Spatial transcriptomics shows Notch2 and its ligand Jag1 are expressed in distinct domains in the tendon-bone interface at the angular and condyle. RNA ISH validated this, and shows that Jag1 is expressed in the jaw ligament. This could indicate a role for Notch signaling in the differentiation of the ligamentocytes in the jaw. **Conclusion**: Notch signaling maintains boundaries between connective and non-connective tissues through expression of ligands and crosstalk with Fgfr2. This project is ongoing, and successful completion of this study may provide a deeper understanding of Notch-associated syndromes such as Alagille syndrome and aid in developing therapies.

**Title**: AhR and BMP pathways interaction during osteogenic differentiation in mesenchymal cells

**Authors**: Mohammadreza Vatankhah, Prerna Sehgal, Julia Raulino Lima, Tal Rosen, Mehrnaz Zarinfar, and Jian Xu

**Faculty Advisor**: Jian Xu

**Background**: Dioxins, a group of toxic chemicals in the environment and cigarette smoke, have been shown to cause osteogenic disruption and craniofacial defects. The aryl hydrocarbon receptor (AhR) mediates dioxin toxicity, while the bone morphogenetic protein (BMP) pathway is essential for osteogenic differentiation. However, mechanistic studies examining how 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), the most toxic and the most commonly studied dioxin, disrupts osteogenic differentiation through or independent of AhR are lacking. **Purpose**: To characterize the role of AhR in TCDD-induced disruption of BMP-induced osteogenic differentiation. **Methods**: We employed siRNA transfection, RNA-sequencing, quantitative polymerase chain reaction

(qPCR), immunostaining, Western blot, alkaline phosphatase staining, and Chromatin Immunoprecipitation-qPCR in ST2 mesenchymal cells. **Results**: TCDD activated the AhR pathway in ST2 cells with AhR regulating its downstream factors. TCDD treatment downregulated osteogenic genes and reduced alkaline phosphatase activity. Notably, AhR knockdown inhibited BMP-induced osteogenic differentiation. BMP pathway activation, in turn, downregulated AhR pathway components. Further investigation revealed that AhR knockdown reduced phosphorylation of Smad1/5 and its nuclear translocation. **Conclusion**: AhR plays a crucial regulatory role in BMP signaling during osteogenic differentiation in ST2 cells. TCDD's disruptive effect on osteogenic differentiation occurs through modulation of this AhR-BMP pathway interaction.

**Title**: Targeting a viral deamidase to boost antiviral immune defense

**Authors**: Rui Wang, Diana Ingles, Zhenfeng Shu, Chao Qin, Syed Kaleem Ahmed, and Pinghui Feng

**Faculty Advisor**: Pinghui Feng

**Background**: Herpes Simplex Virus 1 (HSV-1) is the etiological agent of various pathologies, ranging from cold sores to life-threatening dysfunction of the brain, such as encephalitis and Alzheimer's disease. The HSV-1 UL37 tegument protein is a *bona fide* deamidase that deamidates and inactivates key cellular immune signaling molecules such as cGAS and RIG-I receptors, thereby effectively negating antiviral immune defense. These results prompt us to develop small molecules that inhibit the deamidase activity of UL37, which is predicted to boost antiviral immune defense to defeat HSV-1 infection. **Purpose**: To develop small molecule inhibitors that block the UL37 deamidase to defeat HSV infection. **Methods and Results**: We were interested in glutamine analogs that can modulate cellular glutamine-consuming enzymes.

In this study, we repurpose and further improve these small molecules to target the UL37 deamidase. To this end, we obtained a small molecule, PA-04 as a potent inhibitor of UL37. Biochemical assays demonstrated that PA-04 blocks the UL37-mediated RIG-I deamidation in vitro and in cells. Functionally, PA-04 boosts antiviral immune response induced by HSV-1. PA-04 inhibits HSV-1 lytic replication in human foreskin fibroblasts with an IC50 of 1.1μM, while exhibiting minimal cytotoxicity. Moreover, PA-04 showed excellent metabolic stability, with a half-life exceeding 255.85 minutes in human liver microsomes, suggesting a strong potential for in vivo effect. The antiherpetic activity of PA-04 in a mouse model for HSV-1 infection is under way and findings will be presented at the meeting. **Conclusion**: PA-04 specifically inhibit UL37 deamidase activity and prevent HSV-1-mediated evasion of nucleic acid sensing pathways, which potently inhibits HSV-1 lytic replication and provide a novel antiviral strategy.

### Poster #44

**Title**: Probe the Roles of IS-Gylation in Bacteria-herpesvirus Interaction

**Authors**: Shutong Li, Yongzhen Liu, Chao Qin, Casey Chen, and Pinghui Feng

**Faculty Advisor**: Pinghui Feng

**Background**: Periodontitis involves both microbial infection and host immune responses. Herpesviruses such as Kaposi's sarcoma herpesvirus (KSHV) and Epstein-Barr virus (EBV) contribute to periodontal diseases in immunocompromised individuals, suggesting a complex interplay between herpesviruses and bacteria in these conditions. The innate immune system constitutes the first line of host defense against microbial pathogens. Ubiquitin-like protein ISG15 is implicated in this process but its functions remain underexplored in infection contexts. **Purpose**: We investigated the interactions between murine gammaherpesvirus 68 (MHV68) and *Aggregatibacter actinomycetemcomitans* (*A.a*), focusing the role of ISG15 role in bacteria-herpesvirus interaction. **Methods**: Using mouse embryonic fibroblasts

(MEFs), we assessed MHV68 replication in the presence of *A.a*, employing affinity purification and mass spectrometry to identify ISGylated viral proteins. The effect of ISGylation was examined by virological and immunological analyses. The recombinant MHV68 via bacteria artificial chromosome (BAC) technology that contains ISGylation-resistant mutations were engineered to examine the function of ISGylation. **Results**: *A.a* promoted the lytic replication of MHV68. MHV68 and *A.a* synergized to induce ISG15 expression. Loss of ISG15 impaired A.a to promote MHV68 replication MEFs. Structural proteins (capsid, portal, and tegument) were identified as ISGylation targets. The ISGylation sites within the major capsid protein were identified. The recombinant MHV68 containing ISGylation-resistant mutations exhibits impaired lytic replication, with impaired incorporation of structural proteins into virions, as well as subsequent virus entry. **Conclusion**: The interplay between *A.a* and MHV68 promotes ISG15-dependent viral replication, revealing a novel mechanism where viral pathogens exploit host antiviral responses for enhanced replication.

### Poster #45

**Title**: Intron Retention Orchestrates Spliceosome Reprogramming in Osteogenic Differentiation

**Authors**: Tal Rosen, Qing Chen, Weiqun Peng, and Jian Xu

**Faculty Advisor**: Jian Xu

**Background**: The spliceosome, a complex of RNA and proteins, is indispensable for orchestrating splicing events critical to mRNA maturation. Mutations in spliceosome components are linked to tissue-specific diseases known as spliceosomopathies. Among the diverse splicing events mediated by the spliceosome, intron retention (IR) has been extensively studied in plants and fungi. However, its functional significance in mammals has only recently gained attention. **Purpose**: IR is recognized for its role in cell

differentiation and is hypothesized to influence osteogenic differentiation, though its precise mechanisms remain unclear. **Methods**: This study leverages RNA sequencing to explore IR events during BMP2-induced osteogenic differentiation in ST2 cells. Genome-wide analysis revealed a significant increase in IR during differentiation, affecting numerous genes involved in RNA processing. **Results**: The identification of premature termination codons (PTCs) within intron-retaining transcripts indicates that IR may regulate RNA processing through nonsense-mediated decay. Additionally, we propose that splicing factors play a critical role in modulating IR during differentiation. **Conclusion**: Osteogenic differentiation is essential for directing progenitor cells to form the intricate craniofacial bone structures necessary for proper development and function. Understanding the role of IR in this process could provide valuable insights into novel therapeutic approaches to prevent dysregulated bone formation and associated pathologies.

### Poster #46

**Title**: Immune activation inhibits CAD-mediated metabolic reprogramming through TBK1 and IKKβ

**Authors**: Taolin Xie, Chi Liang, Hansong Xia, Anjie Lu, Chao Qin, Ali Can Savas, Yongzhen Liu, and Pinghui Feng

**Faculty Advisor**: Pinghui Feng

**Background**: CAD (**C**arbamoyl-phosphate synthetase, **A**spartate transcarbamoylase and **D**ihydroorotase) catalyzes the first three steps of *de novo* pyrimidine synthesis. Our lab previously reported that CAD deamidates NF-κB transcriptional factor RelA, which shunts RelA from mediating inflammation to aerobic glycolysis. We hypothesize that CAD-mediated RelA deamidation serves as a switch between immune activation and cell proliferation. Thus, we are keen on the question how CAD activity is modulated in response to infection. **Purpose**: This study aims to determine whether CAD

activity is regulated by immune activation and, if so, how it is regulated. **Methods**: CAD enzymatic activity is comprised of dihydroorotate synthesis and protein deamidation. The synthesis rate of dihydroorotate is measured by tracing and pool size using mass spectrometer coupled to liquid chromatograph, indicative of CAD metabolic activity, while RelA deamidation is analyzed by two-dimensional gel electrophoresis. Additionally, canonical or deamidated RelA-mediated gene expression is quantified by real-time PCR. **Results**: We found that CAD enzymatic activity is inhibited upon immune activation in multiple cell lines. Mechanistically, CAD is phosphorylated by TANK-binding kinase-1 (TBK1) and inhibitor of nuclear factor κB kinase-β (IKKβ) at multiple sites, which block its activities in pyrimidine synthesis and RelA deamidation. Intriguingly, a portion of cancer cells can switch TBK1 from inhibiting CAD to activate mTOR signaling, thereby promoting CAD activation and subsequent tumor cell growth. **Conclusion**: Our study highlights a novel crosstalk between innate immunity and cellular metabolism, placing cellular metabolism as a ramification of immune response against infection and tumorigenesis.

### Poster #47

**Title**: Microfluidic 3D Organoid co-culture system for HNSCC Immunotherapy and Metabolic Profiling

**Authors**: Tianming Zhou, Young Min Park, Hua Zhao, Jerry Wu, Chehyun Nam, Uttam Sinha, and Dechen Lin

**Faculty Advisor**: Dechen Lin

**Background**: Head and neck squamous cell carcinoma (HNSCC), a malignancy originating from the oral squamous epithelium and pharyngeal mucosa, accounts for over 90% of head and neck cancers. HNSCC exhibits genetic, metabolic, and immune heterogeneity, complicating therapy. Patient-derived tumor organoids (PDOs) offer 3D models that faithfully retain the primary tumor biology and treatment responses' genomic, histological, and functional

characteristics. **Purpose**: This study aims to investigate the molecular and metabolic drivers in HNSCC using PDOs and genetically engineered mouse organoid models, including both HPV-positive and HPV-negative subtypes. **Methods**: Forty HPV-negative PDO lines were cultured in the basement membrane matrix. 20 additional lines are being adapted to microfluidic platforms, which will be tested with flow cytometry and immunofluorescence, cytokine profiling, and viability assays to study immune components. RNA-seq and ChIP-seq are planned for transcriptional and epigenetic analyses. Metabolomic profiling of 20 PDO lines (HPV-positive and HPV-negative) and three mouse organoids is ongoing. **Results**: An initial analysis of 31 HNSCC samples confirms that PDO faithfully maintains genomic features and histopathological traits of primary tumors. Long-term culture preserved key characteristics, affirming PDOs as robust representative models. PDOs demonstrated predictive capability for cisplatin treatment responses, correlating ex vivo drug sensitivity with patient outcomes. Bulk and single-cell RNA sequencing unveiled molecular subtypes and intratumor heterogeneity (ITH) in PDOs, paralleling patient tumors. **Conclusion**: This study combines advanced models, multi-omics, and machine learning to gain insights into HNSCC biology and inform therapeutic strategies, with implications for both HPV-positive and HPV-negative subtypes.

Poster #48

**Title**: Viral Glutamine Amidotransferase Activates Purine Synthesis and Induces Tumor Formation

**Authors**: Wayne Yeh, Chao Qin, Ali Can Savas, Ting-Yu Wang, and Pinghui Feng

**Faculty Advisor**: Pinghui Feng

**Background**: Cancer cells are highly proliferative and metabolically demanding. Cellular glutamine amidotransferases (GATs) catalyze the synthesis of nucleotides, amino acids, glycoproteins, and enzyme cofactors, which serve as building blocks for proliferating cells. Phosphoribosylformylglycinamidine synthetase (PFAS) is a member of the GAT family and scaffolds the assembly of the purinosome, a cytosolic membrane-less organelle for *de novo* purine synthesis. We have observed that Kaposi's sarcoma-associated herpesvirus (KSHV) vGAT interacts with PFAS and induces tumor formation in nude mice. Our hypothesis is that vGAT interacts PFAS and activates *de novo* purine synthesis, thereby promoting cell proliferation and contributing to KSHV-associated tumorigenesis. **Purpose**: We propose to investigate the molecular action by which vGAT activates PFAS in *de novo* purine synthesis via post-translational modification of PFAS. **Methods**: PFAS activity in purine synthesis and protein deamidation will be analyzed by mass spectrometry. **Results**: Metabolite analysis by mass spectrometry shows that vGAT expression increases purine and pyrimidine levels. The enhancement of *de novo* purine synthesis by vGAT was further confirmed by tracing analysis. Interestingly, vGAT expression can promote tumor formation in nude mice. **Conclusion**: vGAT expression increases purine and pyrimidine synthesis and can interact with PFAS and other components of the purinosome, suggesting that vGAT may influence *de novo* purine synthesis by promoting purinosome formation. Several deamidation modification sites on PFAS were altered by vGAT, indicating a possible role of vGAT in PFAS post-translational modification and enzymatic activity. Ongoing work aims to determine the mechanism by which vGAT activates the purinosome through PFAS-dependent enzymatic activity.

Poster #49

**Title**: Lymphatic activation mitigates inflammatory temporomandibular joint osteoarthritis (TMJOA) and pain

**Authors**: Yang Shu, Paofen Ko, Qing Chang, Jingyi Chen, and Jianfu Chen

**Faculty Advisor**: Jianfu Chen

**Background**: Temporomandibular joint (TMJ) osteoarthritis (OA) is a craniofacial disorder that is characterized by defects in TMJ cartilage and bone as well as chronic pain. The pathogenesis and treatment strategies of TMJOA remain to be established. The lymphatic system regulates fluid and immune surveillance and its roles in craniofacial tissues are poorly understood. We recently reported that skull mesenchymal stem cells (MSCs) modulate brain lymphatic functions and mitigate neurocognitive dysfunctions in mouse models of craniosynostosis (Cell Stem Cell, 2023). Here we found that lymphatic dysfunction drives TMJOA and pain. **Purpose**: To investigate the lymphatic functions in TMJOA, we established an inflammatory painful TMJOA mouse model via intra-articular injection of CFA (Complete Freund's Adjuvant) (JCI Insights, 2025). **Methods**: Using genetic report mouse, uDISCO tissue clearing, and light sheet imaging, we identified and defined lymphatic vessel morphology, structure, and anatomic location in adult mouse TMJ. **Results**: Our histopathological and scRNA-seq studies found that lymphatic vessels undergo extensive remodeling and lymphangiogenesis in TMJOA mice, leading to the impairment of lymphatic drainage function. Mouse genetics studies showed that lymphatic dysfunction exacerbate cartilage defects, bone loss, synovitis, and pain behaviors in TMJOA. Conversely, lymphatic activation results in reversed beneficial effects in mitigating TMJOA and pain. Specifically, we utilized a degradable, injectable, sustainable, hydrogel (DISH-Gel) approach to deliver VEGF-C, a master regulator of lymphangiogenesis, into TMJ. **Conclusion**: Lymphatic activation leads to reduced inflammation, cartilage defects, bone loss, synovitis, and pain behaviors in TMJOA mouse models.

Poster #50

**Title**: Identifying LAT1 as a Novel Cancer Stem Cell factor

**Authors**: Yuhao Pan, Chehyun Nam, and Dechen Lin

**Faculty Advisor**: Dechen Lin

**Background**: Cancer stem cells (CSCs) are difficult to identify within the cancer cell population. Functionally, CSCs drive tumor growth, metastasis, and therapy resistance by self-renewing, differentiating, and promoting epithelial-mesenchymal transition (EMT), leading to recurrence and poor prognosis in various cancers. **Purpose**: Therefore, identifying novel CSC markers is crucial for advancing cancer research and therapy. CSCs play a key role in tumor initiation, progression, and treatment resistance. Novel markers enable precise targeting of CSCs, improving early diagnosis, prognosis, and development of therapies. LAT1 (SLC7A5 combined with SLC3A2) is a crucial amino acid transporter, facilitating the uptake of essential neutral amino acids. It plays a significant role in cell growth, metabolism, and cancer progression. Our previous study revealed that the cancer cell population exhibits high LAT1 expression. This elevated expression regulates the EMT pathway, linking LAT1 to the modulation of both epithelial and mesenchymal cell states, thereby reinforcing a cancer stem cell state. **Method**: Multiple squamous cancer cell lines were cultured as free-floating 3D spheroids to maintain stemness. **Results**: LAT1 knockdown reduced stemness markers in multiple cell lines and reduced the chemo-drug resistance of the cells. These findings emphasize LAT1's role in cancer progression and as therapeutic targeting. In the future research, we will use flow cytometry to ensure LAT1 as a cell surface marker, allowing the isolation of LAT1-high populations for further analysis. **Conclusion**: Identifying novel CSC markers like LAT1 is critical for advancing cancer research and therapy.

Poster #51

**Title**: Herpes Simplex Virus-1 US3 kinase deregulates Tau in infection and pathogenesis

**Authors**: Zhenfeng Shu and Pinghui Feng

**Faculty Advisor**: Pinghui Feng

**Background**: Neurodegeneration, including Alzheimer's Disease (AD), is a growing concern in aging populations. Emerging evidence links herpes simplex virus type 1 (HSV-1) brain infection to AD pathogenesis, although the mechanisms remain unclear. **Purpose**: This study aimed to investigate the role of the HSV-1-encoded protein kinase US3 in Tau phosphorylation, expression, and aggregation, as well as its impact on HSV-1 replication in neurodegeneration. **Method**: Using an HSV-1 US3 kinase-dead mutant (HSV-1 K220M), we examined the necessity of US3-induced Tau phosphorylation for promoting Tau expression and aggregation. Genetically modified mouse models, including 5xFAD and PS19 strains, were used to assess susceptibility to HSV-1 infection and the effects of Tau overexpression. Viral replication assays and in vitro studies explored the interplay between Tau expression, HSV-1 replication, and innate immune responses. **Results**: HSV-1 US3 phosphorylated Tau, promoting its expression and aggregation, while the HSV-1 K220M mutant failed to induce these effects. Tau overexpression hindered HSV-1 replication, with a stronger impact in PS19 mice. Conversely, 5xFAD mice showed heightened susceptibility to HSV-1 infection. Hyperactivated immune responses facilitated HSV-1 replication, while Tau overexpression suppressed virus-triggered immune responses. **Conclusion**: These findings reveal Tau's dual role: as an antiviral agent and, when phosphorylated by HSV-1 US3, as a contributor to neurodegeneration. Excessive immune responses aiding HSV-1 replication highlight therapeutic targets for neurodegenerative diseases.

### Poster #52

**Title**: Investigating the Role of CTPS1 in Antiviral Immune Responses

**Authors**: Zhenhao An, Chao Qin, Youliang Rao, and Pinghui Feng

**Faculty Advisor**: Pinghui Feng

**Background**: CTP synthase 1 (CTPS1) is a crucial enzyme in pyrimidine biosynthesis, playing a key role in cellular proliferation and viral replication. CTPS1 contributes to viral propagation through two main mechanisms. First, as a regulatory enzyme in pyrimidine biosynthesis, CTPS1 catalyzes the conversion of ATP, UTP, and glutamine into CTP, thereby supporting nucleotide synthesis essential for viral replication. Second, humans possess two isoforms of CTP synthase, *CTPS1* and *CTPS2*, encoded by distinct genes. Recent studies indicate that *CTPS1*, but not *CTPS2*, is essential for cell proliferation, suggesting a unique role in viral infections. **Purpose**: This project aims to elucidate the mechanisms by which CTPS1 modulates antiviral immune responses. Specifically, we will investigate whether viral infections activate CTPS1 to deamidate interferon regulatory factor 3 (IRF3), thereby impairing the host's antiviral defense. **Methods**: The role of CTPS1 in viral replication was assessed using CTPS1-depleted cells. The impact of CTPS1 on antiviral immune responses was evaluated through quantitative real-time PCR (qRT-PCR). In vitro deamidation assays using CTPS1 purified from infected cells were conducted to determine its ability to modify IRF3. **Results**: CTPS1 can promote replication of multiple viruses. Viruses impede antiviral immune response through CTPS1. Virus infection may deamidate IRF3. **Conclusion**: This research could reveal novel insights into how viruses manipulate host metabolic pathways to suppress immune responses, potentially identifying CTPS1 as a therapeutic target for antiviral intervention.

### Poster #53

**Title**: Macrophages Regulate MSC Heterogeneity in Skull Repair: Insights from scRNA-seq

**Authors**: Ziying Lin, Li Ma, Jing Wang, Qing Chang, Supawadee Jariyasakulroj, and Jianfu Chen

**Faculty Advisor**: Jianfu Chen

**Background**: Calvarial sutures connect flat bones of the skull and serve as growth centers. Their development and homeostasis are tightly regulated, which is critical for understanding and treating craniofacial disorders. However, the mechanisms underlying skull injury repair and suture regeneration remain unclear. **Purpose**: To uncover the cellular dynamics and signaling interactions involved in skull injury repair and suture regeneration. **Methods**: We performed single-cell RNA sequencing (scRNA-seq) on regenerating mouse coronal sutures post-suturectomy, followed by RNAScope validation. CellChat analysis was used to investigate cell-cell signaling interactions, and genetic knockout experiments targeting Igf1 in CX3CR1+ macrophages explored specific signaling pathways in the repair process. **Results**: Mesenchymal stem cells (MSCs) were limited in regenerating tissue, while injury induced a marked increase in three macrophage sub-populations with distinct localization. Four sub-clusters of fibroblasts – fibrotic and regenerative – at the wound site were identified as potential progenitors for replenishing lost sutures. Transcriptomic analysis indicated these fibroblasts may arise from ectocranial layers and meninges via a cell state transition resembling suture development. CellChat revealed potential macrophage-MSC interactions via Igf1 signaling post-injury. Genetic knockout of Igf1 in CX3CR1+ macrophages delayed bone generation and mesenchyme formation, impairing skull repair. Igf1 knockout increased Ddr2+ MSCs and decreased Gli1+ MSCs during repair. **Conclusion**: This study provides a comprehensive view of cell dynamics in skull injury repair and highlights how distinct MSC populations differentially respond to Igf1 signaling disruption within macrophages.

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**DENTISTRY & CCMB FACULTY**

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### Poster #54

**Title**: "OCEAN" personality domains representation in a dental cohort

**Authors**: Anita Tourah, Mahvash Navazesh, and Mariela Padilla

**Faculty Advisor**: Mahvash Navazesh and Mariela Padilla

**Background**: Research has shown that personality traits have an impact on the ability of the clinicians to provide care. **Purpose**: This study's goal is to identify the representation of personality traits by the OCEAN domains in a dental cohort. **Methods**: Retrospective study with de-identified data from recorded interviews generated during the admission process is analyzed with an application programming interface and analytic tool. The data is analyzed using descriptive statistics to identify the most common traits. **Results**: Each one of the domains is present in the cohort at different levels. Openness (O) examines the degree to which individuals are curious and innovative with average score of 47.90 (SD of 3.95). Conscientiousness (C) is the degree to which individuals show diligence. The cohort showed an average of 48.59 (SD 5.22) and is the domain with the highest representation. Extraversion (E) examines if individuals have the tendency to be sociable. The cohort shows a score of 44.72 (SD 4.23) and is the domain with the lowest average score. Agreeableness (A) examines the degree to which an individual has the tendency to be friendly. The average score is 47.06 (SD 4.37). Neuroticism (N) examines the degree to which individuals have the tendency to be stable and controlled (the inverse is considered resilience). The average score is 46.97 (SD 4.20). There are three domains with outlier data (C, E and N). When comparing C (highest average) and E (lowest average), there is no statistically significant difference (p>0.05). **Conclusion**: When considering the trait's representation, there are challenges and opportunities that should be addressed, such as ability to give attention to details, engagement in group settings, and taking feedback in a positive manner. More research is needed to validate the use of traits as part of the recruitment metrics and the impact in performance.

**Title**: Stem cell-based organoid models to understand neurodevelopment disorders

**Author**: Lu Wang

**Background**: Learn to cure the pediatric neurodevelopmental disorders. Our lab investigates the cellular and molecular foundations of the developing human brain under conditions of health, stress, and disease. **Purpose**: Modeling the pathogenesis of pediatric neurodevelopmental disorders with brain organoid. Our aim is to expand our knowledge of the cell-cell communication, fate dynamics, and niche homeostatic of the non-neuronal cells, environmental factors in health, and emergency rescue when they are under stress or in disease. **Method**: Patient-derived brain organoids, genomics and genetics. We employ human induced pluripotent stem cell-based organoids, assembloids, induced neurons/neural crest cell models, as well as related animal models (e.g., mouse models). These are combined with advanced genetic/genomics techniques at the functional and single-cell levels. **Results**: Brain organoids precisely recapitulate the pathogenesis of neurodevelopmental disorders at the cellular and molecular levels. **Conclusion**: Neurodevelopmental disorders represent convergent and divergent cellular and molecular events. Ultimately, our collective efforts, alongside those of others in the field, will pave the way for groundbreaking interventions in the realm of pediatric disease.

**Title**: Ten-year Outcomes: Learner-Centered Pedagogy at USC's Ostrow School of Dentistry

**Authors**: Mahvash Navazesh and Xi (Anna) Chen

**Background**: The learner-centered pedagogy inclusive of an integrated curriculum in biomedical, behavioral, and clinical sciences was implemented at the Ostrow School of Dentistry of University of Southern California (OSDUSC) in 2005. Its curricular design,

implementation, and outcomes were initially reported in 2014. **Purpose**: This study further evaluated the outcomes of this pedagogy over ten years through performances from the graduating classes of 2013 through 2022. **Methods**: The four class performance indicators accessed in this study included on-time graduation rate and passing rates of the National Board Dental Examinations (NBDE) Parts I and II, and the Western Regional Examining Board (WREB). The ten class cohorts had a total of 1744 dental students. The study also incorporated student feedback from graduation clearance surveys at the same period. The study received an exempt status from USC IRB review (#UP-23-00828). **Results**: On-time graduation rates from the classes of 2013 through 2022 were between 82% and 97% with an average of 93%. Passing rates of NBDE I ranged from 89% to 100% with an average of 96%. Passing rates of NBDE II and WREB by graduation deadline were 86%-97% and 85%-100%, respectively. Graduation clearance surveys of 1744 students reported positive reviews on their experiences in providing comprehensive patient care (74%-87%) and service learning (88%-93%), and that graduates felt well prepared to enter the practice of dentistry independently (83%-94%). **Conclusion**: The OSDUSC's learner-centered pedagogy proves to be effective in developing competent and confident future healthcare providers in general dentistry.

**Title**: Thirteen-year Review: Triple-Jump Examination at USC's Ostrow School of Dentistry

**Authors**: Mahvash Navazesh, Xi (Anna) Chen, Hannah Schilperoort, Sharon Bautista, and Larry Eisenberg

**Background**: The triple jump examination (TJE) has been instituted at the Ostrow School of Dentistry of the University of Southern California (OSDUSC) since 2001 as an assessment tool of critical thinking skills for its learner-centered pedagogy. A 2013 study detailed the

TJE's design, validity, and initial outcomes. **Purpose**: The current study focused on its thirteen-year sustainability including a transition from in-person to hybrid TJE by assessing outcomes from the graduating Classes of 2014 through 2026. **Methods**: The study was approved by the USC Institutional Review Board (#UP-21-00272-AM001). To assess sustainability, the study first examined agreements among TJE faculty raters based on a total of 10,512 TJEs given to 1,872 students from the thirteen classes. Next, to determine whether the effectiveness of TJE was impacted by the transition from traditional to hybrid TJE, an independent t test was performed to examine student performance between the two exam delivery methods based on 4,896 TJEs given to 864 students. **Results**: The study observed a high level of agreement among faculty raters throughout the study period. The general agreement rates, exact agreement rates, and disagreement rates averaged at 99.2%, 77.3% and 0.8%, respectively. Students' TJE performance were similar between the traditional and hybrid delivery methods ($p$-value = 0.629 > 0.05, t critical two-tail = 2.074, t stat = 0.489). **Conclusion**: The TJE at OSDUSC proves to be a sustainable and reliable instrument with high internal consistency among raters when evaluating students' performance. The transition from traditional to hybrid TJE has no impact on the TJE's effectiveness.

**Title**: All Aboard: Practices to promote diversity, inclusion, equity and belonging (DIEB) in dental schools

**Authors**: Mariela Padilla, Joan Wang, Anita Tourah, Mina Habibian, and Mahvash Navazesh

**Background**: Dental education is challenged to produce a workforce who understands the needs of an increasingly diverse society. **Purpose**: The purpose of this topical review is to identify the practices and strategies being implemented to promote DIEB in dental education. **Methods**: A liter-

ature search was performed using the following keywords: [(Diversity AND/OR Inclusion AND/OR Equity AND/OR Belonging] AND [Dental School OR Dentistry], for publications from 2013 to 2024. For each paper, information about understanding and best practices to promote DIEB in dental education was extracted. **Results**: The authors selected 46 papers that were pertinent to the topic. The concept of diversity has multiple interpretations, including different genders, underrepresented populations, ethnicities, and educational backgrounds. The following strategies were identified in the review: pipeline programs for underrepresented groups; fostering discussions, educational, and clinical experiences that nurture unbiased professionals; to advocate for inclusive policies; to identify and reduce barriers to care to vulnerable populations; and to use data-driven process to analyze the diverse composition of the dental school. **Conclusion**: There are lingering challenges for the implementation of DIEB strategies in dental education, starting with a consolidated set of definitions and a clear understanding of the gaps that require to be addressed. Further research is required to validate the concepts and its application and to assess the impact in oral health provision. Identifying biases and recognizing challenges in the integration of DIEB strategies in the dental education requires to foster and nurture inclusive academic communities.

**Title**: Examining Potential Bias in Student Evaluation of PBL Facilitators' Performance

**Authors**: Nasrin Bahari Chopiuk, Larry Eisenberg, and Mahvash Navazesh

**Background**: Student evaluations of teaching (SET) are influenced by race, gender, ethnicity, and stereotypes in traditional lecture-based pedagogy. Student evaluations are often critical indicators of teaching effectiveness and play a key role in faculty promotion processes. Limited information is available

on how these biases manifest in Problem-Based Learning (PBL), a collaborative and small-group student-centered teaching pedagogy. **Purpose**: This study investigates whether facilitator gender, ethnicity, and years of experience influence SET in PBL settings. It seeks to address gaps in the literature by exploring if these factors impact teaching assessments within this distinct pedagogical framework. **Method**: A retrospective analysis was conducted on 64,046 evaluations of PBL facilitators from 2009 to 2023. The dataset included 108 male facilitators (32,205 evaluations) and 82 female facilitators (31,841 evaluations). Two-way ANOVA was performed to examine the effects of facilitator gender, ethnicity, and years of experience, alongside potential interactions with student gender, on evaluation scores. **Results**: Male facilitators were rated significantly higher for case facilitation compared to female facilitators ($p < 0.0014$), indicating a potential gender bias. No significant differences were observed in ratings across ethnic backgrounds. Facilitators with 11-20 years of experience received significantly lower ratings than those with 5 years or less, 6-10 years, or 20 or more years of experience. **Conclusion**: These findings highlight potential gender bias in PBL teaching evaluations while showing no significant ethnic bias. Further research will examine factors such as student ethnicity and generational differences to better understand evaluation dynamics and improve equity in assessment practices.

**Title**: PBL Facilitator Calibration through Vignette-Based Workshops

**Authors**: Nasrin Bahari Chopiuk, Margarita Zeichner-David, and Amy Merrill-Brugger

**Background**: Faculty development is essential for maintaining high-quality teaching, traditionally focusing on PBL principles through observation or practice. With the increasing reliance on Zoom-based PBL at HOSD, innovative methods are needed to address emerging facilitation challenges. Developing real-world scenarios can enhance faculty engagement,

decision-making, and instructional strategies, improving virtual classroom effectiveness. **Purpose**: This study aims to develop real-world scenarios that actively engage faculty in Zoom-based PBL sessions. The goal is to foster innovative solutions to emerging challenges while addressing the need for creative approaches to faculty development and calibration. **Methods**: Three vignette-based scenarios, each presenting a facilitation challenge around a common theme, were developed for a faculty development workshop. More than 30 Biomedical Sciences faculty members participated via Zoom. Faculty were randomly assigned to three groups and placed in breakout rooms to discuss potential solutions for an assigned scenario over 15 minutes. After each discussion, groups rotated to a new scenario, repeating the process. Following the breakout sessions, all participants reconvened to share insights and collaboratively develop short- and long-term strategies for addressing facilitation challenges. **Results**: Participants completed a post-workshop survey assessing their experience, expectations, clarity, and workshop format. Results indicated overwhelmingly positive feedback, with an average satisfaction score of 4.92/5 on the Likert scale for overall workshop experience and 4.67/5 for all other survey questions. **Conclusion**: This workshop marked the first in a series aimed at developing vignette-based, real-world facilitator challenge scenarios for faculty development and calibration at HOSD. Future analyses will include a comprehensive statistical evaluation of survey responses using SPSS to further assess the workshop's effectiveness and impact.

## DENTISTRY & CCMB AFFILIATES

**Title**: Dormancy of *Aggregatibacter actinomycetemcomitans*: Survival during Famine

**Authors**: Bryant Tran, Natalia Tjokro, and Casey Chen

**Faculty Advisor**: Casey Chen

**Background**: Microbes often face nutrient starvation in natural environments and may enter dormancy for survival. *Aggregatibacter actinomycetemcomitans* (*Aa*) is an oral pathogen that may establish long-term colonization in periodontal pockets via dormancy. Dormant cells exhibit low metabolic activity, distinct gene expression, and extended viability. Upon return of favorable conditions, they resume metabolism and exit dormancy. **Purpose**: This study aimed to characterize *Aa* dormancy in vitro and characterize its phenotypes and essential genes. **Methods**: We tested the growth of a clinical isolate strain D7S1 (4 biological replicates) in nutrient-deficient (ND) and nutrient-limited (NL) media, developed based on chemically-defined medium (CDM), with nutrient-enriched (NE) trypticase soy broth-based medium as the control. Metabolic activity was assessed using Alamar Blue assays. **Results**: *Aa* survived more than 100 days in ND and NL media without fresh media supplementation, while it became uncultivable in NE medium by day 7. On day 56, *Aa* viability in ND and NL was 1000-fold higher than in NE media (average CFU= $3.6 \times 10^3$ for ND, $1.0 \times 10^3$ for NL, less than $5.0 \times 10^1$ for NE). When dormant and non-growing *Aa* was transferred to NE medium after 28 days of dormancy, it was rescued and resumed growth, with metabolic activity increasing by over 10-fold. Whole genome sequencing of 44 individual colonies from ND and NL media on days 0, 14, 28, 108, 147 revealed no confirmed mutations associated with the phenotype. **Conclusion**: *Aa* exhibited a phenotype resembling dormancy in ND and NL media, characterized by extended viability and low metabolic activities that could be reversed in NE medium.

**Title**: Achieving Compliance and Excellence in Distance Learning

**Authors**: David Goldizen, Gina Ianelli, Paul Frellick,

Glenn Clark, and Anette Vistoso Monreal

**Faculty Advisor**: Anette Vistoso Monreal

**Background**: The evolution of higher education, particularly during the COVID-19 pandemic, has emphasized the need for rigorous compliance in distance learning programs. The Orofacial Pain and Oral Medicine (OFPOM) Master and Certificate programs at the Ostrow School of Dentistry, USC, faced the challenge of aligning its curriculum with both USC guidelines and U.S. Department of Education (USDE) standards for credit hours and instructional quality. **Purpose**: This study aimed to evaluate the OFPOM program's adherence to compliance standards, ensuring regular and substantive interaction between instructors and students while maintaining functional equivalency to traditional in-person education. **Methods**: A comprehensive analysis of the OFPOM program was conducted, focusing on compliance with USDE regulations, including credit hour definitions, instructional methodologies, and accreditation criteria. The study assessed asynchronous recorded lectures, faculty-moderated online forums, and live Zoom sessions, alongside institutional policies for course design and implementation. **Results**: The OFPOM program met and exceeded USDE and USC compliance standards by delivering structured, high-quality online education. Key strategies included faculty-driven content delivery, integration of flexible asynchronous and synchronous learning modes, and adherence to the functional equivalency of in-person instruction. Regular interaction was facilitated through moderated discussions and real-time sessions, supporting academic excellence and professional development. **Conclusion**: The OFPOM programs exemplifies a model for rigorous compliance in online education, showcasing how distance learning can maintain educational integrity while meeting regulatory standards. This framework offers a scalable approach for similar programs seeking to balance flexibility

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with quality assurance in professional education.

**Title**: FaceBase3: Craniofacial Development and Dysmorphology Data Management and Integration

**Authors**: Ishmael Howard, Thach-Vu Ho, Robert Schuler, Cristina Williams, Bridget Samuels, Yuan Yuan, Joseph Hacia, Carl Kesselman, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: The major goal of the FaceBase Consortium is to advance research by creating a comprehensive repository of datasets on craniofacial development and dysmorphologies, and disseminating these datasets to the research community. **Purpose**: The FaceBase3 Data Management and Integration Hub builds on the existing and successful scientific and technical team that has led the development, deployment, operation and community engagement of the FaceBase 2 data hub. Looking forward to the future impact of the FaceBase Consortium, we face major challenges that include (1) how to annotate large datasets to empower the biomedical research community; (2) how to improve data integration and facilitate data search and retrieval from the hub; (3) how to use the data from FaceBase to design studies and otherwise inform our future research; and (4) how to translate our knowledge from animal model studies to improve human craniofacial health. **Methods**: FaceBase provides innovative tools for the identification, retrieval, display, curation, and analysis of data on human and animal models of craniofacial development and disease. **Results**: FaceBase currently includes over 950 datasets from human, zebrafish, mouse, and chimpanzee. Alongside these models, chick and xenopus data represent priorities. We are also expanding our data repository to include morphological and functional data on tooth development. **Conclusion**: FaceBase seeks to provide a comprehensive, trustworthy data repository and educational resource on craniofacial development, through ensuring that contributed datasets are findable, accessible, interoperable, and reusable. FaceBase promotes multidisciplinary collaboration and research in craniofacial development, molecular genetics and genomics.

**Title**: Rabbit Calvarial Bone Regeneration Using a 3D-printed Scaffold

**Authors**: Jesse Anderson-Ramirez, Janet Sanchez, Zoe Johnson, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Head trauma, congenital defects, disease, and tumor resection can leave patients with large, full thickness calvarial defects that are incapable of healing on their own. These critical-sized defects (CSDs) are currently repaired using inferior metal or plastic implants. Bone grafting causes additional trauma to the body which should be avoided if possible. There is a significant need for improved treatment of calvarial CSDs. **Purpose**: In this study we used bone marrow aspirate (BMA) to regenerate bone in two bilateral circular calvarial CSDs. **Methods**: BMA was collected from the rabbit's tibial crest. Two bilateral 1 cm circular defects were made in the calvaria. The MSCs were combined with 3D-printed osteoconductive scaffolds of hydroxyapatite and tricalcium phosphate (HA/TCP) and placed into the defect sites. **Results**: We have defined a critical size regular defect model in the rabbit calvaria as 1 cm over a 12-week timepoint. MSCs combined with our 3D-printed scaffold successfully regenerated complex cortical bone that integrated with native bone in this model. Density, compression, and trabecular analyses indicated the regenerated bone was of good quality and sound structure compared to native bone. **Conclusion**: We have successfully regenerated cortical bone in the rabbit calvaria using BMA combined with an osteoconductive 3D-printed scaffold. This represents a unique opportunity to utilize MSC-mediated tissue regeneration in improving care for human patients with calvarial CSDs.

**Title**: Role of Lgr5 in Ankyloglossia: Insights into Tongue Tissue Development

**Authors**: Monica Rodriguez and Amy Merrill

**Faculty Advisor**: Amy Merrill

**Background**: Ankyloglossia, or tongue-tie, is a congenital condition affecting 4.2-10.7% of neonates, characterized by restricted tongue mobility due to abnormal connective tissue attachments. This anatomical abnormality can significantly impair critical oral functions, including breastfeeding, speech articulation, and oral hygiene. Previous research has shown that loss of Lgr5 in mice induces ankyloglossia, suggesting a crucial role in Lgr5 in tongue development. However, the role of Lgr5 in connective tissue/tongue development remains unknown. **Purpose**: This study aims to investigate the role of Lgr5 in tongue connective tissue development. **Methods**: Genetic lineage tracing at early embryonic stages in *Lgr5CreERT;tdTomato* mice reveal low expression of tdTomato and GFP in the connective tissue surrounding the tongue. **Results**: Preliminary histological analysis comparing wild-type (WT) and *Lgr5* null mice shows that pentachrome staining of WT tongue tissue at postnatal day 0 demonstrates well-organized intrinsic and extrinsic muscle fibers, a homogenous distribution of connective tissue, and appropriately stratified lingual epithelium. Ongoing studies aim to characterize the phenotypic differences between Lgr5 null and heterozygous samples to better define the role of *Lgr5* in tongue development, particularly in relation to ankyloglossia. **Conclusion**: This research provides novel insights into the functional role of Lgr5 in the tongue connective tissue, potentially guiding future therapeutic approaches for ankyloglossia by elucidating how Lgr5 contributes to connective tissue changes in tongue development.

**Title**: Analyzing palatal development in *Wnt1-Cre;Alk5^{f/f}* mice

**Authors**: Mst Samiha Siddik, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: The *Alk5^{f/f}* gene, also known as the TGF-β receptor type I gene, works as a crucial TGF-β signaling pathway to regulate the midline epithelial seam (MES)/palatal shelf fusion and development. The lack of or over-expression of *Alk5^{f/f}* can cause disruption in cell signaling that leads to impaired palatal formation. **Purpose**: This research aims to investigate the abnormalities in palatal development caused by the *Alk5^{f/f}* gene, which may potentially lead to cleft lip/palate deformities. **Methods**: One major technique used was genotyping. Here, we compared the wildtype to control by extracting DNA from the tails of *Wnt1-Cre* mice, which were bred to produce *Wnt1-Cre;Alk5^{f/f}* mutant mice. Using microCT data from FaceBase, we evaluated the *Wnt1-Cre;Alk5^{f/f}* mouse models in the P0 stage and compared findings to those from E18.5, measuring differences in key bone structures (palatine, premaxilla, mandible, frontal) in both hard and soft tissue scans. We collected mouse heads fixed and decalcified in Decalcifier I. We dehydrated them using the Spin Tissue Processor. After embedding in wax, each embryonic tissue was thinly sectioned to 0.7 μm on slides. We used histology and immunofluorescence for further analysis. **Results**: Micro CT scans and histological imaging revealed how wildtype with the crossed over *Wnt1-Cre;Alk5^{f/f}* gene has significantly smaller/defected bone structures in the palatine bones and malformations in the jaw structure of craniofacial tissues. **Conclusion**: The goal behind the study of the *Alk5^{f/f}* gene is to advance the understanding of craniofacial developmental biology in relation to cellular signaling pathways for promising treatment alternatives.

**Title**: Molecular Mechanisms of Fusion of the Intersphenoid Synchondrosis in BBDS

**Authors**: Sebastian Ko, Audrey Nickle, and Amy Merrill

**Faculty Advisor**: Amy Merrill

**Background**: The synchondroses of the cranial base play a pivotal role as growth centers for the skull during early development. Premature fusion of the synchondroses contributes to midface hypoplasia in syndromic craniosynostosis. Bent Bone Dysplasia Syndrome (BBDS), which is caused by missense mutations in the transmembrane domain of FGFR2, is characterized by craniosynostosis, craniofacial dysmorphia, thickened periosteum, and bent long bones. **Purpose**: The goal of this study is to identify key molecular mechanisms contributing to premature fusion of the intersphenoid synchondrosis in BBDS. **Methods**: The Wnt1-Cre2 transgenic mouse was used to drive the FGFR2-M391R mutation in cranial neural crest cells. Samples were then processed for whole mount and in section histological staining. The intersphenoid synchondrosis was dissected for RNA bulk sequencing. In situ hybridization was used to validate RNA sequencing results. **Results**: Histological sections showed that fusion of the synchondrosis begins around postnatal day 6 and is in part due to formation of ectopic bone and thickening of the perichondrium. As the phenotype progresses, expressional changes drive differentiation of chondrocytes within the growth plate-like cartilage of the synchondrosis. RNA-sequencing shows upregulation of the IL6 signaling pathway. Immunofluorescent staining shows increases in phosphorylation of STAT3 further validating changes in IL6 signaling. **Conclusion**: This work implicates a role for FGFR2 in regulation of chondrocyte maturation within the synchondrosis of the cranial base. Further research will better resolve key molecular regulators affected by mutation of FGFR2.

**Title**: Topical Imiquimod for Oral Dysplastic Lesions

**Authors**: Shermineh Roshan, Yuyueyang Qiu, Parish Sedghizadeh, and Anette Vistoso Monreal

**Faculty Advisor**: Anette Vistoso Monreal

**Background**: Oral cavity cancer, primarily Oral Squamous Cell Carcinoma (OSCC), is a significant public health issue, with over 54,000 new cases projected in the U.S. in 2024. OSCC often originates from Oral Leukoplakia (OL), a potentially malignant disorder affecting 4.11% of the global population. OL's progression to malignancy remains inadequately addressed due to the lack of consensus on treatment guidelines, particularly for oral epithelial dysplasia. **Purpose**: This study aims to evaluate the efficacy of 5% imiquimod cream as a non-invasive treatment for biopsy-proven oral epithelial dysplasia. Imiquimod's antitumor properties make it a promising alternative to surgical interventions. **Methods**: Literature review for establishment of protocol: Participants with oral dysplastic lesions unsuitable for surgery or laser therapy will apply 5% imiquimod cream daily for one hour, five days per week, over seven weeks. Clinical and histological changes in lesions will be assessed through regular follow-ups, photographs, and biopsies. Side effects will be monitored and managed to ensure safety. **Results**: Preliminary research has shown imiquimod's potential to reduce or resolve dysplastic lesions. This expanded study will systematically evaluate its clinical efficacy, histological impact, and tolerability. **Conclusion**: Imiquimod cream offers a non-invasive treatment alternative for patients with pre-cancerous oral lesions, reducing the need for surgical intervention. If successful, this approach could transform the management of oral epithelial dysplasia, mitigating its progression to OSCC.

**Title**: Reprogramming of Fibroblasts by HPV+ Oropharyngeal Cancer Cells

**Authors**: Shu-Yun Cheng, Liyang Tang, Daniel Kwon, Mark Swanson, Niels Kokot, Uttam Sinha, Yang Chai, and Albert Han

**Faculty Advisor**: Albert Han

**Background**: Head and neck squamous cell carcinoma (HNSCC) is the sixth most common cancer worldwide. Therapeutic resistance in HNSCC is often driven by interactions between tumor cells and the tumor microenvironment (TME). Cancer-associated fibroblasts (CAFs) are key players in the TME, contributing to therapeutic resistance and poor prognosis through the secretion cytokines and by promoting epithelial-mesenchymal transition (EMT) in tumor cells. Despite their significance, the origin and conversion of normal fibroblasts (NF) into CAFs remains unclear. **Purpose**: We hypothesize that cancer cells can reprogram the cellular phenotype of normal tonsillar fibroblasts to a pro-inflammatory state. **Methods**: Patient-derived NF were obtained and co-cultured with UM-SCC-47, an HPV-16 positive HNSCC cell line. The cells were co-cultured at a 1:1 ratio and enriched via FACS. After enrichment, the cells were analyzed for the expression of epithelial markers, mesenchymal markers, cytokines, and membrane receptors using qPCR. **Results**: NF co-cultured with UM-SCC-47 cells exhibited gene expression changes indicative of CAF phenotypes. qPCR analysis revealed an upregulation of CD29 and CAV1, markers associated with inflammatory CAFs (iCAFs), alongside a downregulation of α-SMA ($[FC] = 0.77$; $p < 0.004$). These alterations suggest that UM-SCC-47 cancer cells can reprogram NF into iCAF phenotype, thereby promoting cancer progression. **Conclusion**: Our study shows that UM-SCC-47 cancer cells convert normal fibroblasts (NF) into iCAFs by upregulating CD29 and CAV1, and downregulating α-SMA. This promotes EMT and contributes to therapeutic resistance in HNSCC. Future research will focus on the mechanisms of CAF development from NF.

**Title**: Educational Materials for Oral Health Care in Older Adults

**Authors**: Silvina Rajschmir, Piedad Suarez-Durall, and Reyes Enciso

**Faculty Advisor**: Reyes Enciso and Piedad Suarez-Durall

**Background**: Herman Ostrow School of Dentistry (USC) is actively involved in interdisciplinary care for geriatric patients, recognizing the unique oral health challenges faced by this population. **Purpose**: To develop educational materials about oral health and prevention of diseases targeting older adults and their caregivers in clinics, nursing homes, and older adults' day care centers. **Methods**: One resident of the Masters in Geriatric dentistry and her mentors, searched the literature (PubMed and other dental associations) on different topics relevant to geriatric dentistry, such as oral health interventions for older adult patients with systemic diseases, the impact of medications on oral health, periodontal disease and caries prevention, as well as fall prevention. **Results**: Two educational materials were the product of this capstone project. The first was one video educating older adults about preventive visits to the dentist, caries and periodontal disease prevention and oral care. The second educational material was a handout for older adults and caregivers in oral health prevention and education about oral diseases associated with systemic conditions, as well as care for dentures, oral cancer and fall prevention. **Conclusion**: Multiple learning resources are available for older adults about their oral health, however, looking for a handout to find practical, evidence-based information is challenging. The evidence-based handout (outcome of this capstone project) contains most of the information an older adult and caregivers may need in one convenient colorful format that can be used at the waiting area of a medical/dental clinic or as an educational material to be sent via mail or email.

**Abstracts**

**Title**: Role of Tgfbr2 in craniofacial development in mice

**Authors**: Sofia Najarro, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Tgfbr2 is vital in TGF-β signaling which plays a pivotal role in craniofacial development. **Purpose**: Specifically, lack of Tgfbr2 is shown to have cleft palates either syndromic or nonsyndromic through diseases such as DiGeorge Syndrome. **Methods**: We performed genotyping using PCR to confirm that there was a deletion of Tgfbr2 in *Wnt1-Cre;Tgfbr2$^{fl/fl}$* mice. After confirming we dissected the mouse embryonic head to create paraffin samples which were then cut into strips of 0.7 μm using a microtome. We analyze the sections using histology and immunofluorescence. Additionally, the use of MicroCT analysis to examine specific bones related to the craniofacial region such as: Premaxilla, Mandible, Frontal Bone, and Palatine Bone. These bones are then compared to the control mice in specific measurements. **Results**: We found that the mutant mice were significantly smaller than the control mice in the measurements. Histology and immunofluorescent analyses also showed defects in the craniofacial regions with mice having cleft palates, suggesting Tgfbr2 is critical for craniofacial development. **Conclusion**: The study of Tgfbr2 is not limited to just craniofacial development but also palate development. Using this work may provide insight to how Tgfbr2 works in both craniofacial and palate development and the importance of it may help syndromic or nonsyndromic diseases.

**Title**: ETS1-overexpression is associated with decreased CD8$^+$ T-cell infiltration in HNSCC

**Authors**: Talia A. Wenger, Chehyun Nam, Benjamin Ziman, Uttam K. Sinha, and Dechen Lin

**Faculty Advisor**: Dechen Lin

and Uttam Sinha

**Background**: Head and neck squamous cell carcinoma (HNSCC) is the sixth most common cancer worldwide. A major clinical challenge of HNSCC is its high propensity for metastasis. E26 Transformation-Specific 1 (ETS1) is a transcription factor with a known role in metastasis and invasion in HNSCC. Metastatic cells in SCC are known to have immunosuppressive effects, allowing for escape from the innate immune system. **Purpose**: In analysis of single-cell RNA-sequencing data, ETS1 was identified to modulate various immune pathways. We sought to understand how ETS1 alters immune infiltration of the tumor microenvironment in HNSCC. **Methods**: C57BL/6 mice received orthotopic buccal injections of murine oral SCC (MOC2) control or MOC2-ETS1-overexpression cells. Mice were observed for tumor growth and tumor-associated morbidity. Tumors and lymph nodes were collected and immune cell populations analyzed by flow cytometry and immunohistochemistry. **Results**: Mice with ETS1-overexpression tumors had significantly faster tumor growth and poorer survival compared to control. Flow cytometry and immunohistochemistry revealed that ETS1-overexpression tumors had significantly decreased CD8$^+$ and CD4$^+$ T cell infiltration compared to control tumors. **Conclusion**: ETS1-overexpression is associated with decreased infiltration by cytotoxic T cells in the HNSCC tumor microenvironment, which may contribute to tumorigenesis and invasion. Further, as immunotherapy relies upon a population of exhausted T cells that can be reinvigorated to fight cancer, ETS1-overexpression may be prognostic of poor response to immunotherapy.

**Title**: Training the Next Generation of Researchers in Developmental Biology

**Authors**: Thach-Vu Ho, Jesse Anderson-Ramirez, Ishmael Howard, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Comprehensive datasets available through FaceBase can be used to train high school students on craniofacial development. Student applicants at USC's Science, Technology, and Research (STAR) program were selected to participate in hands-on research in Dr. Yang Chai's laboratory at USC. **Purpose**: The aim is to train students in STEM research. **Methods**: Students used microCT datasets deposited into FaceBase to perform morphometric analyses of craniofacial bones as part of their training. They used established anatomical landmarks to analyze the size and shape of the craniofacial bones quantitatively. They also learn laboratory techniques, including genotyping, animal handling, and biochemical assays. **Results**: At the end of the program, students presented their research posters at a research symposium at USC. High school students who completed the STAR program have received academic scholarships and attended top-tier colleges and research institutions. **Conclusion**: The STAR program is a model for training STEM students in craniofacial development.

**Title**: Dental varnishes to prevent caries in older adults: Systematic Review

**Authors**: Theresa Cleary, Enas Rostom, Reyes Enciso, and Roseann Mulligan

**Faculty Advisor**: Roseann Mulligan

**Background**: Older adults are at higher risk of root caries due to recession and hyposalivary function. **Purpose**: To evaluate the efficacy of dental varnishes/gels in the prevention/management of dental caries in older adults. **Methods**: Four databases were searched (PubMed, Web of Science, Cochrane and EMBASE) through 04/2024. Only Randomized Controlled Trials (RCTs) involving either patients≥60 years of age or having an average age ≥60 were included. Outcomes included incidence of caries and clinical parameters measuring progression/reversal of lesions. **Results**: Out of 112 abstracts reviewed, 10 RCTs at unclear/high risk of bias were included. Significant findings included one study favorable to 1% chlorhexidine & 1% thymol over placebo (p<0.05) while another RCT study demonstrated that 5% NaF varnish or 5000ppm F$^-$ toothpaste significantly improved caries status compared to 1450ppm F$^-$ toothpaste. There were no significant differences between 1% chlorhexidine, 5% NaF or a placebo varnish in another study, in which all participants received a professional cleaning and educational session at each varnish application. A final study reviewed showed that 38% SDF solution, 1% chlorhexidine varnish or 5% NaF varnish were more effective than just oral hygiene instructions. **Conclusion**: Due to the heterogeneity of the outcomes and unclear/high risk of bias, the quality of the evidence was low/moderate. Most studies showed no significant differences among treatment groups but highlighted the benefits of professional preventive treatments or high fluoride prescription-strength toothpaste in preventing and controlling root caries progression. More research is needed in this area to study the true effect of office-applied varnishes.

**Title**: Metabolic Profiling of HNSCC Tumor Microenvironment Using single-cell Multi-Omic Analysis

**Authors**: Thomas Tilton*, Tianming Zhou*, Chao Qin, Zhixuan Jing, Hua Zhao, Pinghui Feng, and Dechen Lin (*Equal contribution)

**Faculty Advisor**: Dechen Lin

**Background**: Cells within a tumor microenvironment (TME) undergo significant metabolic changes to support survival and proliferation of cancer. Cancer cells have higher energetic and biosynthetic demands than normal cells, such as higher glucose metabolism. The cells within the TME, including endothelial, fibroblast, immune, and cancer epithelial cells, communicate partly through metabolites and regulate each other's metabolic pathways in response to new

nutrient demands. Metabolic changes of non-cancer cells are much less studied but essential contributors to cancer progression. For example, cancer-associated-fibroblasts upregulate arachidonic acid metabolism and promote Head and Neck Squamous Cell Carcinoma (HNSCC) through leukotriene release. **Purpose**: This study utilizes organoid data and a large cohort of HNSCC metabolomic and single-cell transcriptomic data to metabolically profile cells within the TME and identify therapeutic targets. **Methods**: We have performed metabolomic analysis using liquid chromatography-mass spectrometry (LC-MS) on 4 paired tumor/normal patient tissues. We are conducting bioinformatic analysis and GSVA on 114 HNSCC samples of paired single-cell RNA sequencing and clinical data. **Results**: Metabolomic analysis showed increased glycolysis (Warburg Effect), glutamine metabolism, lipid metabolism reprogramming, and elevated Pentose Phosphate Pathway (PPP) activity. GSVA and bioinformatic analyses revealed the metabolic changes of cells as they progress from normal to pre-cancer to tumor microenvironments. Additionally, we metabolically compared the TME of HPV positive and negative cases. **Conclusion**: Our results demonstrate how different cell types metabolically adapt to support the TME of HNSCC, revealing metabolic biomarkers of HNSCC stage and progression, differences between HPV positive and negative cases, and therapeutic targets.

### Poster #76

**Title**: Bridging the Research Valley of Death through C-DOCTOR

**Authors**: VyVy Nguyen, Bridget Samuels, Scott Fraser, Kevin Healy, Michael Jamieson, Nancy Lane, Michael Longaker, Jeffrey Lotz, Uttam Sinha, Mark Urata, Benjamin Wu, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: The Center for Dental, Oral and Craniofacial Tissue and Organ Regeneration (C-DOCTOR) (DOCTRC) is an NIH/NIDCR-supported consortium focused on bridging the research "valley of death" between basic discovery research and

clinical adoption. **Purpose**: C-DOCTOR aims to accelerate the clinical translation of promising tissue engineering/regenerative medicine therapies for dental, oral, and craniofacial (DOC) tissues and organs lost to congenital disorders, traumatic injuries, diseases, and medical procedures. **Methods**: C-DOCTOR maintains a portfolio of projects that have been selected based on their significance in addressing unmet clinical needs in DOC fields. C-DOCTOR provides the necessary clinical, scientific, technical, regulatory, financial, business-oriented, and managerial resources to support our projects to complete preclinical, IND/IDE-enabling activities in preparation of Phase I clinical trials. Through regular, quarterly evaluation of progress toward milestones, C-DOCTOR de-risks these projects and prepares them for successful interactions with the FDA. **Results**: Currently, C-DOCTOR supports 8 projects. Two teams have submitted an IND to the FDA; three teams are likely to submit the IDE/IND application by April 2025. The remaining teams continue preclinical development of their technologies/therapies. C-DOCTOR continues to provide support to our project teams to adequately de-risk their technologies with the goal of reaching human clinical trials. **Conclusion**: Through the successful IND/IDE submission to date and with more anticipated within the next year, C-DOCTOR aims to improve and sustain its effective model as a national resource that bridges the gap from academic/early-stage research to human clinical trials and adoption. C-DOCTOR aims to improve and sustain its effective model.

### Poster #77

**Title**: A Comparative Study of Metabolomic and Proteomic Profiles in Periodontitis

**Authors**: Wen Fu, Mirali Pandya, Deng Hanfrey, Kim Jinnu, Sydney Kidd, Natalia Tjokro, Chao Qin, Kian Kar, Casey Chen, and Pinghui Feng

**Faculty Advisor**: Pinghui Feng and Casey Chen

**Background**: Periodontitis is a chronic inflammatory disease driven by an imbalance in the oral microbiota and dysregulated host immune responses, leading to local tissue destruction. Although its clinical manifestations, such as periodontal tissue loss and tooth mobility, are well-documented, the molecular mechanisms underlying these changes remain incompletely understood. **Purpose**: By comparing the metabolic and proteomic profiles of healthy individuals and periodontitis patients, we aim to uncover the molecular mechanisms underlying periodontitis progression. **Methods**: Clinical samples were collected from both healthy individuals and periodontitis patients, including gingival tissues and periodontal pocket samples. Metabolic and proteomic profiling was performed using mass spectrometry (MS). The resulting metabolic and proteomic data were analysed. **Results**: At the protein level, pathways related to amino acid metabolism were significantly altered, with upregulation of tyrosine metabolism, arginine biosynthesis, and beta-alanine metabolism. Consistent with the proteomic changes, metabolomic profiling identified 18 significantly altered metabolites, including 12 downregulated and 6 upregulated species. The most prominent changes were observed in amino acid metabolism, with significant decreases in serine, asparagine and alanine. Our analysis identified viral proteins from Human herpesvirus 8 (KSHV), Human herpesvirus 1(HSV-1), and Human immunodeficiency virus type 1 (HIV-1) exclusively in periodontitis patients, while no viral proteins were detected in healthy controls. **Conclusion**: The integration of metabolic and proteomic data demonstrated a strong connection between altered amino acid metabolism and changes in immune-related proteins. The presence of viral proteins suggests a potential involvement of viral infections in the pathogenesis of periodontitis.

### Poster #78

**Title**: Single-cell Analysis Reveals Tumor Heterogeneity in Head and Neck Cancer

**Authors**: Zhixuan Jing*, Youngmin Park*, Thomas Tilton, and Dechen Lin (*Equal contribution)

**Faculty Advisor**: Dechen Lin

**Background**: Head and neck squamous cell carcinoma (HNSCC) is a highly heterogeneous malignancy characterized by significant cellular diversity and complex tumor microenvironments (TMEs). **Purpose**: The full extent of the heterogeneity within the TME remains poorly understood. This study focuses on finding patterns of cellular activities and pathways that lead to heterogeneity. **Methods**: We leveraged a robust dataset comprising five integrated cohorts (four external and one internal), which included 645,356 cells categorized into 62 cell subtypes across six tissue types from 167 patient samples. We examined specific pathway activity through Gene Set Enrichment Analysis (GSEA) and Gene Set Variation Analysis (GSVA). We also used the ratio of observation vs. expectation (Ro/e) to highlight the enrichment of particular cell types in cancer tissues. **Results**: We discovered a notable enrichment of exhausted T cells within tumor tissues, indicating a potential role in immune evasion. Additionally, the Ro/e heatmap highlighted the high expression levels of endothelial cells in lymph node tissues, suggesting possible interactions between endothelial cells and the metastatic process. In CD8+ T cells, gene correlation analysis identified the negative correlation of ETS1 and CD8T_MKI67, suggesting some possible regulatory effects of ETS1 in cancer. **Conclusion**: This study shed light on the heterogeneity of intratumor activity and tumor microenvironment with key genes and specific pathways, providing further insights into the molecular mechanisms shaping the TME in HNSCC.

### DENTISTRY & CCMB POST-DOCTORAL TRAINEES

### Poster #79

**Title**: CAD shows a neuroprotective effect in NAMPT

deamidation pathway

**Authors**: Bingbing Li, Yu Zhou, and Pinghui Feng

**Faculty Advisor**: Pinghui Feng

**Background**: Neurodegenerative diseases have a rising prevalence, particularly with aging populations. Despite extensive research efforts in neurodegenerative disease treatment, significant progress remains limited, partially due to the uncovering complex pathogenesis, involving protein misfolding, neuroinflammation, mitochondrial dysfunction, and genetic factors. Nicotinamide adenine dinucleotide ($NAD^+$) plays a key role in energy metabolism, DNA repair and cell survival. $NAD^+$ and its essential enzyme nicotinamide phosphoribosyl transferase (NAMPT) shows a significantly decrease trend in aging brain, causing an energy deficit in neuronal cells. Carbamoyl-phosphate synthetase 2, aspartate transcarbamylase, and dihydroorotase (CAD), the first, rate-limiting enzyme in *de novo* pyrimidine biosynthesis, could regulate protein stability and function in a deamidation way. **Purpose**: To investigate whether CAD deamidates NAMPT and results in a change in $NAD^+$ level, and whether this deamidation affects neurodegenerative disease and to figure out the deamidation site and design CAD small molecule inhibitors. **Method**: Two-dimensional gel electrophoresis was used to test NAMPT deamidation in aging mice brain and 5xFAD aging mice model. We confirm the role of CAD in NAMPT deamidation by depleting and overexpression CAD and *in vitro* assay. We confirm the neuroprotective effect in aging mice model with behavior test and brain immunostaining. **Results**: CAD could deamidate NAMPT at N285/Q268 sites, and improving neurodegeneration process in both *in vitro* and *in vivo* analysis, this process was reversed in CAD knockout aging mice and CAD inhibitor intervention aging mice. **Conclusion**: These results highlight the important role of CAD in neurodegeneration, provides a new potential pathogenic mechanism for neurodegenerative diseas-

es. Small molecule inhibitors targeting CAD have shown promising effects in improving neurodegenerative diseases in animal models.

**Title**: The MLL3/GRHL2 Complex modulates early malignant development and anti-tumor immunity

**Authors**: Chehyun Nam, Guowei Huang, Yueyuan Zheng, Hua Zhao, Ethan Yuhao Pan, Boyan Hu, Hieu Van, Liyan Xu, En-min Li, H. Phillip Koeffler, Kai Ge, Yali Dou, Uttam K. Sinha, Young Min Park, and Dechen Lin

**Faculty Advisor**: Dechen Lin

**Background**: Upper aerodigestive squamous cell carcinoma (UASCC), including head and neck squamous cell carcinoma (HNSCC) and esophageal squamous cell carcinoma (ESCC), poses substantial challenges in clinical care due to its aggressive behavior and poorly understood mechanisms of early malignant transformation. **Purpose**: This study investigates the role of MLL3 mutations as critical, clonal genomic events driving UASCC tumorigenesis. **Methods**: We utilized organoid models, syngeneic mouse models. flow cytometry assay, ELISA assay, and immune checkpoint blockade (ICB) therapy **Results**: We demonstrate that MLL3 loss facilitates early squamous neoplastic evolution. Additionally, we uncover an MLL3/GRHL2 protein complex that orchestrates epigenomic regulation, particularly influencing immune-related pathways. Strikingly, we identify a novel MLL3/GRHL2-IRF1 axis that induces the expression of Th1 chemokines, such as CXCL9 and CXCL10, enhancing anti-tumor immunity by promoting T cell infiltration within the tumor microenvironment. In syngeneic mouse models, MLL3 was shown to modulate the efficacy of immune checkpoint blockade (ICB) therapy. Consistently, clinical data from human patients demonstrate a robust correlation between MLL3 expression and responsiveness to ICB therapy. **Conclusion**: This study underscores the pivotal role of

MLL3 in UASCC pathogenesis and highlights the therapeutic potential of targeting the MLL3/GRHL2-mediated immune response pathways to improve outcomes in UASCC treatment.

**Title**: Ameloblastin amphipathic helix mutation inhibits ameloblast polarization and matrix secretion

**Authors**: Gayathri Visakan, Marziyeh Aghazadeh, and Janet Moradian-Oldak

**Faculty Advisor**: Janet Moradian-Oldak

**Background**: Ameloblastin promotes the elongation and polarization of ameloblasts in 3D culture. A cell binding amphipathic helix (AH) motif in Ambn is evolutionarily correlated with the emergence of prismatic enamel. Mutant mouse lines that delete either the polar ($Ambn^{\Delta K74-L79}$) or the hydrophobic amino acids ($Ambn^{\Delta L76-P86}$) within the AH motif were generated. Enamel of both mutant lines was hypomineralized with defects in prism organization. **Purpose**: To investigate the effect of Ambn AH motif mutations on ameloblast polarization and enamel matrix organization using 3D cell culture and genetically engineered mouse models. **Methods**: Ameloblast morphology and polarization were assessed in vivo using immunohistochemistry (IHC) labeling of Par 3 and claudin-1 proteins and in vitro using 3D cell culture and recombinant mutant proteins - Ambn ΔK74-L79 and Ambn ΔL76-P86. Enamel matrix protein (Amel and Ambn) secretion and processing by MMP-20 were analyzed in both mutants. **Results**: Ambn secretion was defective in $Ambn^{\Delta L76-P86\ -/-}$ and was instead sequestered within the ameloblasts, while Ambn displayed defective matrix organization in $Ambn^{\Delta K74-L79\ -/-}$. Both recombinant mutant proteins Ambn ΔK74-L79 and Ambn ΔL76-P86 were digested faster by MMP-20 compared to full-length Ambn. In vitro 3D cell aspect ratio measurements revealed that both the recombinant mutants promoted

significantly lesser elongation of ALC compared to full-length Ambn. *In vivo* ameloblast cell height measurements confirmed the presence of shorter ameloblasts in the $Ambn^{\Delta L76-P86\ -/-}$ mice. **Conclusion**: The presence of an intact and functional AH motif on Ambn is necessary for maintaining a tall and polarized ameloblast morphology and hierarchical enamel matrix organization.

**Title**: PIEZO maintains mesenchymal stem cell quiescence in the mouse incisor

**Authors**: Guanchen Ye, Lin Meng, Tingwei Guo, Mingyi Zhang, Jifan Feng, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Tissue homeostasis and regeneration depend on a balance between stem cell differentiation and self-renewal. The continuously growing incisors of mice provide a unique model for studying stem cell behavior due to their lifelong tissue turnover and regenerative capacity. Incisor mesenchymal stem cells (MSCs) in the cervical loop area play a crucial role in maintaining tissue renewal by responding to both biochemical and mechanical signals within their niche. However, the role of PIEZO channels in MSC function remains underexplored. **Purpose**: Our study aims to investigate how PIEZO channels influence the behavior of MSCs of the incisor, offering insights into the interplay between mechanical signaling and stem cell function. **Methods**: We employed single-cell RNA sequencing (scRNA-seq) to characterize the cell population in the cervical loop area and validated the expression pattern of *Piezo1/Piezo2* using RNAscope. Gli1-LacZ mice were generated to assess the relationship between MSCs and PIEZO. *Gli1-Cre^{ERT};Piezo2^{fl/fl}* and *Gli1-Cre^{ERT};Piezo1^{fl/fl}; Piezo2^{fl/fl}* mice were generated to elucidate the role of PIEZO channels. **Results**: scRNA-seq data revealed that mesenchymal cells in the cervical loop area of incisor can be classified into MSC, dental pulp, dental follicle, (pre)-odonto-

blast, and transit-amplifying (TA) cells. The expression patterns of *Piezo1* and *Piezo2* were distinct: *Piezo1* was predominantly expressed in the dental pulp and odontoblasts, while *Piezo2* showed high expression in MSCs and TACs, with significant overlap observed in Gli1+ cells. **Conclusion**: Our findings highlight the critical role of PIEZO channels in maintaining MSC function in the mouse incisor, offering new insights into the mechanical regulation of MSC homeostasis.

**Title**: Exploring DNA Sequence Specificity in cGAS Activation and Innate Immune Response

**Authors**: Guoli Hou, Taolin Xie, Ying Wu, Wen Fu, Ali Can Savas, Chao Qin, and Pinghui Feng

**Faculty Advisor**: Pinghui Feng

**Background**: The cyclic GMP-AMP synthase (cGAS) is a key cytoplasmic sensor, detecting DNA from pathogens or tumors and activating the cGAS-STING pathway. Essential in triggering innate immune responses, previous research has suggested that cGAS activation by double-stranded DNA (dsDNA) depends on DNA length rather than sequence. This study aims to challenge this notion and investigate cGAS's potential sequence specificity in activation. **Purpose**: This research seeks to determine if cGAS recognizes specific DNA sequences, influencing innate immune response activation. **Methods**: We utilized DNA-protein interaction assays, innate immune signaling factor detection, DNA cloning, sequencing, and RT-qPCR, FPLC, and immunofluorescence. These methods focused on analyzing the interaction between cGAS and various DNA sequences, especially A-rich and G-rich dsDNA fragments. **Results**: Our study shows a new phenomenon of the preference of cGAS for specific DNA sequences. A-rich dsDNA fragments were preferentially recognized, enhancing the innate immune response. These findings were supported by comprehensive biochemical assays and molecular analysis. **Conclusion**: This research revises our understanding of DNA sequence specificity in cGAS

activation and suggests a nuanced mechanism of innate immune system activation. These insights have significant implications for developing targeted therapies for immune-related diseases and advancing our knowledge of immune responses.

**Title**: Genetically-engineered organoid models reveal oral neoplastic evolution and therapeutic vulnerabilities

**Authors**: Hua Zhao, Young Min Park, Yueyuan Zheng, Qiong Mao, Casey Collet, Boyan Hu, Tianming Zhou, Luda Lin, Stephanie Wong, Uttam K. Sinha, Alice Soragni, and Dechen Lin

**Faculty Advisor**: Dechen Lin

**Background**: Head and neck squamous cell carcinoma (HNSCC) is an aggressive and frequently lethal neoplasm. Despite advancements in deciphering HNSCC tumorigenesis, the initial neoplastic transformation steps remain elusive. **Purpose**: We aim to dissect crucial early events in neoplastic progression and identify therapeutic vulnerability of HNSCC. **Methods**: Using murine and human samples, we established 25 different genetically-engineered organoid models from oral-esophageal organs by CRISPR/Cas9-based gene knockout or retrovirus-mediated gene transfer, targeting key driver genes (*TP53*, *CKND2A*, *PIK3CA*, *NOTCH1*, and *KMT2C*). Histology, IF, WST-1 assay, allograft transplantation, single-cell RNA sequencing (scRNA-seq), and drug screens at single-organoid resolution via bioprinting were employed to characterize organoids. **Results**: Double knockout of *TP53/CKND2A* (DKO) significantly increased organoid proliferation and size, loss of squamous differentiation, and tumorigenicity, with further amplification in the presence of *PIK3CA E545K* (DKOE). ScRNA-seq analysis revealed an increase in quiescent basal cells and proliferative squamous cells in DKO, sustained in DKOE, while differentiated squamous cells decreased in both groups. A distinctive

senescence-immune program substantially reduced in DKO and further decreased in DKOE. ANXA1, identified as a novel master regulator of the senescence-immune program, showed decrease in DKO and DKOE. Notably, overexpressing ANXA1 promoted the senescence-immune program and hindered neoplastic cellular features in both murine and human organoid models. Additionally, drug screens revealed the survival advantages of PIK3CA mutation against most drugs, with Mitomycin C and Onalespib demonstrating higher killing in DKOE. **Conclusion**: Our study unveils that inactivation of *TP53* and *CDKN2A*, and amplification of *PIK3CA E545K* induce oral neoplastic evolution and therapeutic vulnerabilities.

**Title**: Spatial Transcriptomics and Lineage Analysis for Craniofacial Mesenchymal Fate Determination

**Authors**: Jifan Feng, Eva Janečková, Tingwei Guo, Heliya Ziaei, Mingyi Zhang, Jessica Junyan Geng, Sa Cha, Angelita Araujo-Villalba, Mengmeng Liu, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: The differentiation of post-migratory cranial neural crest cells (CNCCs) into spatially and genetically distinct mesenchymal subpopulations is critical for craniofacial development. **Purpose**: In this study, using palate development as a model, we aim to establish real-time, high-resolution spatial transcriptomic and cell-type atlas to reveal the diversification of CNCC-derived mesenchyme during craniofacial development. **Methods**: Single-cell RNA sequencing was conducted on mouse palatal shelves at E12.5, E13.5, E14.5, E15.5, and E18.5. SeqFISH spatial genomics was performed on cryosections from E12.5, E13.5, and E15.5 using a custom gene panel. For cell lineage tracing, all pregnant female mice received tamoxifen at a dosage of 1.5 mg/10 g body weight. **Results**: We systematically identified specif-

ic markers for each mesenchymal cell type by mapping their transcriptomic profiles to spatial identities. Additionally, we discovered a heterogeneous mesenchymal progenitor population at the onset of palatal development, with subpopulations activating region-specific markers. Integrative analysis of spatial transcriptomic data from E12.5 to E15.5 revealed dynamic anatomical locations and gene expression patterns of mesenchymal cell types in distinct regions as palatogenesis progressed, confirming the early establishment of mesenchymal subpopulations at the onset of palatogenesis. *In vivo* lineage tracing demonstrated that these early populations contribute to their respective lineages at later stages, further supporting early fate specification. **Conclusions**: Our findings reveal the dynamic cellular positioning and gene expression patterns during the specification of CNCC-derived mesenchymal subpopulations throughout palatogenesis. Our data provide a dynamic and comprehensive resource for analyzing gene regulatory network during craniofacial development.

**Title**: Characterization of circuit mechanism underlying inflammation-induced temporomandibular joint pain

**Authors**: Li Ma, Ziying Lin, and Jianfu Chen

**Faculty Advisor**: Jianfu Chen

**Background**: Temporomandibular joint (TMJ) pain refers to discomfort or dysfunction in the temporomandibular joint, which connects the jawbone to the skull. The local inflammation caused by bacterial/viral infection or joint injury can result in TMJ pain. The specific circuit mechanism underlying the TMJ pain transmission still remains to be fully characterized. Clincal studies show that the TMJ pain is prevalent in female patients and closely related with migraine. **Purpose**: This study seeks to fully characterize the circuit which sense the nociceptive signals from peripheral TMJ tissue and transmit to the central nervous system, by which we further

investigate the cellular and molecular mechansims on how TMJ pain is sex dimorphic and closely related with migraine. **Methods**: We established an inflammatory TMJ pain via intra-articular injection of CFA adjuvant. Anterograde/retrograde tracing and chemogenetics are employed to characterize the neural circuit of TMJ pain transmission. Single-cell RNA sequeing (sc-RNA seq), multiplex immunodetection and genetic mouse model to investigate the cellular and molecular mechanisms. **Results**: We found that the trigeminal ganglion (TG) V3-Sp5C-PBL (Lateral parabranchial nuclei) circuit exclusively mediates the TMJ pain transmission. The TG V3 neurons were sensitized in both migraine-induced and female mice, and inhition of which acitiviy by ultrasound treatment can mitigate the CFA induced inflammatory TMJ pain. **Conclusion**: We unveiled that TG V3-Sp5C-PBL cirucuit may be the potential therapeutic target to mitigate the female prevalent TMJ pain and decouple the circuit connection with migraine.

**Title**: *Hic1* regulates palatogenesis and soft palatal muscle development through tissue-tissue interactions

**Authors**: Lin Lan, Eva Janečková, Jifan Feng, Heliya Ziaei, Tingwei Guo, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Craniofacial muscle development requires precise cellular interactions between mesodermal and cranial neural crest (CNC)-derived populations, alongside key transcription factors and signaling molecules. Perimysial cells are key players in this process representing a connective tissue subpopulation that regulates craniofacial myogenesis, including soft palatal muscle formation. Disruptions in perimysial signaling have been implicated in defects such as cleft palate, but the downstream targets of these signals remain poorly understood. **Purpose**: This study investigates the regulatory role of *Hic1* in the differen-

tiation and patterning of mouse soft palatal muscles. **Methods**: We generated a *Wnt1-Cre;Hic-1fl/+* mouse model and checked cellular gene expression changes related to soft palatal muscle developmental defects at different embryonic stages in mice. The morphological changes in the soft palate were analyzed by MicroCT and H&E staining, while gene expression changes were examined using *in situ* hybridization and immunofluorescent staining. **Results**: *Hic1* is primarily expressed in mesenchymal cells of the palatal region. Histological sections show minimal expression of *Hic1* in the hard palate framework. In contrast, *Hic1* is abundantly expressed in the peritendinous cells surrounding all soft palatal muscles. The specific deletion of *Hic1* from CNC-derived mesenchymal cells causes cleft soft palate together with major defects in the soft palatal muscles. **Conclusion**: This study demonstrates that *Hic1* is crucial for the growth and morphological development of the palate. The specific loss of *Hic1* in CNC-derived mesenchymal cells leads to cleft soft palate and significant defects in soft palatal muscles.

**Title**: *Piezo2*+ mechanosensory neurons regulate PDGF signaling to control tooth root

**Authors**: Lin Meng, Jifan Feng, Tingwei Guo, Mingyi Zhang, Sa Cha, Peng Chen, Heliya Ziaei, Aaron Harouni, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Sensory nerves actively participate in tissue and organ development. However, the complexity and heterogeneity of these neurons make it difficult to investigate their regulatory mechanisms during organogenesis. **Purpose**: Using the mouse incisor as a model, we investigated the function of mechanosensory neurons during organogenesis. **Methods**: We used genetic mouse models (*AvCreERT2;DTA* and *AvCreERT2;Piezo2fl/fl*) to investigate the role of sensory nerves and *Piezo2* in tooth root development. Single-cell

RNA sequencing (scRNA-seq) was employed to analyze gene expression profiles in the trigeminal ganglion and molars, identifying neuronal subsets and their interactions with dental mesenchyme. PIEZO2-mediated mechanosensory activity was assessed during root formation, and exogenous PDGFA protein treatments were performed to evaluate its ability to rescue defects in *AvCreERT2;Piezo2fl/fl mice*. Tooth root morphogenesis and cell proliferation were analyzed using morphological, histological, and molecular techniques to elucidate the mechanisms underlying sensory neuron regulation of tooth root development. **Results**: We show an essential role for sensory neurons during organogenesis. Specifically, *Piezo2+* mechanosensory neurons regulate tooth root formation by controlling the secretion of PDGF (platelet-derived growth factor) ligands through the PIEZO2 mechanosensory ion channel. Furthermore, loss of *Piezo2* in sensory nerves disrupts nerve-derived PDGFA secretion, impairing the regulation of progenitor fate by PDGF signaling in the dental mesenchyme and resulting in defective tooth root development. **Conclusion**: *Piezo2+* mechanosensory nerves play an active role in regulating tooth root development by controlling the secretion of PDGF ligands and modulating the PDGF signaling pathway in the dental mesenchyme.

**Title**: FGFR2 signaling-retinoic acid signaling interactions in regulating coronal suture development

**Authors**: Lu Gao, Peng Chen, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: FGFR mutations cause the majority of syndromic craniosynostosis. Gain-of-function mutations of FGFRs can cause cranial suture synostosis. However, the function of FGFR2 signaling in cranial progenitor cells that cause craniosynostosis is still largely unknown. **Purpose**: Clarify the cellular mechanisms behind the FGFR2 mutation-related

craniosynostosis. **Methods**: The *Gli1-CreERT2;Fgfr2IIIcfl/+* mouse model is generated to study the potential calvarial developmental defects and the underlying molecular mechanisms. **Results**: The FGFR2 gain-of-function mutation leads to coronal suture synostosis and abnormal skull shape, with decreased *Gli1* expression and increased osteogenic activity. Especially, the craniosynostosis starts from the dura mater side. Transcriptomic analyses reveal upregulation of retinoic acid (RA) signaling member genes, including RA synthesis-related genes *Aldh1a3* and *Rbp1*, and nuclear receptor genes. We unveil the enrichment of RA in the dura mater and the functional role of RA in coronal suture development. Furthermore, by reducing RA signaling, we successfully rescue the craniosynostosis phenotype and restore the *Gli1+* progenitor cell population. Moreover, we identify that the FGFR2 signaling upregulates RA signaling through the P38 signaling. **Conclusion**: Our results identify a critical FGFR2-RA signaling axis in the craniosynostosis process *in vivo* and provide potential therapeutic targets for eliminating the craniosynostosis disease. A better understanding of the regulatory role of FGFR2-RA signaling interaction could help develop novel treatment strategies for craniosynostosis.

**Title**: The ARID1-BAF Network Safeguards Stem Cell Commitment in Adult Tissues

**Authors**: Mingyi Zhang, Tingwei Guo, Jifan Feng, Yuchen Yang, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: ARID1-BAF is a chromatin remodeler, and its specific mechanisms in maintaining stem cell commitment and adult tissue homeostasis remain to be investigated. **Purpose**: To explore the ARID1-BAF overarching regulatory network in maintaining stem cell commitment during adult tissue homeostasis. **Methods**: Utilizing scRNA-seq, scATAC-seq, CUT&RUN-seq, bulk RNA-seq, bioinformatic analyses, and *in vivo* vali-

dations. **Results**: Our study demonstrates the indispensable roles of ARID1-BAF in maintaining replenishment mouse incisor growth, tissue homeostasis, and injury repair capabilities through deletion of *Arid1a* and *Arid1b* in the GLI1+ mesenchymal stem cell (MSC) lineage. scATAC-seq bioinformatics analysis revealed that cBAF predominantly regulates chromatin accessibility at the enhancer region, providing the *in vivo* evidence to display the cBAF regulatory activity. scRNA-seq analysis and *in vivo* validation showed that the dual loss of Arid1a and Arid1b induces abnormal MSC-TAC axis transition, causing DNA damage, cell apoptosis, and differentiation defects. Mechanistically, the ARID1-BAF complex directly binds to the promoters or enhancers of essential transcription factors (TFs), such as STAT3, TRP53, YY1, etc., which may play roles in regulating MSC-TAC homeostasis. TRP53 is one of the crucial and functional downstream TFs of the ARID1-BAF complex. *Trp53* haploinsufficiency in DKO mice partially rescues the mouse incisor defect. **Conclusion**: Our findings underscore that the ARID1-BAF safeguards proper adult mesenchymal stem cell and tissue homeostasis. *In vivo* evidence shows that cBAF modulates global chromatin accessibility, mainly at the AT-enriched enhancers in adult mesenchymal tissue. TRP53 is one of the functional downstream TFs of the ARID1-BAF complex, and it is regulated through promoter-enhancer interactions.

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<div style="color:#c0504d">Poster #91</div>

**Title**: Suture-Dura Interaction Supports Coronal Suture Regeneration in Craniosynostosis

**Authors**: Peng Chen, Lu Gao, Tingwei Guo, Jifan Feng, Mingyi Zhang, Sa Cha, Lin Meng, Oscar Peng, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Craniosynostosis disrupts skull and brain development, necessitating innovative regenerative approaches to restore suture function and address associated complications. **Purpose**: We aim to develop an ideal biomaterial to support cranial suture regeneration and to elucidate the role of dura mater in this process. **Methods**: *Twist1*+/- mice, which can phenocopy human craniosynostosis (Saethre-Chotzen syndrome), were treated with a biodegradable scaffold seeded with wild-type mouse suture stromal cells. The scaffold was composed of gelatin methacryloyl (GelMA), hyaluronic acid methacrylate (HAMA), and Collagen-I, termed H-GM. The impact of this treatment was assessed with regard to skull morphology, intracranial pressure, and neurocognitive function. Coronal suture single-cell analysis was utilized to identify the key signaling pathway that mediates suture-dura interactions. **Results**: The combination of H-GM and suture stromal cells successfully supported functional coronal suture regeneration in *Twist1*+/- mice. This regeneration partially corrected skull deformities, significantly reduced intracranial pressure, and improved neurocognitive deficits. Importantly, TGF-β3 secreted by the suture mesenchyme was found to attract *Tgfbr2+* dura mater cells, guiding their migration toward the suture, thus contributing to the suture regeneration process. **Conclusion**: The biodegradable H-GM scaffold, when combined with suture stromal cells, shows promising results in functional coronal suture regeneration in the *Twist1*+/- synostosis model, with key outcomes including the rescue of skull deformity and brain function. The use of FDA-approved materials in the scaffold makes it a viable candidate for future clinical applications in treating craniosynostosis. The study also highlights the critical role of TGFβ signaling in guiding dura mater cell migration during suture regeneration.

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<div style="color:#c0504d">Poster #92</div>

**Title**: Ameloblastin Multitargeting Domain Influences Ameloblast Gene Expression During Enamel Formation

**Authors**: Rucha Arun Bapat, Gayathri Visakan, Marziyeh Aghazadeh, Natalie Kegulian, and Janet Moradian-Oldak

**Faculty Advisor**: Janet Moradian-Oldak

**Background**: Ameloblastin, the second most abundant enamel matrix protein, contains a multitargeting domain (MTD) that plays a crucial role in its interactions and multiple functions. MTD facilitates ameloblastin self-assembly, co-assembly (amelogenin-in-ameloblastin interactions), and binds to ameloblast cell membranes. We developed two novel mouse models with targeted mutations within this region. **Purpose**: To investigate the impact of mutations in distinct regions within the MTD on enamel formation. **Methods**: Two engineered mouse models, Ambn$^{\Delta K74-L79}$ and Ambn$^{\Delta L76-P86}$, were generated by deleting amino acids 74-79 and 76-86 in the mouse ameloblastin sequence. To evaluate enamel mineral density, micro-computed tomography (μCT) was performed on 7-week-old mutant and WT mandibles at USC Molecular Imaging Center. RNA-sequencing was performed to determine differentially expressed genes between the mutants and WT by using post-natal-day 5 pups' 1$^{st}$ molar enamel organs. **Results**: While both Ambn$^{\Delta K74-L79}$ and Ambn$^{\Delta L76-P86}$ mutants had blunt, chalky white incisor tips, the Ambn$^{\Delta L76-P86}$ had a more severe phenotype, with the entire length of the incisor affected. Seven-week-old Ambn$^{\Delta L76-P86}$ mutants had reduced enamel volume and mineral density. The analysis of Ambn$^{\Delta K74-L79}$ mutants is underway. Preliminary RNA-sequencing data suggests an upregulation of maturation stage genes such as *Odam*, *Amelotin* and *Kallekrein-4* in the Ambn$^{\Delta K74-L79}$ animals. Analysis of Ambn$^{\Delta L76-P86}$ mutants, functional analysis of the differentially expressed genes and Ingenuity Pathway analysis will follow. **Conclusion**: Mutations in the MTD of ameloblastin leads to enamel hypomineralization and hypomaturation. We suggest that the domain regulates signaling pathways critical to normal enamel development in addition to contributing to the characteristics of extracellular matrix structure.

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<div style="color:#c0504d">Poster #93</div>

**Title**: Sensory Nerve-Derived GDF11 Regulates Soft Palate Muscle Development and Suckling/Swallowing Function

**Authors**: Sa Cha, Jifan Feng, Tingwei Guo, Peng Chen, Lin Meng, Thach-Vu Ho, Jeffrey D. Moore, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: The palate is a critical functional structure for suckling, feeding, and swallowing. These functions rely on the coordinated development of the palate, oral pharyngeal muscles, and the cranial nerves that control these structures. However, the role of innervation during palate development is not fully understood. **Purpose**: This study aims to examine the potential regulatory role and molecular mechanisms of innervation during palate development at single-cell resolution. **Methods**: We used the development of the mouse levator veli palatini (LVP), the major soft palate muscle, as a model to systematically investigate how sensory nerves communicate with various cell types in the palatal shelves to regulate soft palate muscle development. Using single-cell RNA sequencing and cell-cell interaction analysis, we identified neuron-to-palate-specific ligand-receptor pairs. We further used genetic animal models to verify the functional roles of these interactions. **Results**: There is robust sensory innervation guiding palate development. The loss of somatosensory nerves during palate development leads to a complete cleft palate and soft palate muscle defects. Trigeminal nerve-derived GDF11 acts on cranial neural crest-derived mesenchyme, mediating neuron-to-mesenchyme signals specific to soft palate development. Deletion of sensory nerve-derived GDF11 results in defects in perimysial fibroblasts and soft palate muscle malformation. The power of suckling kinetics and swallowing efficiency are impaired in *Gdf11* mutant mice. Mechanistically, sensory nerve-derived GDF11 promotes the proliferation of perimysial cells through the PI3K-AKT-FOXO1 signaling cascade and indirectly regulates soft palate muscle formation. **Conclusion**: Collectively, our findings provide

insights into the regulatory role of somatosensory innervation during palate development.

**Title**: Trp53 Coordinates with Hippo Signaling During Tooth Root Development

**Authors**: Tingwei Guo, Fei Pei, Mingyi Zhang, Jifan feng, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Cranial neural crest cells (CNCCs) play an essential role in craniofacial development and function. These cells have the ability to differentiate into multiple cell types, contributing to diverse craniofacial structures, including bones, cartilage, and connective tissue. Despite their significance, the mechanisms governing the cell fate decisions of post-migratory CNCCs remain largely unknown. Transcription factors play a central role in orchestrating these developmental processes by regulating gene expression programs. P53 is a well-known master regulator, extensively studied in cancer biology for its role in controlling cell growth and apoptosis. However, its role in postnatal development, particularly in craniofacial development, is less understood. **Methods**: The transgenic mouse model used in this study was *Gli1-CreER;Trp53<sup>fl/fl</sup>*. Techniques used in this study included immunohistochemistry, RNAscope, CUT&RUN-seq, bioinformatic analyses, and cell culture. **Results**: In this study, we used the mouse molar as a model to investigate the role of P53 signaling in tooth development, revealing that P53 not only regulates key processes in tooth development but also interacts with the transcription factor Arnt to modulate Hippo signaling. This coordination influences the expression of *Gli1* during the postnatal development of CNCCs. We demonstrated that the interplay among the P53, Hippo, and hedgehog signaling pathways is essential for regulating tooth root development. These insights provide a deeper understanding of how these pathways converge to regulate postnatal craniofacial development. **Conclusions**:

These findings suggest that P53 plays a broader role in developmental biology beyond its established functions in cancer, potentially influencing other aspects of postnatal tissue formation and regeneration.

**Title**: Human iPSC suture MSC and humanized mouse models for craniosynostosis

**Authors**: Wei Zhang, Peng Chen, Li Ma, Qing Chang, Ziyin Lin, and Jianfu Chen

**Faculty Advisor**: Jianfu Chen

**Background**: Cranial suture mesenchymal stem cells (MSCs) are essential for suture development, homeostasis, and regeneration. Loss of suture MSCs leads to craniosynostosis, a major congenital craniofacial disorder. **Purpose**: The goal of this study is to develop human models of craniofacial stem cells and improve human cell-based therapeutic strategies for craniofacial disorders. **Methods**: Differentiate human induced pluripotent stem cells (iPSCs) into GLI1+ induced cranial MSCs (iMSCs) and implant these iMSCs for cranial suture and bone regeneration after suturectomy. **Results**: Here we generated GLI1-GFP reporter human induced pluripotent stem cells (iPSCs) lines. Through screening the small molecules that can activate GLI1 reporter, we established a robust protocol of differentiating human iPSCs into highly uniformed GLI1+ induced cranial MSCs (iMSCs) in a defined xeno-free and serum-free culture condition. The GLI1+ iMSCs display clonal multipotency and self-renewal, and are capable to participate cranial suture and bone regeneration in mice after suturectomy, the surgical procedure to treat craniosynostosis in current clinic. Using CRISPR-Cas9 genome editing, we generated isogenic human iMSCs with craniosynostosis disease mutations in *TWIST1* and *TCF12* genes, which cause impaired proliferation and premature osteogenic differentiation of human iMSCs. **Conclusion**: Our iPSC suture MSC and humanized mouse models provide ex

vivo human models to study craniosynostosis pathogenesis and treatment.

**Title**: Interferon regulatory factor 3 Deamidation mediates Tumor Progression via DNA damage

**Authors**: Ying Wu, Youliang Rao, Qin Chao, and Pinghui Feng

**Faculty Advisor**: Pinghui Feng

**Background**: Interferon regulatory factor 3 (IRF3) is a pivotal transcription factor that regulates type I interferon (IFN) responses and plays a fundamental role in antiviral immunity. Recent studies have revealed a complex interplay between IRF3 and the innate immune response to both DNA and RNA viruses. However, its role in mediating DNA damage within the context of cancer development remains largely unexplored. **Purpose**: Our previous study demonstrated that the pyrimidine synthesis enzyme CTP synthetase 1 suppresses antiviral interferon (IFN) induction by deamidating IRF3 at N85. This deamidation impairs IRF3 binding to promoters containing IRF3-responsive elements, thereby attenuating IFN signaling. Notably, IRF3-N85D deamidated mice exhibited a high incidence of tumor formation in the head and neck region. Additionally, IRF3-N85D deamidated cancer cell lines displayed less sensitivity to the DNA-damaging agent Taxol. Therefore, in this study, we aim to elucidate the mechanistic role of IRF3 deamidation in mediating DNA damage within the context of cancer development. **Methods**: We integrated metabolic analysis and RNA sequencing to identify candidate genes and pathways associated with DNA damage in head and neck cells. These findings were further validated using a series of conventional biochemical assays, including colony formation assays and western blotting. Subsequently, head and neck cancer cell lines were treated with DNA-damaging agents like Taxol to investigate the mechanistic role of IRF3 deamidation in DNA damage regulation.

**Results**: Our preliminary data indicate that IRF3-N85D promotes tumor growth in an IRF3 mouse model. Additionally, colony formation assays revealed that IRF3 deamidation enhances cell proliferation. Furthermore, IRF3-N85D deamidated cancer cell lines exhibited decreased sensitivity to the DNA-damaging agent Taxol. **Conclusion**: However, we anticipate that our future findings will highlight the dual role of IRF3 in cancer development and its complex interplay with DNA damage, IRF3 deamidation, and the tumor microenvironment.

**Title**: Multidisciplinary Dental Management of Lymphoma

**Authors**: Yu-Chen Xie, Kathleen Chung, Pooja Patel, and Rebecca Dayanim

**Faculty Advisor**: Rebecca Dayanim

**Background**: Lymphoma can manifest in the oral cavity and often mimics other odontogenic/non-odontogenic pathologies. This causes challenges in diagnosis, treatment planning, and management for dental and medical practitioners. **Purpose**: This study defines the role of the dentist as the leading practitioner in the multidisciplinary management of a patient with NK-T cell lymphoma, nasal type with oral manifestations. The dentist is responsible for meticulous documentation of changes in the oral cavity and follow-up, which are essential in differentiating the etiology of symptoms between lymphoma and odontogenic infection. **Methods**: This study analyzed three patients with NK-T cell lymphoma. The process emphasized correlating clinical symptoms with vitality testing, periodontal assessment, taking a thorough dental history, radiographs, and follow-ups to rule out odontogenic sources of infection while integrating multidisciplinary collaboration of endodontists, oral surgeons, maxillofacial prosthodontists, otolaryngologists, radiology oncologists, oncologists, and pathologists. **Results**: Symptoms such as pain, swelling, tooth loosening, pathological

fractures and radiolucencies are rare but documented manifestations of lymphoma involving the jaws. These features can closely resemble endodontic or periodontal infections, leading to erroneous treatment and delayed lymphoma diagnosis. Correlation of clinical findings with diagnostic tests, maintaining a thorough dental history, and communication with multidisciplinary team members were critical for diagnosis and treatment planning. **Conclusion**: This study highlights the variable oral presentations of lymphoma, correlating symptoms to vitality testing, periodontal assessment, and maintaining detailed documentation while leveraging a multidisciplinary approach. Raising awareness among dental professionals about these rare manifestations is essential to reduce misdiagnoses, ensure timely referral, and improve patient outcomes.

**Title**: Unraveling FGFR2 Mutations: Mechanisms Behind Bent Bone Dysplasia Syndrome

**Authors**: Ze Liu, Sebastian Ko, and Amy Merrill

**Faculty Advisor**: Amy Merrill

**Background**: Fibroblast growth factor receptor 2 (FGFR2) plays a critical role in bone development, particularly in regulating osteoprogenitor cell proliferation and differentiation during embryogenesis. Mutations (Y381D and M391R) in FGFR2 are implicated in bent bone dysplasia syndrome (BBDS), a perinatal lethal skeletal disorder characterized by defective bone mineralization and severe skeletal abnormalities. These mutations are known to diminish FGFR2 signaling at the plasma membrane while concurrently enhancing its nucleolar activity, leading to altered ribosome biogenesis and activation of the p53 stress response. **Purpose**: This study's goal is to investigate the mechanisms underlying FGFR2 nuclear translocation and how specific mutations contribute to the pathophysiology of BBDS. **Methods**: We propose a comprehensive, multi-faceted approach to compare wild type and mutated FGFR2, using advanced tools such as AlphaFold3 predictions for structural analysis

to assess conformational changes. Additionally, receptor dimerization will be examined through co-immunoprecipitation and proximity ligation assay, while Western blotting will be employed to explore differences in receptor activation and signaling transduction. Posttranslational modifications and protein-protein interactions will be analyzed by mass spectrometry, and alternative splicing of FGFR2 will be studied using RT-PCR and RNA-seq. Furthermore, changes in gene expression and transcriptional regulation will be assessed using qPCR, RNA-seq, and ChIP-seq. **Results**: Protein structural analysis shows that mutations may disrupt receptor dimerization, ligand binding, and autophosphorylation, which collectively contribute to the BBDS phenotype. **Conclusion**: These insights are essential for understanding the role of FGFR2 in skeletal development and may inform the development of targeted therapeutic strategies for BBDS and related skeletal disorders.

**UNDERGRADUATE & DDS STUDENTS - BASIC SCIENCES**

**Title**: *Kdm6b* Maintains Mesenchymal Tissue Homeostasis in the Mouse Incisor

**Authors**: Aaron Harouni, Lin Meng, Tingwei Guo, Jifan Feng, Mingyi Zhang, Heliya Ziaei, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Epigenetic modification affects gene transcription and influences the development of cells. *Kdm6b*, an H3K27me3 demethylase, plays an important role in fate determination. However, it is unclear how *Kdm6b* affects tissue homeostasis. **Purpose**: Using the mouse incisor as a model, we investigated the function of Kdm6b in tissue homeostasis. **Methods**: Conditional deletion of *Kdm6b* in *Gli1-CreER$^{T2}$;Kdm6b$^{fl/fl}$* mice was induced at one month of age with tamoxifen, and samples were analyzed two months post-induction using micro-CT imaging, histological

staining (HE and DSPP), and molecular assays. Proliferation, apoptosis, and differentiation were assessed, alongside bulk RNA-seq and Cut & Run-seq to elucidate underlying mechanisms. **Results**: The loss of *Kdm6b* resulted in thinner dentin, disorganized odontoblasts, reduced alveolar bone, and impaired differentiation due to increased apoptosis and decreased proliferation in transit-amplifying cells (TACs). Mechanistically, *Kdm6b* deletion downregulated Bmi1 expression, a key component of the PRC1 complex, through an H3K27me3-dependent pathway. Reduced *Bmi1* expression subsequently upregulated the mechanosensitive ion channel *Piezo1*, leading to increased calcium ion influx, activation of the PI3K-Akt signaling pathway, and enhanced apoptosis in TACs. These disruptions compromised tissue homeostasis in the mouse incisor. **Conclusion**: *Kdm6b* sustains tissue homeostasis by inhibiting *Piezo1*-mediated apoptosis through the H3K27me3-*Bmi1* regulatory pathway.

**Title**: Stat3 Regulation Spurs Growth Plate Fusion and Overarching Craniofacial Development

**Authors**: Alexander Lewandrowski, Sebastian Ko, and Amy Merrill

**Faculty Advisor**: Amy Merrill

**Background**: The Stat3 transcription factor is a central mediator of the chemical mechanisms responsible for skeletal development, influencing critical transcription networks regulating osteogenesis and craniofacial morphogenesis. Previous research has shown that Stat3 deletion in pre-osteoblasts and bone marrow mesenchymal stem cells effectuate craniofacial deformities such as clavicle hypoplasia and the development of osteoporosis. Although Stat3's involvement in bone homeostasis has been previously investigated in the Stat3 knockout mouse model, observed skull shortening remains an unexplored phenotype. **Purpose**: To clarify

Stat3's role in cranial neural crest cells and synchondrosis fusion, we hypothesize that Stat3 deletion in the cranial neural crest disrupts growth plate fusion, contributing to skeletal shortening. **Methods**: Whole mount skeletal preparation and histological analysis of *Wnt1-Cre2; Stat3$^{fl/fl}$* samples identified morphological alterations resulting from Stat3 deletion. **Results**: Mouse samples treated with EC359, a Lifr inhibitor that diminishes JAK/STAT signaling, showed reduced growth plate fusion at the cranial base and potential prevention of midface hypoplasia associated with cranial base developmental syndromes. **Conclusion**: By investigating the mechanisms linking Stat3 activity to growth plate homeostasis and cranial synchondroses fusion, this study explicates a prominent factor influencing skeletal morphology. Altered Stat3 signaling has been repeatedly associated with atypical growth plate fusion and skull morphology, confidently implicating Stat3 as a key factor in craniofacial development. Future studies focusing on the interrelated mechanisms of the Fgfr2 and Stat3 pathways will aid the development of therapeutic practices targeting craniofacial abnormalities.

**Title**: Investigating the Role of Arl13b in Palatogenesis and Craniofacial Myogenesis

**Authors**: Angelita Araujo-Villalba, Heliya Ziaei, Eva Janeckova, Jifan Feng, Tingwei Guo, Thach-Vu Ho, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Craniofacial malformations rank among the most prevalent birth defects, with approximately 30% of ciliopathies linked to craniofacial abnormalities, such as cleft lip and palate. Arl13b, a small GTPase within the RAS superfamily, is essential for ciliogenesis, making it a promising candidate for exploring the role of cilia in craniofacial development. This study aims to investigate the potential involvement of Arl13b in palatogenesis. **Methods**: Immunofluorescence, RNA in

situ hybridization, microCT, histology. **Results**: Arl13b was found to be broadly expressed across the palatal region at various stages of development. To assess the role of Arl13b in palate formation, a *Wnt1-Cre;Arl13b^fl/fl* mouse model was developed, in which Arl13b was specifically deleted in cranial neural crest (CNC)-derived mesenchymal cells. This model exhibited complete penetrance of soft palate clefts and 80% penetrance of total cleft palate. MicroCT analysis at embryonic day (E) 18.5 revealed abnormalities in the maxillary and mandibular bones, alongside distinct defects in the shape and size of soft palatal muscles. To further investigate molecular changes underlying this phenotype, bulk RNA sequencing at E12.5 identified significant alterations in genes primarily enriched in the Wnt signaling pathway and pathways involved in muscle formation. **Conclusion**: The observed defects in hard and soft palate development in *Wnt1-Cre;Arl13b^fl/fl* mice highlight the critical role of cilia in palatogenesis. Future research will focus on elucidating the regulatory mechanisms of palatal muscle formation via Wnt signaling.

### Poster #102

**Title**: Role of Mechanical Ion Channel Piezo2 in Maintaining Tissue Homeostasis

**Authors**: Ara Hartounian, Mengmeng Liu, Aaron Harouni, Thach-Vu Ho, Shaohua Ge, and Yang Chai

**Faculty Advisor**: Yang Chai

**Background**: Mechanosensors play a crucial role in sensing and responding to mechanical forces, converting them into electrical or chemical signals that influence both embryonic development and the maintenance of adult tissues. Despite their importance, the molecular mechanisms governing how mechanosensors convert mechanical forces into the regulation of tissue and organ morphogenesis remain unclear. **Purpose**: This study investigates the essential role of the mechanosensitive ion channel Piezo2 in maintaining

tissue homeostasis during tooth root development, particularly its impact on mitochondrial function. **Methods**: We examined the effects of Piezo2 absence on Gli1+ root progenitor cells, revealing its influence on cell proliferation through Hedgehog (Hh) signaling, ultimately leading to shortened roots. **Results**: Our findings highlight the integral involvement of Piezo2 in regulating mitochondrial function during tooth root development, shedding light on its crucial role in tissue homeostasis. **Conclusion**: Understanding Piezo2's contribution to cellular processes is vital for proper tissue development, particularly during tooth root development. This research offers insights into potential therapeutic targets for conditions affecting dental tissue development and homeostasis.

### Poster #103

**Title**: Zone-Specific Cartilage Changes in TMJ After Anterior Disc Displacement

**Authors**: Daniela Gioia, Maria Pacheco, and Amy Merrill

**Faculty Advisor**: Amy Merrill

**Background**: Temporomandibular joint disorders (TMDs) affect approximately 10-15% of adults and are characterized by orofacial pain and TMJ dysfunction. These disorders can lead to joint instability and mechanical overload, resulting in progressive damage to the articular cartilage and subchondral bone, often culminating in osteoarthritis. Despite the high prevalence of TMDs, the cellular and transcriptional changes following anterior disc displacement (ADD) remain poorly understood. **Purpose**: This study aims to determine zone-specific changes in protein expression of key condylar cartilage markers and investigate how Sox9- and Scx-lineage cells contribute to defects in the condylar cartilage following ADD. **Methods**: A mouse surgical model of ADD was developed to induce TMJ derangement, allowing the study of cellular changes. Sox9CreERT2;Td and Scx-CreERT2;Td mouse models were used to analyze condylar cartilage zones after cryosec-

tioning. Immunohistochemistry was performed to assess protein expression of Prg4 and Col1 in the superficial zone, Sox9 in the proliferative and mature/prehypertrophic zones, Col2 and aggrecan in the mature/prehypertrophic zones, and Col10 in the hypertrophic zone. **Results**: Preliminary genetic lineage tracing demonstrated that Sox9- and Scx-lineage cells exhibit altered behaviors in the TMJ following ADD. Initial findings indicate zone-specific disruptions in Sox9 marker expression, suggesting impaired cartilage homeostasis. **Conclusion**: This study provides insights into TMJ dysfunction and the role of Sox9- and Scx-lineage cells in cartilage defects following ADD. Future research will explore sex-specific differences in cellular responses, advancing understanding of TMJ cartilage biology and the pathophysiology of arthrogenous TMD while laying the groundwork for targeted therapeutic interventions.

### Poster #104

**Title**: Comparative study between the temporomandibular joint and the tibial joint

**Authors**: Junxi (Will) Guo, Austin Yan, Julia Lima, Zhaoyang Liu, and Jian Xu

**Faculty Advisor**: Jian Xu

**Background**: The temporomandibular joint (TMJ) and the tibial joint are two of the body's most critical load-bearing joints. While the tibial joint functions in walking, the TMJ is primarily involved in mastication, speech and other essential oral functions. Both joints are covered by a layer of cartilage tissue, however, TMJ is a fibrocartilage with greater concentration of type I collagen while the tibial cartilage is a hyaline cartilage with mainly type II collagen. Despite their distinct functions and molecular composition, the difference in their biomechanical properties is not well defined, which could provide valuable insights for advancing TMJ therapeutic strategies. **Purpose**: To determine the biomechanical differences between TMJ and tibia. **Methods**: Biomechanical measurement of mouse TMJ

and knee joint using UNHT3 Bioindenter. **Results**: Using the bioindenter, we characterized the elasticity (E*), elastic modulus (EIT), and other supplementary properties of TMJ and lateral, medial condyle of tibial joint. Both joints are divided into 4 distinct zones based on anatomical and biomechanical features. Comparison within TMJ and within both condyles of the tibial joint showed minimal differences across both sexes (p<0.001). Comparison between the TMJ and the lateral tibial condyle revealed that the TMJ exhibited around 3.7 times lower elastic modulus. Within the two tibial condyles, the lateral condyle exhibited slightly higher elastic modulus than the medial condyle. Within the TMJ, a trend towards increasing elastic modulus exists along the anterior-posterior axis. **Conclusion**: TMJ shows gradual increase in elastic modulus anterior-posteriorly, and has significantly lower elastic modulus compared to the knee joint.

### UNDERGRADUATE & DDS STUDENTS - CLINICAL SCIENCES

### Poster #105

**Title**: Biguanides in OSCC Treatment: In Vivo Tumor-Suppressive Effects

**Authors**: Arman Zograbyan, Talar Kevorkian, and Azadeh Ahmadieh

**Faculty Advisor**: Azadeh Ahmadieh

**Background**: Oral Squamous Cell Carcinoma (OSCC) is a prevalent malignancy with poor prognosis. Biguanides, typically used in diabetes management, may offer tumor-suppressive effects in OSCC. **Purpose**: To evaluate the effects of metformin, phenformin, and combination therapies in inhibiting OSCC tumor growth in vivo. **Methods**: A PubMed search (2019-2024) was conducted using the keywords "OSCC," "biguanides," "metformin," and "phenformin." Studies with various mice strains, therapeutic doses, and administration sites were included. Clinical studies,

reviews, in vitro work, and those not measuring relevant parameters were excluded. **Results**: An initial search yielded 23 results, 5 of which met the selection criteria. Phenformin (150 mg/kg) reduced tumor weight by over 20 mg in 2 weeks. Metformin at 200 mg/kg suppressed tumor growth by over 90 mg in 18 days, while at 250 mg/kg it reduced tumor weight by 53% over 5 weeks. HL156A (30 mg/kg), a metformin derivative, reduced tumor volume by over 20 mm3 in 11 days, but over 100 mm3 when taken with chloroquine. Combining metformin with other treatments resulted in tumor reductions: 200 mg/kg with cisplatin caused over 180 mg reduction in 5 weeks; 250 mg/kg with C1632 led to a 91% reduction in 18 days; and 100 mg/kg with 4SC-202 reduced tumor weight by over 190 mg in 25 days. **Conclusion**: Biguanides, particularly in combination with other therapies, show significant potential in reducing OSCC tumor size and weight. Further clinical studies are needed to confirm these findings in humans.

**Title**: Diagnosis and treatment of idiopathic bone cavity in the mandible

**Authors**: Bryan Do Nguyen, Elham Radan, and Parish Sedghizadeh

**Faculty Advisor**: Elham Radan

**Background**: Idiopathic bone cavity (IBC), also known as simple bone cyst or traumatic bone cyst, is an uncommon, asymptomatic lesion of the mandible that lacks an epithelial lining. It is unclear pathogenesis and etiology present diagnostic and treatment challenges to oral health clinicians. **Purpose**: A 19-year-old male presented with a radiolucency incidentally discovered on the right side of the mandible. The patient reported a dull, intraoral sensation of pain on the right of his mandible during biting. **Method**: Panoramic examination observed a unilocular, well-defined radiolucent area associated with the roots of teeth #29, #30, #31, and the mesial surface of the unerupted tooth #32. A biopsy was performed curettage triggered bleeding within the cavity. **Results**: The surgical procedure

revealed the absence of an epithelial lining, a definitive characteristic of traumatic bone cavity, and the biopsy of the buccal cortical bone plate sample confirmed the diagnosis of idiopathic bone cavity. A 5-month follow-up panoramic radiograph was taken on the patient and showed evidence of healing and bone formation. **Conclusion**: The case highlights the importance of surgical treatment and biopsy in treating and diagnosing idiopathic bone cavity. Regular follow-up screenings are recommended to monitor the progress of healing or any signs of recurrence. Further research is needed to improve diagnosis, treatment, and management of idiopathic bone cavity.

**Title**: Case Report: Periapical Cemento-Osseous Dysplasia

**Authors**: Emanuel Harouni, Elham Radan, and Parish Sedghizadeh

**Faculty Advisor**: Elham Radan

**Background**: Periapical Cemento-Osseous Dysplasia (PCOD) is a benign lesion, often asymptomatic, in which fibro-osseous tissue replaces the normal bone tissue and marrow. This is mostly seen in the periapical region, predominantly observed in middle-aged African American women. It is often discovered incidentally during radiographic examinations, making accurate diagnosis critical to avoid unnecessary interventions. **Purpose**: We are presenting a rare case of large mandibular PCOD in a 62-year-old female for over two decades. This report aims to emphasize the importance of proper diagnosis and management of PCOD. **Methods**: A comprehensive clinical and radiographic evaluation was performed on the patient, who presented with mild bony expansion in the anterior mandible and radiographic findings consistent with PCOD. A biopsy confirmed the diagnosis, and regular monitoring without surgical intervention was implemented due to the benign and asymptomatic nature of the lesion. **Results**: Radiographic

findings revealed a sclerotic lesion with mixed radiodensity, intact lamina dura, and no root resorption. The patient's symptoms were limited to mild dysesthesia, with no progression of the lesion or associated complications over the observation period. **Conclusion**: This case highlights the conservative management of PCOD, demonstrating the importance of regular monitoring and patient education. Avoiding unnecessary invasive procedures ensures optimal outcomes while minimizing risks. Accurate diagnosis is essential to distinguish PCOD from other fibro-osseous lesions and inflammatory conditions.

**Title**: Evaluating accuracy of an AI-based application for diagnosing temporomandibular disorders

**Authors**: Haeseong Lee, Salma Awwad, Sang Chung, Anette Vistoso, Amila Adili, and Parish Sedghizadeh

**Faculty Advisor**: Parish Sedghizadeh

**Background**: Diagnosing temporomandibular disorders (TMD) can be clinically challenging, particularly for non-specialists. **Purpose**: This study evaluates the diagnostic accuracy of the MyTMJ© artificial intelligence (AI) application by comparing its outputs with diagnoses from board-certified Orofacial Pain professionals at the Herman Ostrow School of Dentistry of USC. **Methods**: The application's ability to identify diagnoses associated with users' chief complaints was assessed. A one-proportion z-test tested whether the app's observed accuracy differed from a hypothesized benchmark of 90% at a significance level of $\alpha = 0.05$ (two-sided). Demographics, including age and gender, were summarized for the overall sample (n = 110). Continuous variables were reported as medians with interquartile ranges (IQR), while categorical variables were summarized as frequencies and percentages. **Results**: The study included 110 patients, of whom 30% were male. The median age

of the participants was 34.0 years, with an interquartile range of [26.0, 47.0]. Of the 110 app-generated diagnoses, 105 (95.5%) were confirmed to be accurate by clinical diagnosis. The observed accuracy of the application was found to be significantly higher than the hypothesized 90%, as evidenced by a p-value of 0.036. The 95% confidence interval (CI) for the observed accuracy was [0.923, 0.997], further supporting the high diagnostic accuracy of the application. **Conclusion**: This study highlights the MyTMJ© application as a reliable tool for preliminary diagnostic support in clinical settings.

**Title**: Biofilm formation on dentin treated with silver-di-amine-fluoride and a sil-ver-binding-peptide

**Authors**: Harrison Chang, Natalia Tjokro, Candan Tamerler, Malcolm Snead, and Casey Chen

**Faculty Advisor**: Casey Chen

**Background**: Silver-diamine fluoride (SDF) topical application effectively treats carious lesions but stains the tooth. We have engineered a silver-binding peptide (AgBP) that can be modified as a restorative material to mask the stains. However, it is unclear whether the peptide coating may enhance biofilm formation and reduce the anticariogenic property of SDF. **Purpose**: To test the effects of AgBP on biofilm formation on dentin treated with SDF. **Methods**: Warthog dentin was demineralized and treated with SDF with or without the peptide coating. Human dentin was treated with SDF and restored with composite resin with or without the peptide. Controls included dentin without treatment or with demineralization alone. The dentin were exposed to *Streptococcus mutans* cultures, and sampled at 16 hours to enumerate the surface bacterial load. **Results**: $1.33 \times 10^4$ and $2.19 \times 10^4$ CFU/mm$^2$ of *Sm* cells were found on warthog dentin with or without the peptide respectively. $1.12 \times 10^5$ and $2.57 \times 10^5$ CFU/mm$^2$ of *Sm* cells were found on human

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dentin restored with composite resin with or without peptide respectively. No statistically significant differences between the surface with or without the peptide were observed (p-value = 0.1231 for human dentin, p-value = 0.4593 for warthog dentin). Similar levels of bacteria were found in the control, including surfaces treated with SDF. **Conclusion**: AgBP on the surface of SDF-treated dentin or in the composite resin does not affect *S. mutans* biofilm formation. The peptide can be used in conjunction with SDF without adverse effects.

### Poster #110

**Title**: Platelet-Rich Fibrin Therapy in Preventing Medication-Related Osteonecrosis of the Jaw

**Authors**: Melodie Saremi, Omar Abdel-Al, and Azadeh Ahmadieh

**Faculty Advisor**: Azadeh Ahmadieh

**Background**: Medication-related osteonecrosis of the jaw (MRONJ), a severe complication of antiresorptive and antiangiogenic therapies often triggered by dental extractions, causes significant morbidity and reduced quality of life. Platelet-rich fibrin (PRF), an autologous biomaterial, shows potential to enhance tissue healing, reduce MRONJ risk, and improve surgical outcomes. **Purpose**: To evaluate the efficacy of PRF in preventing MRONJ and enhancing healing. **Methods**: Using the keywords "Platelet Rich Fibrin" AND "osteonecrosis of the jaw" AND "prevention" OR "treatment," our search spanned PubMed and Scopus databases (2017-2024). Inclusion criteria focused on English-language prospective studies (cohorts and clinical trials), evaluating PRF's role in MRONJ prevention or treatment. Exclusion criteria encompassed non-human studies, reviews, and case reports. **Results**: The initial search yielded 70 articles, with 7 meeting inclusion criteria. Three clinical trials demonstrated PRF's efficacy, showing 0% delayed recovery versus 12% in controls (P < 0.05),

improved MRONJ resolution with PRF + BMP-2 (P = 0.028), and 100% bone closure after surgical curettage. Among 4 cohort studies, PRF achieved 85%-94% success rates with complete necrotic bone removal (P = 0.014), significant short-term benefits at 1 month (P < 0.05), fewer complications (1 PRF-treated patient vs. 6 controls), and complete healing with no MRONJ recurrence over 12-48 months. **Conclusion**: Platelet-rich fibrin (PRF) is highly effective in preventing the development of MRONJ and improving healing outcomes. The limited prospective studies highlight the need for further research to standardize methodologies and evaluate long-term efficacy, solidifying PRF's role in MRONJ prevention and management.

### Poster #111

**Title**: Oral Health Disparities: DMFT Score Analysis of Unhoused vs. General

**Authors**: Sheiva Hodjati, Parastoo Saljughian, and Mehdi Mohammadi

**Faculty Advisor**: Mehdi Mohammadi

**Background**: People experiencing homelessness (PEH) face significant barriers to dental care, resulting in poor oral health outcomes. The Decayed, Missing, and Filled Teeth (DMFT) index serves as a globally recognized metric for assessing oral health disparities, providing valuable insights into the oral health. **Purpose**: This study evaluated DMFT scores across age, gender, and ethnicity in PEH and compared them with data from the U.S. general population, using the NHANES 2017-2020 dataset and the Indian Health Service Data Brief 2022. **Methods**: A cross-sectional analysis was conducted on 1,559 of PEH who received care at the USC/URM dental clinic in downtown Los Angeles from 2007 to 2017. DMFT scores were evaluated using existing data from dental charts and X-rays according to WHO guidelines. Statistical analyses, including ANOVA and Tukey's HSD tests, identified differences among subgroups and compared findings with

national datasets. **Results**: PEH consistently exhibited higher DMFT scores than the general population. Scores increased with age, from 7.23 in the 20-34 group to 19.45 in those 65+. Females had higher scores (16.92) than males (15.84). AI/AN participants had the highest scores (18.72), followed by White and Black participants. **Conclusion**: The study highlights substantial oral health disparities in PEH compared to the U.S. general population, with variations by age, gender, and ethnicity. Addressing these gaps through targeted dental care interventions and improved access to services is crucial for reducing disparities and improving outcomes in this vulnerable population.

### Poster #112

**Title**: CPAP vs. MAD: OSA Treatment Impact on Cardiovascular Outcomes

**Authors**: Talar Kevorkian, Arman Zograbyan, and Azadeh Ahmadieh

**Faculty Advisor**: Azadeh Ahmadieh

**Background**: Obstructive Sleep Apnea (OSA) is a common sleep disorder characterized by airway blockage, resulting in cardiovascular (CV) morbidity, hypertension, and increased risk of heart disease. Continuous Positive Airway Pressure (CPAP) and Mandibular Advancement Devices (MAD) are two primary treatments for OSA. Blood pressure (BP) and CV outcomes in mild to moderate cases are involved in ongoing studies. **Purpose**: Evaluating CPAP versus MAD in reducing BP and improving CV outcomes in mild to moderate OSA. **Methods**: Articles from PubMed (2019-2024) were selected using the keywords CPAP, mandibular advancement device, blood pressure, cardiovascular outcomes, continuous positive airway pressure, oral appliance, and hypertension. Studies compared CPAP and MAD in patients with mild to moderate OSA included. Studies not involving human subjects, crossover studies, and patients with moderate to severe OSA were

excluded. **Results**: According to nine papers that met the inclusion criteria, both CPAP and MAD reduced BP and improved CV outcomes. Systolic and diastolic BP was reduced 2-3 mmHg more when using a CPAP compared to MAD, with an average systolic BP reduction of 7.4 mmHg compared to 5.1 mmHg for MAD. MAD demonstrated better adherence rates due to its ease of use. **Conclusion**: CPAP and MAD are both effective in mild to moderate OSA, with CPAP reducing BP and improving CV, and MAD having better patient adherence.

> **BIOKINESIOLOGY & PHYSICAL THERAPY - PHD CANDIDATES & POST-DOCTORAL ASSOCIATES**

### Poster #113

**Title**: Trail Leg Demands During Pitching: Influence of Stride Phase Strategy

**Authors**: Adam Barrack, Arnel Aguinaldo, Kristen Nicholson, Lori Michener, and Christopher Powers

**Faculty Advisor**: Christopher Powers

**Background**: Baseball pitchers use their back (trail) leg to generate and transfer mechanical energy into the pelvis during stride phase of the pitch. Pitchers have been reported to utilize one of two strategies during stride phase to generate and transfer energy: dip-and-drive (DD), and tall-and-fall (TF). **Purpose**: To evaluate differences in sagittal plane lower extremity demand in TF and DD pitchers. **Methods**: Forty-six healthy, collegiate pitchers participated. Kinematics and kinetics were measured using full-body markered motion capture and an instrumented pitching mound. Pitchers threw 15 max-effort fastballs from the wind-up, over regulation distance, to a catcher or net. The average of the ten fastest pitches were analyzed. Pitchers were classified as DD if their pelvis center-of-mass moved downward more than forward (toward home plate) in the first 20% of stride phase.

Average stride phase support moments were calculated for each group by summing the hip and knee extensor moment impulses and the plantarflexor moment impulse. Joint-specific contributions to the support moment were compared between groups using independent t-tests along with cohen's d effect sizes; $\alpha$=0.05. **Results**: Compared to TF pitchers (N=23), DD pitchers (N=23) exhibited reduced hip extensor demand by 9% (p=0.007,d=-0.84), and increased knee extensor demand by 12% (p=0.002,d=0.99). There was no statistically significant difference in ankle plantarflexor demand (p=0.153,d=-0.43). **Conclusion**: Subtle differences in lower extremtiy demand were noted between strategies. Compared to TF pitchers, DD pitchers rely more on the knee extensors and less on the hip extensors to generate forward momentum.

## Poster #114

**Title**: Menstrual Cycle Phase on Reported Soreness: A Pilot Study

**Authors**: Bailey McLagan, S. Sigward, S. Dusing, R. Mandelbaum, and E.T. Schroeder

**Faculty Advisor**: E. Todd Schroeder

**Background**: Hormonal fluctuations, particularly estrogen and progesterone, throughout the menstrual cycle may affect symptoms of exercise-induced muscle damage, but this is poorly understood. **Purpose**: This pilot study investigated differences in perceived soreness across three different phases of the menstrual cycle. **Methods**: Six (n = 6) recreationally active females were recruited to participate. Participants reported their last two onset of bleeding (day 0) to calculate the length of their menstrual cycle. Hormonal concentrations were measured using urinalysis and confirmed using serum. Participants were randomly assigned to one menstrual cycle phase (early follicular phase (EFP), late follicular phase (LFP), or mid-luteal phase (MLP)). During their assigned phase, they completed a downhill running protocol (20-minutes at -12% grade, 6 mph, with 5% of their body weight in a weighted vest). Soreness was assessed before, immediately after, 24-, and 48-hours post exercise using a 6-point Likert scale. **Results**: Reported soreness was the highest during the EFP, as compared to the LFP and MLP. The LFP reported soreness 0.5 units and 1.5 units lower than the MLP and EFP, respectively. **Conclusion**: Menstrual cycle phases with higher concentrations of estrogen (LFP and MLP) were associated with lower perceived soreness compared to those with low concentrations (i.e., EFP). Evidence suggests estrogen may provide a protective role against exercise induced muscle damage.

## Poster #115

**Title**: Ankle Absorption Work is Heterogenous in Persons with Achilles Tendinopathy

**Authors**: David Ortiz-Weissberg and Kornelia Kulig

**Faculty Advisor**: Kornelia Kulig

**Background**: The Achilles tendon is vital for energy absorption during athletic and daily living activities. Previous research has described neuromechanical adaptations to advanced Achilles degeneration; the nature of these adaptations suggest that they are an attempt to maintain ankle mechanics. It is unknown whether the adaptations achieve this goal. Since active movement control requires adequate energy absorption/generation, mechanical energy provides an ideal perspective for examining ankle mechanics. **Purpose**: To investigate how Achilles tendinopathy affects ankle joint energy absorption during unipedal vertical hopping. **Methods**: Sample: 27 persons with Achilles tendinopathy, 27 with healthy Achilles tendons. Task: Single-leg hopping at 2.33 Hz. We integrated the ankle, knee, and hip negative net joint moment power. The ankle contribution to whole-limb absorption was found by dividing the net joint moment work to the sum across joints. Three subgroups in the Achilles tendinopathy group were identified. The Harrell-Davis estimator for the median was bootstrapped and difference-adjusted confidence intervals were constructed to assess cluster and group differences in ankle net joint moment work. **Results**: There were statistically significant differences in raw and percent ankle net joint moment between the three tendinopathy clusters. One group showed significant differences with the control group (lower than controls). **Conclusion**: The results indicate heterogeneity in the ankle net joint moment in persons with Achilles tendinopathy. Future analyses should investigate factors influencing the heterogeneity, such as differences in tendon health, ankle kinematics, or net joint moment.

## Poster #116

**Title**: Quality of Life and Physical Function in Prostate Cancer Survivors

**Authors**: Guanrong Cai, Jacek Pinski, and George Salem

**Faculty Advisor**: George Salem

**Background**: Health-related quality of life (HRQoL) and physical function are often declined in prostate cancer survivors (PCaS) undergoing hormone therapy. Exercise has been shown to improve both domains but their relations are seldomly reported. **Purpose**: The study's purpose is to investigate the relations between HRQoL and key measures of physical function in the baseline measures of a cohort of PCaS enrolled in an exercise intervention study. **Methods**: Ten prostate cancer survivors (age: 73.7 yrs, SD=5.7) participated in the study. Functional Assessment of Cancer Therapy-Prostate (FACT-P) scores, flexibility (sit-and-reach task), strength (grip strength), and fast gait speed were collected as baseline measures for an exercise intervention study. Descriptive statistics and Spearman's rank correlations were calculated. **Results**: The average FACT-P total score (126.87 ± 13.59) was strongly correlated with the sit-and-reach task performance (14.06 ± 10.13 cm; rho: 0.77, P=0.01), weakly correlated with fast gait speed (1.71 ± 0.31 m/s; rho: 0.26, P=0.47), and very weakly correlated with grip strength (33.45 ± 6.8 kg; rho: 0.09, P=0.82). **Conclusion**: It was hypothesized that HRQoL would be correlated with key measures of physical function. Preliminary findings indicated that only flexibility was significantly associated with HRQoL in the study cohort, which was unexpected. Possible explanations could be that the small sample exhibited a bias towards high HRQoL. This is an ongoing exercise study that will increase in sample size. Future studies could focus on predicting the changes in HRQoL based on participants' baseline characteristics.

## Poster #117

**Title**: Determining the factors driving the speed-accuracy trade-off during precision walking

**Authors**: Isaiah J. Lachica and James M. Finley

**Faculty Advisor**: James M. Finley

**Background**: When walking in risky environments, such as across stepping stones, we walk slowly to improve accuracy. The speed-accuracy trade-off is hypothesized to be driven by visuomotor processing delays and signal-dependent motor noise in upper extremity and gaze movements, with these effects greater in older adults. **Purpose**: Whether similar factors drive the trade-off during walking and the effect of aging on the trade-off and its driving factors are unknown. **Methods**: We had 15 young and older adults complete a precision walking task on a treadmill, which required taking steps of prescribed length at different walking speeds using real-time visual biofeedback (full feedback). To determine the influence of visuomotor processing delays on the trade-off, participants only saw visual feedback at the end of each step in some trials (endpoint feedback). We calculated error as the mean absolute distance between their step length and the targets and the influence of signal-dependent motor noise as the standard deviation of the step lengths at each speed. **Results**: We found a speed-accuracy trade-off as errors increased

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with walking speed similarly in both age groups. However, older adults exhibited greater errors on average than young adults. Visuomotor processing delays appeared to partially drive the trade-off as errors were greater on average with endpoint than full feedback similarly in both age groups. However, signal-dependent motor noise did not appear to be a factor as step length variability decreased with gait speed similarly in both age groups. **Conclusion**: As such, other speed-dependent factors unique to walking may influence the trade-off in the task.

**Title**: Do novel interventions improve altered loading strategies during squats post-ACLr

**Authors**: Jiaqi Wang and Susan Sigward

**Faculty Advisor**: Susan Sigward

**Background**: Knee extensor loading deficits compensations that shift demand to the hip and ankle in the surgical limb persist during a bilateral task in patients post-ACLr. It is unclear how specific exercise parameters influence these loading strategies. **Purpose**: To evaluate the effects of interventions aimed at increasing knee extensor loading and limiting compensations from hip and ankle influence loading strategies during a bilateral squat task. **Methods**: Sixteen individuals (7 females) 120±25 days post-ACLr performed bilateral squats under five conditions: 1) uninstructed/natural, with 2) technique instructions 3) GRF feedback of between-limb loading 4) physical constrains for technique and 5) combined GRF feedback and physical constraints. Data collected using 3D motion capture and force platforms were used to calculate sagittal-plane moments. Percent contribution from the knee, hip extensors and ankle plantarflexors were calculated from moment impulse (KEI, HEI, APFI) across squats. Average knee extensor moment KEM (KEI/time) characterized knee extensor demands. Repeated measures ANOVA examined the effects of interventions with post-hoc

paired t-tests compared to the natural squats. **Results**: Significant main effects of condition were observed for all variables. Post-hoc analysis revealed % contribution of the knee increased (p<.001) and of the hip decreased (p<.015) compared to natural squats in all interventions. Ankle contribution decreased in all but the instructed intervention. Average KEM decreased in GRF feedback and constraint conditions. **Conclusion**: All interventions redistributed the demands with the highest redistribution in the combined technique condition. Average KEM did not increase across conditions, and even decreased slightly in GRF feedback and constraints conditions.

**Title**: Rotator Cuff Tendinopathy: Peripheral & Central Contributors to Symptom Severity

**Authors**: Matthew Heindel, Jason Kutch, Oscar Vila Dieguez, and Lori Michener

**Faculty Advisor**: Lori Michener

**Background**: Rotator cuff (RC) tendinopathy is the most common cause of shoulder pain. Unfortunately, up to 50% of those with RC tendinopathy develop chronic pain. Tendinopathy is defined by damage to tendon structure, but it poorly explains variance in symptom severity and clinical outcomes. Central factors of pain processing and pain-related fear have a stronger relationship to symptom severity and clinical outcomes, but no studies measure intrinsic brain activity measurements. **Purpose**: Establish the relative contributions of tendon structure, pain-related fear, and pain-related brain activity in those with rotator cuff tendinopathy. **Methods**: Participants with RC tendinopathy (n=72) were recruited. Supraspinatus tendon thickness (TT) was measured with ultrasound. Collagen alignment was estimated by the distance of the peak frequency content in the power spectrum known as peak spatial frequency radius (PSFR) from TT images. Brain activity in pain-specific regions of interest was measured

with resting-state functional magnetic resonance imaging. Pain-related fear (PRF) was measured from the Orthopedic Screening for Prediction of Referral and Outcome Yellow Flag Assessment Tool. Symptom severity was measured from the PENN Shoulder Score (PENN). Multivariable linear regression was run with PENN as the dependent variable with PRF, TT, PSFR, and brain activity as predictors controlled for weight, age, sex, hand dominance, and side of pain. **Results**: Brain activity (-2.1 SE: 0.6); p=<0.01), PRF (-3.9 SE: 0.6; p=<0.01), and TT (3.6 SE: 1.2; p=<0.01) were all significant predictors of PENN. **Conclusion**: Central pain and psychosocial processing factors significantly contribute to symptom severity in RC tendinopathy with tendon structure.

**Title**: Dynamic Weight Support Enhances Walking and Exploration of Pre-Walking Infants.

**Authors**: Nora Almoadi, S. Dusing, J. Finley, L. Prosser, F. Choudhury, and B. Sargent

**Faculty Advisor**: Barbara Sargent

**Background**: The onset of walking enhances infants' opportunities for exploration. We hypothesized that Dynamic Weight Support (DWS) may enhance time spent on specific walking skills, increase exploration, and promote longer step lengths in pre-walking infants. **Purpose**: To compare differences in walking skills, path length, and step length in pre-walking infants with and without DWS. **Methods**: Fifteen infants born full-term participated in 2 days of DWS. On both days, walking skills, path length, and step length were measured during 10-min conditions. Day 1 included: (a) play without DWS, (b) play in DWS, (c) play in DWS with adult motivation. Day 2 included: (a) play in DWS, (b) play in DWS with adult motivation, (c) play in DWS, (d) play without DWS. **Results**: On Day 1, time spent on specific walking skills significantly increased with DWS compared to without DWS (41.7% vs. 25.2%, *p* <

.0001), with no changes in path or step length. On Day 2, time spent on specific walking skills (53.6% vs. 25.2%, *p* < .0001), path length (63.6 vs. 45.8 meters, *p* < .0001), and normalized step length (0.75 vs. 0.63; *p* < .0001) significantly increased with DWS, compared to without DWS on Day 1. **Conclusion**: Infants born full-term demonstrated increased time spent on specific walking skills, longer path lengths, and increased step lengths with DWS. The next step is to assess infants born preterm and compare their performance to infants born full-term.

**Title**: Role of the cerebellum in visuomotor learning in Parkinon's Disease

**Authors**: Pooja C. Iyer and Beth E. Fisher

**Faculty Advisor**: Beth E. Fisher

**Background and Purpose**: People with Parkinson's Disease (PwPD) can learn adaptation tasks and may process trial outcome feedback of success or failure (reinforcement task). Neuroimaging studies show that increased cerebellar activity maintains motor performance ability in PwPD. However, it is uncertain if cerebellar compensation enables learning. Hence, while PwPD learned the task, we tested compensation by modulating cerebellar activity using transcranial magnetic stimulation (TMS). **Methods**: 16 PwPD (70±11years) visited the laboratory twice with a one-week interval to learn the reinforcement task involving a 25$^0$ perturbation. During the second visit, the cerebellum was disrupted using 1-Hz repetitive-TMS (rTMS) in learners before the task, whereas non-learners received additional cursor-position feedback. Learners showed significant reach angle (angle between the target and cursor) differences between post-perturbation and baseline trials. CBI ratio: The Test Stimulus (TS) delivered to the first dorsal interossei representation in the motor cortex produced a motor-evoked potential (MEP) of

1mV. The Conditioning Stimulus (CS) to the ipsilateral cerebellum 5ms before TS produced MEPs<1mV. The CBI ratio indexed as the MEP amplitude ratio-(CS-TS)/(TS-only) was calculated at baseline, early (start of performance asymptote), and end of perturbation trials. **Results**: Eight PwPD who learned the task ($-7^0 \pm 1^0$, $p<0.001$) showed an increased CBI ratio from baseline ($0.8 \pm 0.05$mV, $p<0.05$), but their learning was impaired post-rTMS ($-2^0 \pm 1^0$, $p>0.05$). The six non-learners showed a statistically insignificant increase in CBI ratio from the baseline ($0.79 \pm 0.15$mV, $p>0.05$), but additional feedback enabled learning ($-8^0 \pm 2^0$, $p<0.01$). **Conclusion**: We showed the potential compensatory role of the cerebellum, warranting further testing.

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### Poster #122

**Title**: Validity of between-limb symmetry for insole sensors during daily activities

**Authors**: Willa Ma, Jiaqi Wang, Jason Cherin, Finley, and Susan Sigward

**Faculty Advisor**: Susan Sigward

**Background**: Restoring loading symmetry is a key recovery goal after neurologic and musculoskeletal injuries. Current understanding of lower extremity loading relies on laboratory force plate data. Understanding natural environment loading behaviors is essential to translate laboratory findings to real life. **Purpose**: To assess the concurrent validity of force plates and insole sensors for between-limb loading symmetry during activities of daily living. **Methods**: Twelve participants performed daily loading tasks on an instrumented split-belt treadmill across two days while wearing loadsol insole sensors. Vertical ground reaction forces (vGRF) were recorded concurrently during single-limb stance (SLS) and randomized tasks including walking. Daily loading was analyzed and considered with and without normalization by SLS body weight. Between-limb symmetry (BLS) was calculated as the ratio of left and right force impulse for both systems. Intraclass correlation coefficients (ICC3,k) assessed validity of body weight during SLS, BLS, and normal-

ized BLS ($BLS_N$). Average between-system differences and limits of agreement (LOA) were calculated. **Results**: ICC results were excellent for SLS ($0.99$, $p<0.001$), poor for BLS ($0.46$, $p=.07$) and moderate for $BLS_N$ ($0.66$, $p=0.006$). Bias and LOA were 6.26N (-62,74.5), -0.014(-0.11,0.08) and 0.02(-0.05,0.09) for SLS, BLS and $BLS_N$, respectively. **Conclusion**: Loadsols are valid for quantifying limb loading symmetry throughout the day. These results validate their use in ecological settings. Despite excellent vGRF agreement during SLS, LOA were up to 15% of body weight. Poor BLS ICC could be attributed to combined error between sensors. Improved $BLS_N$ suggests the necessity of normalizing insole vGRF by SLS values to interpret daily loading deficits.

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### BIOKINESIOLOGY & PHYSICAL THERAPY - PHD STUDENTS, MS STUDENTS, & RESIDENTS

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### Poster #123

**Title**: Dynamic weight support's impact on prone mobility of pre-crawling infants

**Authors**: Ai-Tzu Chan, Stacey Dusing, and Barbara Sargent

**Faculty Advisor**: Barbara Sargent

**Background**: Crawling is one of the first independent locomotor skills. Infants born preterm (PT) demonstrate delayed crawling. Dynamic weight support (DWS) promotes standing and walking skills in pre-walking infants born full-term (FT). We hypothesize that DWS will promote hands-and-knees crawling and increase prone exploration in pre-crawling infants born FT and PT. **Purpose**: To investigate differences of pre-crawling infants born FT and PT in crawling behavior and prone path length with and without DWS. **Methods**: Two pre-crawling infants born FT participated in two consecutive days of prone play with and without DWS while position data was collected using a Qualisys Motion Capture System. On both days, crawling behavior and path length were

measured during the following three conditions: 5-minutes of prone play without DWS, 10-minutes of prone play with DWS, and 5-minutes of prone play without DWS. Crawling behavior (combat crawling, hands-and-knees crawling) was coded via video analysis using Datavyu. Path length was calculated using a custom Matlab program. **Results**: No change was observed in crawling behavior among DWS conditions. However, both infants showed longer path lengths during DWS compared to without DWS. **Conclusion**: These findings suggest that DWS may enhance movement in prone but does not promote hands-and-knees crawling. We plan to collect data from 30 infants born FT and 30 infants born PT to further investigate the impact of DWS on crawling behavior and prone path lengths in both groups.

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### Poster #124

**Title**: Influence of toy affordances on APSP validity in preterm infants

**Authors**: Arya Salgaonkar, Rebecca Molinini, Richard Stevenson, Jennifer Burnsed, Amy Harper, Karen D. Hendricks-Muñoz, Leroy Thacker, and Stacey C. Dusing

**Faculty Advisor**: Stacey C. Dusing

**Background**: Assessment of Problem-Solving in Play (APSP-4) is a play-based tool used to measure motor-based problem-solving abilities in children 3-36 months using three standardized toys (Popup, Cups, Gumball). The popup toy used in previous studies was replaced with same type of toy, that activated with simple contact, rather than switch activation. **Purpose**: This study aimed to determine if variation in toy affordances reduces the validity of the APSP. **Methods**: APSP was performed on extremely preterm (<32 weeks of gestation) infants as a part of the Supporting Play Exploration Early Developmental Intervention (SPEEDI) trial. APSP videos were behaviorally coded to quantify problem-solving behaviors. All five APSP behaviors: look(LK),

Simple (ES) and Complex Explores (EC), Function (FN), and Solution (SL) were compared across three visits. **Results**: The frequency of EC, ES, FN, and SL for the popup toy was high. The interaction between toys and visits is statistically significant in LK, ES, and FN behaviors ($p<0.005$). We compared the weighted total APSP score (rate per minute, RPM), when including only cups and gumball vs all three toys. Total APSP RPM scores were significantly lower when Popup was not included across all visits ($p<0.005$). **Conclusion**: The affordances and ease of non-purposeful activation of the easiest toy could impact the scores of the APSP tool. Toy properties and stability between assessments should be considered when using the APSP to measure problem-solving behaviors.

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### Poster #125

**Title**: Prediction of Secondary ACL Injury: Anatomical and Biomechanical Risk Factors: A Preliminary Analysis

**Authors**: Daniel Edon and Christopher Powers

**Faculty Advisor**: Christopher Powers

**Background**: A limitation of research related to ACL injury mechanisms is the fact that anatomical and biomechanical risk factors have been studied in isolation with only moderate predictive ability at best. It is reasonable to suggest non-contact ACL injuries may be the result of the interaction(s) among anatomical and biomechanical risk factors. **Purpose**: To characterize an individual's risk for secondary ACL injury as defined by the presence of anatomical and biomechanical risk factors. **Methods**: We performed a retrospective analysis of imaging and 2D kinematic data of 40 female athletes who had undergone ACL reconstruction. Twenty had experienced a primary ACL injury and 20 experienced a second ACL injury. Variables of interest included those previously reported to be predictive of ACL injury (4 anatomical risk factors and 3 biomechanical risk factors). Using an aggregated cumulative risk

z-score (dependent variable), we compared the classification accuracy of three risk regression models (anatomical, biomechanical, and combined) to predict secondary ACL injury status (independent variable). **Results**: The regression model encompassing anatomical and biomechanical risk factors significantly predicted secondary ACL injury (p=0.033) and yielded slightly better classification accuracy (65%) compared to when anatomical and biomechanical risk factors were considered in isolation (60% and 57.5%, respectively). **Conclusion**: The presence of anatomical and biomechanical risk factors better predict secondary ACL injury compared to when each is considered in isolation. However, anatomical risk factors appear to have a greater influence on re-injury status than biomechanical risk factors.

**Title**: Computational models of effort and risk trade-offs in walking

**Authors**: Jackeline Tafur-Oviedo and James Finley

**Faculty Advisor**: James Finley

**Background**: Walking control involves a decision-making process between physical effort and risk of falling. People generally prefer comfortable walking speeds that require less effort, but faced with the possibility of falling, they may be willing to exert more effort to control balance. However, we think that these trade-offs may change among individuals. We hypothesize that young adults will be willing to expend less effort as walking speed increases. **Purpose**: To use computational models as an approach to understanding how young adults weigh risk and effort during walking. **Methods**: We used decision data obtained from an experimental protocol where participants chose between a condition with varied physical effort (walking speed) and another with increased risk of falling (walking with forward perturbations). We estimated physical effort by means of metabolic rate and cost of transport, whereas we used the mean

magnitude of the perturbations as a measure of risk. Then, based on expected utility theory, we calculated the utility of each condition as parameters for a logistic regression model to predict the probability of individuals choosing the risky option. **Results**: Generally, as effort increases (walking speeds exceeding their comfortable speeds), the probability of choosing the risky option increases. However, some individuals show a preference for low-risk walking conditions when walking speeds are below their comfortable walking speed. **Conclusion**: Young adults weigh effort based on metabolic rate, although some of them may also prioritize walking efficiency. At speeds above comfortable walking speeds, they prioritize balance over physical effort.

**Title**: Validating a step counter for measuring real-world infant walking

**Authors**: Juliette Pope, Flor Enriques, Christina Hospodar, and Kari Kretch

**Faculty Advisor**: Kari Kretch

**Background**: Prior work has demonstrated discrepancies between what individuals are capable of in standardized tasks (e.g., standardized gait assessment) and how they actually perform in daily life (e.g., real-world walking). Children with Down syndrome (DS) demonstrate differences in gait development compared to their peers with typical development (TD); however, we know little about their real-world walking activity. **Purpose**: Step counters can quantify real-world walking activity; however, they have not yet been validated for children younger than 2 years old or individuals with DS. Our primary purpose is to assess the validity of a step counter (Modus StepWatch) for these populations. **Methods**: We videorecord pre-walking and walking infants (planned N = 20 with TD and 20 with DS) playing for 20 minutes in a lab playroom while wearing a StepWatch on the right ankle. We manually count steps from video and compare manual step counts to StepWatch step

counts. **Results**: Preliminary data from 6 children (3 with TD, 3 with DS) show variable agreement between the StepWatch and manually coded steps (TD: 62%, 96%, 167%; DS: 97%, 101%, 139%; values <100 indicate the StepWatch undercounted, and values >100 indicate that it overcounted). Across participants, the intraclass correlation coefficient was 0.97. Preliminary observations suggest that the StepWatch fails to capture small steps, and erroneously counts steps during activities like climbing on furniture. **Conclusion**: The StepWatch shows reasonable preliminary agreement with human coding. Ongoing analyses will examine which contexts or behaviors increase or decrease StepWatch accuracy.

**Title**: The brainstem modulates sensory transmission to SI in task-dependent ways

**Authors**: Majid Abbasi Sisara, Hesam Azadjou, Shinji Kubota, Kazuhiko Seki, and Francisco Valero-Cuevas

**Faculty Advisor**: Francisco Valero-Cuevas

**Background**: Cutaneous and muscle proprioceptive mechanoreceptors provide critical sensory information to the primary somatosensory cortex (SI) for voluntary hand function in primates. Textbooks describe the thalamus as the main relay for sensory signals from the spinal cord to SI-although the less known cuneate nucleus (CN) of the brainstem, in fact, relays information from the dorsal root ganglion to the thalamus. Given that the CN is known to modulate haptic signals in the cat, we investigated if it also modulates upper limb cutaneous and muscle proprioceptive signals in primates. **Purpose**: To test for differential and contextual modulation in the cuneate nucleus on the way to SI during voluntary wrist flexion and extension movements. **Methods**: We recorded stimulation-evoked local field potentials (SEPs) from the cuneate nucleus (8 electrodes) and the SI (32 electrodes) during stimulation of the sensory (i) deep radial

nerve (DR, muscle proprioceptive) and (ii) superficial radial nerve (SR, cutaneous) during voluntary wrist flexion and extension. **Results**: The average SEPs have distinct shapes across subregions of CN and SI and across tasks. During SR stimulation (Cutaneous sensory information), with a larger initial negative peak in SEPs, compared to DR stimulation (muscle proprioceptive sensory information). Novel cross-correlations between CN and SI are lower for DR stimuli and tend to peak after cross-correlations for SR stimuli during both flexion and extension. **Conclusion**: Lower correlations in DR may suggest that the DR signal is weakly represented in the SI, compared with the SR signal, which is expected because of the subconscious nature of muscle proprioception.

**Title**: Post-Stroke Apathy, Motivation, and Walking Speed

**Authors**: Morgan Kelly, Amelia Cain, Sylwia Lipior, and Kristan Leech

**Faculty Advisor**: Kristan Leech

**Background**: Post-stroke apathy affects forty percent of stroke survivors and is associated with worse functional recovery and decreased participation in daily life. One way post-stroke apathy may influence functional recovery is by impacting walking speed, with apathetic people choosing to walk at speeds much slower than they are capable. **Purpose**: The purpose of this study is to determine if higher apathy and lower motivation are positively associated with walking speed reserve (the difference between the fastest someone can walk and their comfortablebutera speed) in people with chronic stroke. **Methods**: Participants with chronic stroke (>6 months) underwent assessments of apathy, motivation, walking speed, cognitive function, and physical function. Analysis was performed with simple and multiple linear regression. **Results**: Twenty-two participants completed the experiment. The average comfortable walking speed was 0.77 m/s (SD =

0.26), and the average walking speed reserve was 0.33 m/s (SD = 0.21). Intrinsic motivation (p = 0.02), but not extrinsic motivation (p = 0.70), or apathy (p = 0.70) was associated with walking speed reserve. This association held when accounting for the effect of functional capacity on walking speed reserve ($R^2$ = 0.51, p = 0.04). **Conclusion**: Low intrinsic motivation may be contributing to chronic stroke survivors choosing comfortable walking speeds much slower than the fastest they can walk.

### Poster #130

**Title**: Positioning devices and Floor play in Very Preterm Infants

**Authors**: Radhika Attal, Rebecca Molinini, Christine Spence, Jennifer Burnsed, Richard Stevenson, Amy Harper, Karen Hendricks-Munoz, and Stacey Dusing

**Faculty Advisor**: Stacey Dusing

**Background**: Floor positions provide varied developmental opportunities whereas positioning and containing devices limit opportunities for variability. **Purpose**: This analysis explores the use of positioning devices and floor time in very preterm infants from 0-6 months. **Methods**: Parents of very preterm infants in the control group of the SPEEDI trial (NCT03518736) completed weekly surveys on infant's daily activities from enrollment through 28 weeks post-baseline. Time spent in floor positions (supine, prone, sitting), non-floor positions (positioning devices, containers, held/worn), and frequency of container use were analyzed across three age groups: Enrollment to 2 months, 3-4 months, and 5-6 months. Kruskal-Wallis and Pearson Chi-square tests were performed. **Results**: Significant differences were observed in median time spent within each floor position across age groups (p's< 0.001). Pairwise comparisons revealed an increase in median duration at 3-4 months and 5-6 months compared to 0-2 months across floor positions (p's< 0.05). No differences were found in the time spent in non-floor positions. There was a significant association between age and frequency of container use, including use of bumbo seat, walker, and exersaucer (p =< 0.05). **Conclusion**: Parents increased the time infant spent in floor positions and modified the type of containing devices as the infant ages. Future analysis can explore the effect of interventions on play positions.

### Poster #131

**Title**: Generalization of Visuomotor gain adaptation among young and old adults

**Authors**: Rukshana Poudel, Yifan Zhang, Selina Hua, and Nicolas Schweighofer

**Faculty Advisor**: Nicolas Schweighofer

**Background**: Visuomotor adaptation is a crucial aspect of motor learning that allows individuals to adjust their movements in response to changes in the environment. However, the extent to which this adaptation generalizes across different movement directions and how it differs between young and older adults remains unclear. **Purpose**: To compare the generalization of visuomotor gain adaptation among healthy young and old adults and measure the implicit component of the task. **Methods**: Healthy young and older adults participated in an online visuomotor gain adaptation experiment deployed via Firebase on the Prolific platform. Participants performed a target-reaching task using a computer mouse with their dominant hand. Targets were positioned at 0° (forward reaching direction in the mid-sagittal plane), ±22.5°, ±45°, ±90°, and 180°. The experiment included familiarization, baseline, learning, generalization, retention, and relearning phases. During the learning phase, a gain of 0.6 was introduced for the training direction (0°), and the implicit component was measured using no-feedback trials. **Results**: Older adults show reduced generalization to untrained directions compared to young adults, particularly for directions further from the trained direction. The implicit component of learning is similar between young and older adults, while explicit strategies are reduced in older adults. **Conclusion**: This study provides insights into age-related differences in visuomotor gain adaptation and its generalization. Understanding these differences can inform the development of targeted interventions to maintain and improve motor learning abilities across the lifespan.

### Poster #132

**Title**: Identification of High-Risk Landing Strategies for ACL injury Using 2D video: A Cluster Analysis

**Authors**: Stanley Smith, Susan Sigward, Nicolas Schweighofer, and Christopher Powers

**Faculty Advisor**: Christopher Powers

**Background**: Previous research has identified kinematic and kinetic risk factors for non-contact ACL injury based on data obtained using 3D motion capture and force-plates. Recently, the use of 2D video has provided reasonable estimates of 3D risk factors collected in a laboratory setting. Providing evidence that 2D surrogates of 3D risk factors can characterize persons at risk for ACL injury is an important step in developing clinic-friendly approaches to ACL injury prevention. **Purpose**: The purpose of this study was to determine if 2D surrogates of 3D biomechanical variables that have been shown to predict future ACL injury can be used to characterize an athlete's landing strategy as high-risk. **Methods**: 3D kinematic and kinetic data and 2D video were obtained simultaneously from 37 healthy athletes during a drop-jump task (13 males and 24 females). Variables of interest included those reported in prospective studies to be predictive of ACL injury and the associated 2D surrogate measures. Separate k-means clustering analyses (k=2) were conducted to group the athletes based on the 3D data and 2D data. The percentage of athletes assigned to the high-risk group using both the 3D data and 2D surrogate measures was the primary outcome of interest. **Results**: The number of athletes assigned to the high-risk cluster using the 3D data and 2D surrogate measures was 13 and 12, respectively. 87% of these individuals were assigned to the high-risk cluster in both situations. **Conclusion**: These findings suggest that high-risk landing strategies can be identified with reasonable accuracy using 2D surrogates of 3D biomechanical risk factors.

### Poster #133

**Title**: Changes in arm choice to abrupt and gradual motor adaptation

**Authors**: Tanya Subash, Lexuan Dai, and Nicolas Schweighofer

**Faculty Advisor**: Nicolas Schweighofer

**Background**: The decision to use one arm over the other is a frequent, automatic part of daily life. In response to a movement perturbation, either following a movement disorder like a stroke or artificially via changes in the environment that affect the arms asymmetrically, learning to reduce movement errors occurs primarily through the gradual update of an internal forward model. As individuals re-learn to move with the arm, their decision-making is updated based on performance. **Purpose**: The nature of the perturbation-whether introduced suddenly or gradually-can affect motor learning and decision-making. The evolution of arm choice behavior in response to different perturbations is not understood. **Methods**: We perturbed one hand by introducing a rotation to the visible cursor relative to the hand's movement during a free-choice reaching task in a virtual reality environment. A large, sudden rotation is introduced to simulate a drastic change in movement, akin to the sudden onset of motor deficits. Small, incremental rotations are introduced over time to simulate a progressive motor impairment. **Results**: Arm choice changes minimally when the perturbation is introduced gradually, but changes drastically when there is an abrupt perturbation. **Conclusion**: During an abrupt perturbation, the error causes target remapping, so the expected motor cost changes. In contrast, during a gradual per-

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turbation, the internal model is updated requiring no change in the movement goal.

**Title**: Patellar Tendon Morphology: Association with Intrinsic Factors in Volleyball Athletes

**Authors**: Ya-Hsin Chang, Jia Liu, Lisa Noceti-DeWit, and Kornelia Kulig

**Faculty Advisor**: Kornelia Kulig

**Background**: Patellar tendinopathy is highly prevalent among volleyball athletes, but the relationship between tendon micromorphology and intrinsic factors is unknown. **Purpose**: To characterize the relationship of proximal and distal patellar tendon micromorphology with body anthropometrics and lower limb mobility in volleyball athletes. **Methods**: 138 active elite-level volleyball athletes were examined. Peak spatial frequency radius (PSFR) represented tendon micromorphology, with higher values indicating better collagen fiber organization. Anthropometrics included body mass, height, and waist-to-hip ratio. Lower limb mobility tests included ankle dorsiflexion, hip rotations, quadriceps flexibility, and a single-leg squat. Athletes with and without patellar tendinopathy were compared. The relationship of PSFR with each variable was examined. **Results**: Athletes with patellar tendinopathy (46.4%) showed greater tendon thickness (5.25 ± 1.17 vs. 4.83 ± 0.86, p = 0.044) and lower PSFR (1.58 ± 0.32 vs. 1.73 ± 0.31, p = 0.02) at the proximal tendon than asymptomatic athletes. In all athletes, proximal PSFR was negatively related to years of play (rho = -0.25, p = 0.012), and distal PSFR was positively correlated to ankle dorsiflexion (r = 0.22, p = 0.028) and hip internal rotation (r = 0.25, p = 0.012), and negatively correlated with body weight (r = -0.27, p = 0.006) and waist-to-hip ratio (rho = -0.28, p = 0.004). **Conclusion**: Athletes with worse distal tendon micromorphology had more limited hip and ankle mobility, larger body mass, and higher mass concentration around the waist. Understanding these factors related to tendon morphology is crucial for tendon health and athletic career longevity.

**Title**: Objective measurement of community mobility in adults with chronic stroke

**Authors**: Amelia Cain and Kristan Leech

**Faculty Advisor**: Kristan Leech

**Background**: Community mobility encompasses an individual's physical activity and activity space, or spatial extent in which they move. Global Positioning Systems (GPS) monitoring allows for direct assessment of activity space and provides unique information about community participation. Despite stroke survivors' report that getting out in their community is important or essential, there has been limited objective measurement of community mobility in adults with chronic stroke. **Purpose**: This work aims to: 1) Establish the validity of a metric of GPS-derived activity space in chronic stroke, 2) Determine how activity space differs between those with chronic stroke and those without. **Methods**: Adults who are at least six months post-stroke and able to walk without another person's assistance, and age- and location-matched adults who have not had a stroke will be included. We will collect 1-week of GPS location data and simultaneous actigraph-derived physical activity data, and a subjective assessment of activity space, the Life-Space Assessment (LSA). We will determine convergent validity of GPS-derived activity space through assessing the correlation between LSA and GPS-derived activity space, and will use semi-structured interviews and surveys of stroke survivors to qualitatively determine which metric best represents activity space. We will use a Wilcoxon Rank Sum test to compare GPS-derived activity space in chronic stroke survivors to controls. **Conclusion**: A validated, objective measure of community mobility for adults with chronic stroke will help to elucidate potential deficits in chronic stroke survivors' participation and provide the necessary foundation to identify factors that influence stroke survivors' community mobility.

**Title**: Investigating the contribution of feedforward control on walking speed post-stroke

**Authors**: Christina K. Holl and Kristan A. Leech

**Faculty Advisor**: Kristan A. Leech

**Background**: While most stroke survivors regain some degree of walking function, many continue to walk slowly compared to age-matched neurotypical individuals. Improving walking speed after a stroke is a priority for stroke survivors and physical therapists alike, as research indicates that reduced walking speed is strongly associated with decreased quality of life and increased mortality. One possible explanation for reduced walking speed post-stroke is feedforward control deficits. Feedforward control prepares motor commands in advance of movement, allowing for fast and coordinated movements. Upper extremity studies have demonstrated impaired feedforward control in people post-stroke. However, less is known about how feedforward control impacts walking speed post-stroke. **Purpose**: Investigate the association between feedforward motor control and self-selected walking speed in individuals living with chronic stroke. **Methods**: People with chronic stroke (>6 months from onset) will perform a target-stepping task, including quickly sliding their foot towards a target along a frictionless surface. Foot targets and feedback of foot position will be displayed on a TV screen in front of them. Feedforward control capacity will be assessed using movement smoothness (number of velocity peaks). Self-selected walking speed will be determined using the 10 Meter Walk Test. **Results**: We expect that individuals post-stroke with decreased feedforward motor control capacity will walk at slower self-selected speeds. **Conclusion**: Addressing persistent slow walking speed in people post-stroke is vital to improving quality of life and decreasing mortality. This work may inform physical therapy practice to focus on tuning feedforward control mechanisms during walking rehabilitation.

**Title**: Effects of whole-body immersive activity on psycho-physical and neural responses: Study Protocol

**Authors**: Jayati Upadhyay and Jason Kutch

**Faculty Advisor**: Jason Kutch

**Background**: As an initial study to determine the specific effects of a whole-body immersive activity, we have developed a virtual reality (VR) surfing simulator to rigorously understand the mechanisms involved. **Purpose**: The study aims to determine whether VR surfing leads to significant changes in participant engagement, brain activity and pain sensitivity. **Methods**: This is a two-phase pilot study that includes recruitment of the intervention group in phase one and matching of participants in a comparator control condition in phase two. Ten healthy adults will be recruited in each group. A repeated measures design will be employed, assessing participants at different timepoints; from baseline to 30 minutes post intervention. The intervention will include 30 minutes of surfing waves in the VR setup. The control task will lack the immersive aspect present in the intervention task. The primary outcome is the participant engagement, assessed using a subjective questionnaire. Secondary outcomes include peak alpha frequency (PAF), a neural biomarker of brain health, obtained using EEG and pain sensitivity, a measure to quantify pain perception, obtained using a pressure algometer. **Results**: We hypothesize that VR surfing will be a more enjoyable task than the control task. We also hypothesize that it would lead to a higher increase in PAF and greater decrease in pain sensitivity. **Conclusion**: Insights from this study may reveal VR surfing's potential as a novel intervention for enhancing brain function and managing chronic pain.

## Poster #138

**Title**: Comparing PAF Metrics in Differentiating Widespread versus Localized Chronic Pain

**Authors**: Jason M. Cherin and Jason J. Kutch

**Faculty Advisor**: Jason J. Kutch

**Background**: Recently, peak alpha frequency (PAF), an electroencephalographic (EEG) measure of brain activity, has emerged as a promising marker for pain sensitivity in acute experimental pain and central sensitization in chronic pain. However, discrepancies exist regarding the relation of PAF to pain-related neural activity, and the optimal PAF metric for these outcomes remains unknown. While some groups focus on a global average PAF, which averages brain activity across the whole scalp, others utilize a component PAF that isolates signals from specific regions of interest. Our lab previously demonstrated that global average PAF could differentiate individuals with urologic chronic pelvic pain syndrome (UCPPS) into groups with widespread or localized pain. In contrast, other groups have used sensorimotor PAF to predict pain sensitivity in acute pain models. **Purpose**: This study will compare the efficacy of global average PAF and sensorimotor PAF in distinguishing between widespread and localized chronic pain. **Methods**: Thirty-eight individuals with UCPPS were categorized as having widespread (n = 24) or localized (n = 14) pain based on self-reported body maps. Resting-state EEG data were collected, and PAF was calculated using spectral analysis and group independent component analysis. **Results and Conclusion**: Preliminary results indicate no significant differences between global average and sensorimotor PAF in differentiating pain categories, suggesting pain-related brain activity may reflect global rather than localized cortical mechanisms. Future studies should replicate these analyses in other chronic pain populations and explore PAF metrics in acute pain models to determine the clinical utility of PAF as a biomarker for pain-related outcomes.

## Poster #139

**Title**: Using an Arm Action Training Device Can Influence Pitch Performance Metrics

**Authors**: Shant Minassian, Daniel Awokuse, Lori Michener, and Jonathan Sum

**Faculty Advisor**: Jonathan Sum

**Background**: The relationships between arm mechanics and ball metrics have been well established and can impact the health of the ulnar collateral ligament (UCL). Arm action training devices may impact arm mechanics in pitchers. **Purpose**: The purpose of this study was to determine the effect of an arm action training device on arm metrics (arm slot:ASl, arm speed: ASp, elbow varus torque: EVT) and ball metrics (spin rate: SR, ball velocity: BV, ball position at point of release: BP) during pitching. **Methods**: Seven college-eligible baseball pitchers threw 5 fastballs at 100% effort and 5 fastballs with the *Pocket-Path Arm Action Trainer®* (PP) SR, BV, BP were measured using Trackman®. ASl, ASp, and EVT were measured using Driveline PULSE®. Paired t-tests were used to compare pitches pre-PP and post-PP. Non-parametric Spearman's correlations were used to determine relationships between arm and ball metrics. **Results**: Comparing measures pre-PP vs. post-PP revealed decreased BV (p=0.009), SR (p=0.71), EVT (p=0.07), and BP (p=0.57), while there was increased ASp (p=0.23) and ASl (p=0.80). With PP, a negative relationship existed between ASp and BV (r=-0.69,p=0.00) and a positive relationship existed between ASl and BV (r=0.44,p=0.02). **Conclusion**: Using an arm action training device can influence ball and arm mechanics impacting pitching performance and elbow stress, which can inform clinicians when designing throwing and rehabilitation programs.

> **OCCUPATIONAL SCIENCE & OCCUPATIONAL THERAPY - DOCTORAL STUDENTS & POST-DOCTORAL SCHOLARS**

## Poster #140

**Title**: Factors Influencing Clinical Decision-Making in Inpatient Rehabilitation: A Scoping Review

**Authors**: Caitlin G. Dobson, Holly Carrington, Sophia Hameed, Gloria Hernandez, Hannah Go, and Alison M. Cogan

**Faculty Advisor**: Alison M. Cogan

**Background**: While much literature on inpatient rehabilitation focuses on using specific interventions, assessments, and therapeutic approaches, the clinical reasoning guiding how rehabilitation practitioners select them remains unclear. Understanding the rationale behind clinicians' decisions may lead to better understanding of rehabilitation service delivery and what can be done to improve inpatient rehabilitation outcomes. **Purpose**: To identify factors surrounding decision-making processes of inpatient rehabilitation clinicians. **Methods**: Scoping review using PubMed, CINAHL, and PsycInfo. Reviewers independently screened articles and extracted data using Covidence. Included studies featured occupational therapists, physical therapists, and speech-language pathologists in inpatient rehabilitation facilities. We extracted sample details, patient population treated, publication year, country, and key findings. Two reviewers coded the extracts and identified themes through inductive analysis. **Results**: Out of 1091 unique articles, 52 met inclusion criteria. Thirty-four featured qualitative study designs. Factors contributing to decisions included patient personal life, team collaboration, within-session communication, knowledge-base and background of the therapist, considerations in treatment delivery (with sub-themes of discharge planning and treatment planning), and institution-related factors that influence practice (with sub-themes of therapist duties, institutional constraints and facilitators, and perceived value and payoff of treatment). **Conclusion**: Inpatient therapists' clinical decisions involve consideration of patient abilities and support, therapist abilities and work conditions, and time pressure. Therapists prefer familiar approaches to complex or time-intensive ones, and work culture shapes decision-making norms. Future research may examine these factors' relationships to patient outcomes and implementation of evidence-based treatments and tools.

## Poster #141

**Title**: Hand Therapy Clinical Documentation Practices and Perspectives

**Authors**: Katherine J. Loomis and Shawn C. Roll

**Faculty Advisor**: Shawn C. Roll

**Background**: Large-scale research using hand therapy (HT) clinical data can provide insights into practice patterns, informing improved care effectiveness to meet diverse patient needs. Such research efforts require accurate clinical harmonized from a wide range of diverse clinical settings. Yet, there is little knowledge on the current state of documentation across these settings. **Purpose**: Explore the variability in hand therapists' practices and priorities regarding clinical documentation. **Methods**: We distributed an electronic survey to hand therapists through the American Society of Hand Therapists and via emails to authors of publications in major HT journals. Multiple choice, multiple selection, Likert-style, and numeric entry questions elicited perspectives on (1) documentation procedures/burden, (2) documentation features, (3) and the importance and reporting of multi-dimensional patient factors. Responses were examined via descriptive analyses to identify trends and variations. **Results**: Most of the165 therapists who completed the survey (98%) use electronic medical records (EMR) systems, with 75% linked to larger entities or networks. The median minutes to complete various documentation types ranged from 10-25, and 90% of the time documentation was finished by end of day. Therapists frequently document clinical measures: 42% complete reassessments at least every few weeks and

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68% often/routinely complete weekly solitary measures. However, 69% only rarely/occasionally have time to document to their preferred standard. Multidimensional factors fell into 3 tiers of importance, with the top factors highly represented throughout documentation. **Conclusion**: These findings provide foundational knowledge to inform future research efforts to synthesize and analyze large-scale HT clinical data.

**Title**: Barriers and Facilitators to Implementing Sensory-Based Modifications in Pediatric Dentistry

**Authors**: Lily Shkhyan, Shannon Roux, and Leah I. Stein Duker

**Faculty Advisor**: Leah I. Stein Duker

**Background**: It is well-documented that sensory processing difficulties are linked to challenges with pediatric dental care, but little is known about the implementation of sensory-based modifications (SBMs) during pediatric dental care. **Purpose**: To explore implementation-related barriers and facilitators influencing the utilization of SBMs in pediatric dental care. **Methods**: An online survey was disseminated nationally to dental professionals treating children using convenience and snowball sampling. The survey included 46 items exploring SBMs across single modalities (i.e., visual, auditory, gustatory, olfactory, tactile, vestibular) as well as use of a sensory adapted dental environment intervention; up to 98 additional items were presented based on respondent responses. This analysis examined the 43 items focused on implementation-related barriers and facilitators. **Results**: Participants (n=550) were primarily White, non-Hispanic, pediatric dentists (all ≥75%) with a mean age of 45 years. Commonly endorsed facilitators (all ≥85%) included the perception that SBMs were: compatible with current practice, moderately-extremely easy to tailor for patients, and could enhance dental care for children.

Respondents most frequently learned about SBMs via dental colleagues (88%), clinical education (53%), and/or professional guidelines (38%). Most frequently endorsed barriers included: cost (29%), training (26%), and time required to implement (23%). Two-thirds of respondents reported that their opinion of SBMs had changed since beginning practice; of those, 99% reported a positive change. **Conclusion**: Results suggest that dental professionals overwhelmingly perceive SBMs to be compatible with practice and beneficial for patients; however, cost, time, and training-related barriers must still be addressed in order to facilitate uptake of these strategies.

**Title**: Neural activity, gut metabolites, and autism symptomatology in autistic youth

**Authors**: Sofronia M. Ringold, Aditya Jayashankar, Emily Kilroy, Christiana Butera, Jonathan P. Jacobs, Skylar Tanartkit, Swapna Mahurkar-Joshi, Mirella Dapretto, Jennifer S. Labus, Emeran A. Mayer, and Lisa Aziz-Zadeh

**Faculty Advisor**: Lisa Aziz-Zadeh

**Background**: Gut metabolites are theorized to play a role in the pathophysiology of autism spectrum disorder (ASD) via the brain-gut-microbiome (BGM) system. Roughly 30% of autistic individuals show elevated blood serotonin, a tryptophan metabolite linked to mood, appetite, and social interactions. Some tryptophan metabolites can cross the blood-brain-barrier and potentially influence brain activity. Prior research links tryptophan metabolites to behavior in ASD, but their interaction with brain activity remains unexplored. **Purpose**: To assess differences in tryptophan metabolites and examine associations between metabolite levels, neural activity during socio-emotional and sensory tasks, and behavior in ASD and neurotypical (NT) children. We also explored whether neural activity mediates associations between metabolites and behavior. **Methods**: 43 ASD

and 41 NT children underwent task-based fMRI, behavioral assessments, and provided fecal samples. General linear models assessed group differences in tryptophan metabolites and associations between tryptophan metabolites, brain activity, and behavior. Mediation modeling evaluated whether neural activity was a mediator of metabolite-behavior relationships. **Results**: NT children had significantly higher levels of the tryptophan metabolite kynurenate (q<0.10). In the ASD group, metabolites were significantly associated with brain activity in the insula and cingulate, autism severity, sleep quality, sensory sensitivities, and disgust sensitivity. Mediation analyses revealed mid-insula and mid-cingulate activity mediated relationships between indolelactate, tryptophan betaine, and ASD severity. **Conclusions**: This study supports prior research implicating dysregulation of the BGM system, specifically related to the tryptophan pathway, in ASD. It is the first to elucidate how interactions between gut metabolites and brain activity may impact autism symptomatology.

**Title**: Multi-Perspectival Study: Building Caregiver-Provider Partnerships in the Autism Community

**Authors**: Svitlana Stremousova, Rhina Padilla, Emily Ochi, Erna Blanche, and Mary C. Lawlor

**Faculty Advisor**: Mary C. Lawlor

**Background**: Multiple pandemics, including health inequities, racial and social injustices, and COVID-19, amplified existing systemic weaknesses. Researchers have previously discussed the significance of service user-provider relationships and collaborative "partnering up" to facilitate desired outcomes (Lawlor & Mattingly, 2018), but knowledge gaps exist on how partnerships between families of autistic children and providers are developed. **Purpose**: To analyze multiple perspectives on partnerships between families of autistic

children and providers developed during times of systemic disruptions. **Methods**: Individual and collective narrative interviews (n=75) containing perspectives of caregivers, educators, and therapists on COVID-19 lived experience were analyzed using narrative phenomenological and thematic analysis approaches to examine the perceptions of partnership development. **Results**: COVID-19 caused occupational disruptions and increased the complexity of daily interactions for many study participants. Families and providers worked together to support children's participation and development. Through data analysis, we identified four main themes: time and place, communication, empathy, and trust in developing family-provider partnerships. **Conclusion**: Our findings reflect that participant perceptions of collaborations and partnerships were heterogeneous and dynamic, ranging from building strong alliances to grappling to keep connections after returning to in-person. Developing partnerships is grounded on complementarity, when involved parties contribute to understandings, expertise, aspirations, and problem-solving strategies (Lawlor & Mattingly, 2018; Park et al., 2021; Restall & Egan, 2021). We suggest that "partnering up" is a multifaceted phenomenon interrelated with person, occupation, and contexts where this process occurs. Further research is needed to examine the role of institutions and communities in shaping contexts where families and providers develop partnerships.

**Title**: Assessing Physical Strain and Ergonomic Risks in Dental Hygiene Training

**Authors**: Yiyang Fang, Jay M. Kapellusch, Nancy A. Baker, and Shawn C. Roll

**Faculty Advisor**: Shawn C. Roll

**Background**: Dental hygienists experience a high prevalence of work-related musculoskeletal disorders (WMSDs) due to the repetitive

and strenuous nature of their work. Examining work patterns of clinical training in education programs is essential to mitigate future WMSD risks. **Purpose**: Identify factors contributing to increased physical strain during dental hygiene clinical training. **Methods**: Video observations of students from two bachelor's degree dental hygiene programs were analyzed during clinical practice sessions. A video observational protocol was employed to administer the Revised Strain Index and quantify a composite strain index (COSI) score for each recording. Exploratory multivariate prediction modeling was conducted to determine force use and posture patterns associated with increased strain. **Results**: Analysis of 151 video recordings revealed an average COSI score of 10.58 (SD = 2.75), with scores >10 indicating a high risk for WMSDs. One program exhibited significantly higher COSI scores (M = 11.87, SD = 2.02) compared to the other (M = 9.31, SD = 2.81), p < 0.001, attributed to a more frequent use of manual scaling over ultrasonic-powered tools. COSI scores were significantly associated with patient diagnostic severity, with greater periodontitis severity linked to higher scores (p = 0.008). Post-hoc analysis indicated that the most severe patients had significantly higher COSI scores than those in the two least severe diagnostic groups. **Conclusion**: Dental Hygiene students are at a high risk of developing WMSDs. Programs that prioritize manual scaling increase physical strain, which may be further exacerbated by patients exhibiting more severe periodontitis diagnostics.

### Poster #146

**Title**: Sensory Response Pattern Trajectories in Children with and without Autism

**Authors**: Yu Tang, April Flores, Megan Kim, Julia Lisle, Katherine Hayes, John Sideris, and Grace T. Baranek

**Faculty Advisor**: Grace T. Baranek

**Background**: The Sensory Experiences Questionnaire Version 3.0 (SEQ-3) is a validated measure for autistic children that assesses Hyperresponsiveness (HYPER), Hyporesponsiveness (HYPO), Sensory Interests, Repetitions, and Seeking Behaviors (SIRS), and Enhanced Perception (EP). Despite the strong validity studies in the literature, age-related trajectories need to be tested across autistic and typically-developing (TD) groups to establish whether differences exist in the rate or shape of change across each sensory pattern. **Purpose**: To examine how sensory response patterns change across age, and test group differences between autistic and TD children ages 2-12 years. **Methods**: SEQ-3 data from three studies was pooled for participants ages 2-12 years old with autism (n=1,271) and that were TD (n=816). Analyses included one to four SEQ-3.0 for each child, with a total of 2,099 SEQ-3.0 measurement points total. SAS PROC MIXED models tested linear, quadratic, and cubic models of age, and tests of group interactions for the four sensory response patterns. **Results**: Compared to TD, autistic children had significantly higher scores across all four sensory response patterns. The groupX-age interaction was significant for SIRS(p=0.03), HYPO(p < 0.01), and EP(p=0.03), indicating age-related differences between both groups. Slopes and shapes for the groups followed a similar trajectory for HYPER. All four main effects of age were significant; the quadratic effect was significant for EP. **Conclusion**: These findings illustrate differences in the expected development across four sensory response patterns from 2-12 years of age, highlighting how autistic and TD children differ in their level and rate of change in some variables.

### Poster #147

**Title**: Illness Intrusiveness Mediating Association between Activity Disruption and Life Satisfaction

**Authors**: Yujia Mo, Raymond Hernandez, Clair Hoogendoorn, Stefan Schneider, Jeffrey Gonzalez, and Elizabeth Pyatak

**Faculty Advisor**: Elizabeth Pyatak

**Background**: Type 1 diabetes is widely recognized for its disruptive effects on daily activities. Illness intrusiveness (II) is a psychological construct mediating the impact of disruptive experiences on health outcomes in chronic conditions. **Purpose**: To examine activity disruptions in adults with T1D and their relationships with illness intrusiveness and life satisfaction (LS). **Methods**: Data were extracted from a longitudinal study, Function and Emotion in Everyday Life with Type 1 Diabetes (FEEL-T1D). AD was measured by a 14-day ecological momentary assessment by participants reporting the current activities and the disruptive status. II and LS are evaluated using Adapted Illness Intrusiveness Rating Scale (AIIRS) and Satisfaction with Life Scale (SWLS), respectively, during follow-up surveys. Linear regression and mediation analyses were conducted, adjusting for demographic and diabetes-related factors. **Results**: 196 participants (aged 18-75 yr) completed the study protocol. The majority are male (54.6%) and identify as Hispanic (40.8%). Of 144,976 reported activities, 1,677 activities were disrupted. Participants had an average AIIRS score of 3.02 (1.00~6.47) and a SWLS score of 21.97 (5~35). There are no significant associations between AD and LS, with and without adjustment. The mediation analyses indicated II fully mediated the relationship between AD and LS when adjusting for income (path a = 2.81, p <0.001; path b = -2.27, p <0.001; direct effect = 4.01, p = 0.11; indirect effect = -6.37, p <0.001). The effects varied in different AD types. **Conclusion**: The inconsistent impact of AD on LS and through the mediation of II highlights the need for re-operationalizing disruption in the population.

### Poster #148

**Title**: An emerging vascular MRI biomarker for classification of post-stroke sensorimotor outcomes

**Authors**: Stuti Chakraborty, Jeiran Choupan, Octavio Marin-Pardo, Mahir H. Khan, Giuseppe Barisano, Bethany P. Tavenner, Miranda R. Donnelly, Aisha Abdullah, Justin W. Andrushko, Nerisa Banaj, Michael R. Borich, Lara A. Boyd, Cathrin M. Buetefisch, Adriana B. Conforto, Steven C. Cramer, Martin Domin, Adrienne Dula A., Jennifer K. Ferris, Brenton Hordacre, Steven A. Kautz, Neda Jahanshad, Martin Lotze, Kyle Nishimura, Fabrizio Piras, Kate P. Revill, Nicolas Schweighofer, Surjo R. Soekadar, Shraddha Srivastava, Sophia I. Thomopoulos, Daniela Vecchio, Lars T. Westlye, Carolee J. Winstein, George F. Wittenberg, Kristin A. Wong, Paul M. Thompson, and Sook-Lei Liew

**Faculty Advisor**: Sook-Lei Liew

**Background**: Perivascular Spaces (PVS) are fluid-filled spaces that are visible on brain imaging and may be a vascular marker of whole-brain health. Previously we found that PVS volume in the white matter centrum semiovale (CSO) is cross-sectionally associated with post-stroke sensorimotor outcomes above and beyond standard stroke lesion metrics. **Purpose**: To determine whether CSO PVS volume can dissociate individuals with good versus poor outcome, despite the same amount of stroke lesion damage [defined here by corticospinal tract lesion load (CST-LL) and lesion volume]. **Methods**: Propensity score matching was applied to individuals with good versus poor sensorimotor outcomes (n = 216,108 matched samples in each group), based on CST-LL and lesion volume. Good balance was achieved across both matched groups (standardized mean difference <0.1). We then used logistic regression on the matched dataset to predict good versus poor sensorimotor outcomes as a binary variable, with CSO PVS volume as the primary predictor; age, sex, time since stroke and intracranial volume as fixed covariates, adding site as a random effect. **Results**: We found that CSO PVS volume marginally significantly dissociated good versus poor sensorimotor outcomes (CSO PVS volume: odds ratio [OR] 0.57, p = 0.061). Individuals with poor outcomes had a higher mean CSO PVS volume (0.96 ± 05.7) than individuals

**Abstracts**

with good outcomes (0.83 ± 0.48) despite the same amount of CST-LL and stroke lesion damage. **Conclusion**: PVS may provide insight into how overall vascular brain health impacts inter-individual differences in post-stroke sensorimotor outcomes.

### Poster #149

**Title**: Evaluating and Understanding Participation in Brain Injury: A Transactional Viewpoint

**Authors**: Holly Carrington and Alison M. Cogan

**Faculty Advisor**: Alison M. Cogan

**Background**: Traumatic brain injury (TBI) is a chronic condition impacting societal participation, a rehabilitation outcome defined as involvement in life situations. The Participation Assessment with Recombined Tools-Objective (PART-O) is a widely used measure of post-TBI participation, consisting of 17 items across three categories: Productivity, Social Relations, and Out and About. Although psychometrically valid, the PART-O measures objective participation and may not capture subjective experiences of individuals with TBI. **Purpose**: To identify gaps in the PART-O using a transactionalism framework and related implications. **Methods**: Transactionalism conceptualizes participation as a dynamic process encompassing the individual and their context as a cohesive whole. Transactionalism was selected for its ability to evaluate participatory outcomes in conjunction with context, subjectivity, and sociodemographic factors. Using transactionalism, the PART-O's gaps were identified and interpretive implications explored. **Results**: Shortcomings in Productivity included a lack of consideration for structural factors affecting participation and variation in how individuals attribute meaning to activities. In Social Relations, gaps included a failure to account for the impact of stigma and exclusion on sociality, and the underexplored benefits of relationships within TBI groups. In Out and About, findings highlighted

issues with the scale's focus on activities requiring financial resources and transportation. **Conclusion**: This critique illuminated the complex nature of participation that extends beyond the scope of the PART-O and emphasized the impact of social and personal factors extraneous to TBI. These findings underscore the need to move beyond objective participation measures, toward research that re-conceptualizes this construct with greater sensitivity for context and subjectivity.

### Poster #150

**Title**: Comparing Feasibility and Health Impacts of Floor and Chair Sitting

**Authors**: Loree Pham and Beth Pyatak

**Faculty Advisor**: Beth Pyatak

**Background**: This protocol outlines a two-phase study investigating the effects of different sitting environments - specifically floor versus chair sitting - on movement, postural changes, and general well-being, with an innovative focus on sedentary behavior modifications. **Methods**: The study consists of a controlled lab experiment followed by a month-long observational phase, involving adults capable of sitting on the floor comfortably. In the first phase, participants undergo 30-minute sessions of floor and chair sitting, during which movement and posture are recorded via accelerometers and video. Mixed models will analyze data to compare movement and postural changes across sitting types, considering repeated measures. The second aim engages participants in daily floor sitting for an hour, with sitting time tracked via daily diaries and a final interview to capture personal insights. Both phases will consist of qualitative interviews to assess the subjective experience and will be analyzed using thematic analysis to gain a deeper understanding of participants' perspectives and experiences. **Conclusion**: This innovative approach explores how sitting environments affect health behaviors and postural dynamics within a Western context

where chair sitting is standard. The study will clarify biomechanical effects and the practicality of floor sitting, potentially informing culturally-inclusive, adaptive lifestyle interventions. By directly comparing floor and chair sitting, the study findings will provide insights and potentially simple yet impactful ways to reduce the harms of sedentary behavior and prolonged sitting while promoting health.

### Poster #151

**Title**: Mothering Practices in the NICU: A Theoretical Inquiry

**Authors**: Sahar Ghahramani and Leah Stein Duker

**Faculty Advisor**: Leah Stein Duker

**Background**: Premature birth and subsequent neonatal intensive care unit (NICU) hospitalization profoundly disrupts mothering practices, challenging maternal identity, emotional well-being, and caregiving engagement. Clinical interventions often prioritize infant survival and developmental outcomes, attending less to the mother's experience. **Purpose**: Exploring the relationship between premature birth/NICU environment and mothering practices. **Methods**: Literature published in multiple disciplines (e.g., psychology, anthropology, occupational therapy) describing mothering practices in the NICU following a premature birth (n=67) were analyzed utilizing the theoretical concept of occupational disruption, as described in occupational science. **Results**: Both barriers and facilitators to developing and enacting mothering practices exist in the NICU. Barriers to mothering practices included a lack of maternal agency (e.g., reliance of infants on medical technology and NICU staff, leaving mothers feeling powerless in caring for their infant), societal expectations (e.g., absence of an immediate bond with infant), and feelings of disrupted and non-linear temporality in the NICU. Facilitators of mothering practices included supportive social environments (e.g., NICU staff, maternal support groups) and education supporting the expansion of preconceived notions of moth-

er-infant engagement (e.g., premature infant engagement behaviors can be subtle). **Conclusion**: Results suggest that occupational disruption is present as related to mothering practices in the NICU; however, supportive interactions and education may be protective against this occupational disruption. Utilizing family-centered care models that place the mother-infant dyad at the core of practice may enhance maternal involvement and well-being, improving outcomes for mothers and their infants. Future research is needed to explore this holistic vision of neonatal care.

### Poster #152

**Title**: Doing, Being, Becoming, and Belonging in an Inclusive Classroom

**Authors**: Shannon Roux and Leah Stein Duker

**Faculty Advisor**: Leah Stein Duker

**Background**: Inclusive education describes the delivery of special education services within the mainstream classroom alongside peers without disabilities. While this model has gained popularity, little is known about the experience of the child and/or teacher in these classrooms. **Purpose**: To understand how interactions between learning occupations and the social and physical environment can create or inhibit belonging in the inclusive classroom. **Methods**: The Occupational Science (OS) framework 'Doing, Being, Becoming, and Belonging' was applied to literature exploring inclusive education (n=61). To illustrate these constructs, individual interviews were conducted with special education students 7-10yrs in an inclusive classroom (n=5; duration: m=38±3mins) and teachers (n=5; duration: m=54±14mins) and analyzed using thematic analysis and a template coding approach guided by the theoretical constructs *doing*, *being*, *becoming*, and *belonging*. **Results**: Results suggested that at an individual level, *doing* is primarily linked to the social environment (e.g., engaging with peers academically and recreationally), while

*being* is closely tied to both the social (e.g., "being yourself" with others) and physical (e.g., challenges "being yourself" when experiencing sensory overstimulation) environments of the classroom, highlighting the importance of environmental fit and flexibility in facilitating *belonging*. At the group/classroom level, *becoming* an inclusive classroom necessitated the development of important relationships achieved by '*doing together*', and a collective identity achieved by careful curation of the physical and social environments; all of which facilitated *belonging*. **Conclusion**: Utilizing an OS framework to understand how to support *belonging* in the inclusive classroom is an innovative approach, helping to identify areas for future research.

**Title**: Networks of Care: Understanding Burnout through Healthcare Culture

**Authors**: Valerie Tapia and Elizabeth Pyatak

**Faculty Advisor**: Elizabeth Pyatak

**Background**: Primary care (PC) healthcare worker (HCW) burnout has reached epidemic levels, significantly affecting PC workforce. **Purpose**: Grounded in occupational science, NOC emphasizes the role of occupational environments, identities, and interactions in shaping HCW experiences of burnout. NOC aims to comprehensively investigate the intersection between HCW culture and burnout in PC settings through a comprehensive, multi-method approach. By synthesizing the findings across components, our research team seeks to identify actionable steps to improve PC workforce well-being. **Methods**: NOC employs four approaches: 1) Scoping Review: A systematic mapping of U.S. based literature on HCW burnout and PC workforce culture will provide a foundational understanding of the topic. 2) Social Network Analysis (SNA): An online survey of 60 patient-facing PC workers, recruited in collaboration with PC clinic leadership at a large, state-funded medical center will evaluate how social connections (Connections During Conversations Scale) influence burnout

(Burnout Assessment Tool). Analyses will include correlations, spline regression, and diffusion of innovations. 3) Phenomenological Interviews: In-depth, thematic analysis of interviews with 14 HCWS through the SNA will explore how contextual factors and lived experiences contribute to burnout. 4) Nominal Group Technique: A participatory action research method will engage NOC participants to collaboratively interpret findings and rank community-preferred strategies for addressing HCW burnout. **Conclusion**: By integrating these innovative approaches, NOC aims to advance understanding of the cultural dimensions of HCW burnout and community-preferred, actionable strategies to enhance workforce well-being in PC settings.

**OCCUPATIONAL SCIENCE & OCCUPATIONAL THERAPY - PROFESSIONAL STUDENTS**

**Title**: Developmental Outcomes of Preterm Infants at 5-7 Years

**Authors**: Syria Powell, Clarissa Setiomiguno, Stacy Sanchez Ramirez, Polly Kellner, and Roberta Pineda

**Faculty Advisor**: Bobbi Pineda

**Background**: Established research links preterm birth to developmental challenges in early childhood. However, the correlation into school-age is limited. **Purpose**: This study aims to identify the impact of infant and family characteristics on the developmental outcomes of former preterm infants at 5-7 years related to executive function, sensory processing, and receptive communication. **Methods**: Preterm infants, born < 32 weeks gestation and hospitalized in a Level IV NICU in St. Louis, were enrolled within seven days of birth. Upon completion of NICU stay, infant and maternal characteristics were documented. At 5-7 years, comprehensive parent questionnaires were completed including the VABS-3-RL, BRIEF, and SP-2. Linear regression was used to identify

relationships between infant and family characteristics and school-aged outcomes. **Results**: Significant relationships were found between infant sex and under-responsivity/sensory-seeking behavior (p=0.01, ß=3.81); race and movement [*movement processing*] (p=0.01, ß=1.51); maternal age and movement [*participation*] (p=0.02, ß=0.12); marital status and taste/smell [*sensitivity*] (p=0.03, ß=3.12); length of hospital stay (LOS) and vision (p=0.03, ß=0.03); LOS and low energy/weakness (p=<0.001; ß=-0.05); and NEC diagnosis and taste/smell (p=0.03; ß =-3.60). **Conclusion**: While characteristics of infants and mothers at the end of NICU stay correlated to some developmental outcomes in school age, the causal link is still unclear. Thus, further research in early development of preterm infants through age 5-7 is recommended.

**Title**: Qualitative Investigation of Occupational Therapy Self-Management Program for Cancer Survivors

**Authors**: Allison Schachter and Alix Sleight

**Faculty Advisor**: Alix Sleight

**Background**: Adopting a healthy lifestyle after a cancer diagnosis is associated with fewer comorbidities, reduced recurrence, and increased survival. Yet, fewer than 25% of survivors adhere to key health behavior recommendations. Personalized self-management programs delivered by occupational therapists for other chronic conditions have improved adherence to health-promoting behaviors and other health outcomes but remain underutilized for cancer survivors. The RISE (Re-invent, Integrate, Strengthen, Expand) program, developed in 2020, is a personalized, occupational therapy self-management program for cancer survivors promoting healthy lifestyles through the strategic planning of everyday activities, personalized education, building self-determination, and assistance with habit formation. **Purpose**: This study explored the lived experiences of cancer

survivors participating in an occupational therapy self-management program. **Methods**: Thirteen semi-structured interviews were conducted with adults who completed cancer treatment within the past five years and expressed interest in improving their diet/and or physical activity. Participants engaged in 30-60-minute virtual sessions with an occupational therapist over six weeks, focusing on goal setting, health behavior coaching, and daily tracking of diet and exercise. Qualitative data were thematically analyzed using Dedoose software. **Results**: Three preliminary themes emerged: 1) perceived "crucial components of the intervention," 2) supportive factors and barriers to success, and 3) suggestions for improving the program. **Conclusion**: These findings highlight RISE's benefits in promoting tailored education, practical goal-setting, and supportive accountability structures. Participant feedback may offer valuable insights for refining the intervention in the future. Programs like RISE are essential for helping cancer survivors maintain healthy lifestyle changes and achieve better long-term outcomes.

**Title**: Exploring differences in parent responsiveness between autism risk groups

**Authors**: April L. Flores, Jhennylyn Rivera-Villano, Savannah Gluck, Julia Lisle, John Sideris, and Grace T. Baranek

**Faculty Advisor**: Grace T. Baranek

**Background**: Development of social communication and self-regulation begins in infancy and is supported by parents responding to their infants prelinguistic communication cues. Infants at risk for autism often present with atypical sensory reactivity (SR), and delays in social communication (SC), making parent responsiveness (PR) critical for developmental progress. **Purpose**: To investigate how PR scores differ across First Year Inventory version 3.1 (FYI) risk groups. We hypothesized that parents of children with more SC risk would

score lower on PR. **Methods**: A community sample of 55 parents of infants ($M_{age}$ =11.53 months) completed the FYI, a measure of autism traits, and participated in parent-child interactions (PCI) during play and snack. Infants were sorted into 4 categories based on FYI scores: high risk in SC (n=14), SR (n=1), both (n=3) or neither (n=36). PCIs were coded for PR. A one-way ANOVA was used to compare PR between risk groups, excluding SR group due to sample size. **Results**: On average, the group with high risk in SC and SR (M=2.50, SD=1.00) had the lowest PR scores, followed by the SC risk group (M=3.86, SD =1.4). The low risk (neither SC or SR) group had the highest PR scores (M=4.51, SD=0.99). A one-way ANOVA comparing the means of the three groups revealed significantly different PR across the three risk groups, F $(2,52)$ = 5.47, p < 0.007. **Conclusion**: Differences in PR by risk group may indicate that parents are misunderstanding or failing to recognize cues in infants that show greater autism traits.

**Title**: Effect of Task-Oriented Training (TOT) on Motor Skills in Cerebral Palsy Children

**Authors**: Devanshi H. Chheda, Milan Kumar, Sohyun Joen, Ya-Chun Yu, and Julia Lisle

**Faculty Advisor**: Julia Lisle

**Background**: Children with CP experience muscle weakness, spasticity, diminished motor skills, and impaired functional abilities. TOT enhances motor learning by emphasizing functional, goal-directed activities in real-life environments, promoting adaptive strategies for improved motor function (Ko et al., 2020). Hence, we want to study if TOT-based interventions could be used for the habilitation of upper extremity motor skills in CP children. **Purpose**: This critical appraisal aims to assess the effectiveness of TOT-based interventions on upper-extremity motor functions in CP children. **Methods**: After forming the clinical scenario and a PICO question, a PubMed search combining the population and intervention

synonyms with Boolean terms, and applying filters, identified 26 studies. Five high-quality articles were selected that best addressed the PICO question. **Results**: VR-based TOT improved fine motor function and grip strength in children with CP (Daliri et al., 2025). Zai et al.'s article supported TOT in improving gross motor function and ADLs. Trunk-restrained TOT refined upper limb movement quality (Schneiberg et al., 2010), while Group TOT improved motor and social skills (Ko et al., 2020). Bimanual TOT combined with botulinum toxin A(BoNT-A) improved upper extremity function (Speth et al., 2015). **Conclusion**: TOT-based interventions, implemented through bimanual therapy, group therapy, VR-based interventions, or trunk restraint or combined with adjunct therapies improve motor function in children with CP. The findings support integrating these evidence-based TOT approaches to achieve functional outcomes in CP children.

**Title**: An Exploration of Environmental Features Fostering Engagement in Activity and Social Interaction

**Authors**: Ellery Ewell, Yousef Babish, and Joy Agner

**Faculty Advisor**: Joy Agner

**Background**: People with serious mental illness (SMI) often experience more social isolation than people without, which can cause or exacerbate physical and psychological challenges. Environmental features, such as natural light and seating arrangements, can shape engagement in activities and social interaction, thereby impacting relationship-building and recovery. However, the explicit role of environmental features in supporting or inhibiting engagement and social interaction within mental health settings is underexplored. **Purpose**: This study aimed to identify the environmental features that influence participation and either facilitate or hinder social interaction within mental health Clubhouses-psychosocial rehabilitation centers that support recovery among

individuals with SMI. **Methods**: This qualitative study utilized semi-structured interviews with 45 Clubhouse members across three Clubhouses in Hawai'i to determine environmental supports, barriers, and suggested modifications to increase engagement and social interaction. **Results**: Members value environments that blend beauty, natural elements, and a homelike atmosphere, while also appreciating layout diversity that provides both high-engagement and quiet spaces. They described needing accessible environments that accommodate various physical and cognitive abilities, as well as high-quality tools and resources to foster engagement. Members mentioned struggling with sensory discomfort from temperature, noise, visual clutter, and inadequate layouts that fail to balance social and solitary needs. Finally, members dreamed of spaces that support both community interaction and personal reflection, with optimized sensory conditions to enhance comfort and participation. **Conclusion**: These findings offer insights into how the physical environments within Clubhouses can be designed or re-envisioned to better foster social interaction and engagement, particularly for individuals with SMI.

**Title**: Interventions to Improve Oral Care for Adolescents and Adults with IDD

**Authors**: Helen Cunningham, Stacey Chang , and Leah Stein Duker

**Faculty Advisor**: Leah Stein Duker

**Background**: Oral health is essential for overall health; however, individuals with intellectual and developmental disabilities (IDD) face both individual-level (e.g., sensory sensitivities, motor coordination, behavior) and system-level (e.g., access, provider education, cost) barriers to oral care. **Purpose**: To systematically review research describing interventions to improve oral care for adolescents/ adults with IDD. **Methods**: The PubMed database and references of identified articles

were searched to identify articles describing the oral health and/or oral care experiences of adolescents/adults with IDD (13+ years) published in English; no restrictions were placed on the year of publication. **Results**: Included articles (n=323) were organized into 6 categories: Accessibility (n=58); Dentist Experience (n=22); Oral Health (n=113); Dentist Education (n=20); Quality of Life (n=9); and Interventions (n=101). Only the Intervention category is analyzed here, clustering into five sub-categories: Training/ Education to support daily oral hygiene routines (n=15); In-Home Strategies examined adaptive tools, apps, and audio visual instruction for toothbrushing (n=11); Preparation for professional care included social stories and desensitization techniques (n=16); In-office interventions explored strategies to address sensory and behavioral needs (n=17); and Pharmacological Interventions to manage anxiety, pain, or behavioral challenges (n=42). **Conclusion**: This review examined interventions aimed to improve oral care for adolescents/adults with IDD. Identified strategies addressed both individual and system-level barriers; however, while pharmacological interventions have been well-studied, other non-pharmacological interventions require further investigation. Closing these gaps is essential to improve oral health for individuals with IDD.

**Title**: Tailoring Lifestyle Redesign® for Diabetic Foot Ulcer Self-management: Expert Perspectives

**Authors**: Jasmine Chapman, Lauren Styer, Elliot Myong, Elaine Wong, Tze-Weoi Tan, and Stacey L. Schepens Niemiec

**Faculty Advisor**: Stacey L. Schepens Niemiec

**Background**: Diabetic foot ulcers (DFUs) are associated with impaired function and increased risk of amputation. Effective DFU management requires prolonged offloading that can disrupt daily life. Lifestyle Redesign® occupational

therapy (LR-OT) has potential to address DFU self-management challenges. The Assessment, Decision, Administration, Production, Topical experts, Integration, Training, Testing (ADAPT-ITT) model provides a systematic framework for tailoring evidence-based interventions like LR-OT. **Purpose**: To synthesize topical experts' perspectives on tailoring an LR-OT intervention to DFU patients. **Methods**: Using individualized interview guides, 18 interviews were conducted with five experts from DFU care teams (podiatric surgeon, physical therapist, LR-trained occupational therapist, vascular nurse, prosthetist/orthotist). Experts provided feedback on tailoring OT- and patient-facing materials. Their recommendations were analyzed using thematic analysis. **Results**: Analysis of expert perspectives revealed guiding themes relevant to tailoring LR-OT to the target population. Experts voiced a lack of accessible educational resources available to DFU patients. They highlighted limited care continuity, cost of intervention recommendations, and device discomfort as key barriers to consider in LR-OT sessions. There was consensus that LR-OT's individualized approach could address these issues. Experts identified foot self-care, offloading management, self-advocacy, and physical activity as top lifestyle domains to target with patients. Leveraging patients' social support was seen as essential to intervention. Suggestions for optimal DFU and offloading self-management practices moderately varied, highlighting a need for triangulation with best-practice literature. **Conclusion**: DFU experts' perspectives supported an individualized approach to DFU and offloading self-management. Study findings are guiding the next steps of the ADAPT-ITT process to further tailor LR-OT.

### Poster #161

**Title**: Use of AI in Occupational Therapy (OT)

**Authors**: Nicole Caballa, Nandita Raman, Sofronia Ringold, Ylenia D'elia, Akila Kadambi, Benjamin Miller-Mills, and Lisa Aziz-Zadeh

**Faculty Advisor**: Lisa Aziz-Zadeh

**Background**: Recently, there has been a rapid increase in the use of Artificial Intelligence (AI). A better understanding of the influence and impact of AI on Occupational Therapy (OT), can help with its early integration in OT practice to better support our clients. **Purpose**: This study explores where AI is currently being applied in the field of OT and identifies areas where it can enhance practice, benefiting both therapists and clients while also addressing the gaps that need to be further explored. **Methods**: We searched different databases, such as PubMed, Google Scholar, and Scopus, to find articles on the use of AI in OT. Our search terms included "Occupational Therapy," "Rehabilitation," "Artificial Intelligence," and "AI" with Boolean terms, AND and OR. **Results**: We found 15 articles published from 2020-2024 that were relevant to the study. On analyzing these articles, five themes emerged. These included-the role of AI in improving the delivery of interventions, enhancing the analysis of assessments through different machine learning models, improving accuracy in diagnosis, and aiding student learning. There were several gaps and concerns related to the use of AI that were noted across the articles. **Conclusion**: The use of AI in the field of OT is growing. It poses many benefits in areas of OT service delivery, evaluation, and education. Although additional research is still required to overcome concerns and gaps, a better understanding of AI will enable us to provide more personalized and client-centered care.

### Poster #162

**Title**: Oral Health Experiences of Autistic Adolescents and Adults: A Review

**Authors**: Stacey Chang and Leah Stein Duker

**Faculty Advisor**: Leah Stein Duker

**Background**: Oral health is essential for both physical and psychological health. Oral care has been reported to be challenging for autistic children, but little is known about the oral care experiences of autistic adolescents/adults. **Purpose**: To systematically review the literature describing the oral health and/or oral care experiences of autistic adolescents/adults. **Methods**: The PubMed database was searched; English articles describing the oral health and/or oral care experiences of autistic adolescents/adults were included. No restrictions were placed on publication date. Articles including pediatric populations (n=61) were excluded if results were not stratified by age. **Results**: Following screening and full-text review of 727 articles, 34 articles met inclusion criteria (n=19 adult; n=13 adolescent; n=2 adolescent + adult). Articles clustered broadly into four categories: Oral Health (n=10; e.g., DMFT, gingival/periodontal health, bruxism); Access (n=5), describing frequency and cost of care; Professional Care (n=14), highlighting common barriers to care (n=7; e.g., pain, anxiety, sensory over-responsivity, behavioral cooperation, communication) and intervention development/efficacy (n=7; e.g., desensitization, mobile apps); and In-Home Care (n=8), examining toothbrushing independence/support needs (n=6) and intervention development/efficacy (n=2; e.g., desensitization, visual pedagogy, mobile apps). **Conclusion**: Results suggest that autistic adolescents/adults experience challenges across all identified categories. However, few articles focused on this population, highlighting the need for additional research for autistic adolescents/adults, especially as related to intervention development and testing. Although the transition to adult dental services are a documented challenge for patients with special healthcare needs, no included articles discussed this topic, highlighting another gap in the literature.

### Poster #163

**Title**: Mindfulness Interventions for Adolescents with Anxiety and Depression

**Authors**: Shannon Howell, Olivia Sanford, Briana Burnett, Tayler Brown, Kennedi Moseley, and Lawrence Stevenson

**Faculty Advisor**: Lawrence Stevenson

**Background**: Adolescence is a critical time in a child's development, marked by significant social, cognitive, and behavioral changes (Langer et al., 2020). These confounding factors impact the occupation of being a student, as adolescents are at high risk of experiencing anxiety and depression as academic demands increase (Idusohan-Moizer et al., 2015; Langer et al., 2020). Statistically, low-income and minority students face adversities affecting academic achievement and are less likely to receive mental health services (Hodgkinson et al., 2017). Research demonstrates implementing mindfulness-based practices (MBP) in schools can effectively enhance adolescents' mental health, educational performance, and overall well-being (Mettler et al., 2024). **Purpose**: An exploration of the efficacy and implementation of low-cost mindfulness-based practices to support adolescents' mental health and well-being in underfunded public schools (Dariotis et al., 2023; Norton & Griffith, 2020; Reindl et al., 2020). **Methods**: Qualitative literature search synthesizing current evidence using thematic analysis. **Results**: Research concluded that mindfulness-based practices resulted in positive outcomes in anxiety management and improved focus, which would benefit the school community (Idusohan-Moizer et al., 2015; Metler et al., 2024). **Conclusion**: The adaptable nature of MBP allows participating schools to meet the needs of their community. The feasibility of MBP within the academic environment can increase accessibility of mental health services to low-income school districts and improve the social and professional climate of the school community (Langer, et al., 2020; Norton & Griffith, 2020; Montero-Marin, et al., 2023; Dariotis et al., 2023; Reindl, eta., 2020).

# FROM THE EDITORS

To our fellow students, faculty, and staff:

It is our honor and privilege to present to you the Seventeenth Edition of *The Explorer* Journal of USC Student Research. This year, our talented student authors have highlighted the exciting and innovative research being conducted at the Herman Ostrow School of Dentistry of USC, including the Chan Division of Occupational Science and Occupational Therapy and the Division of Biokinesiology and Physical Therapy, all of which are proud members of the Ostrow Family.

We would like to acknowledge the discoveries of all our fellow classmates and faculty who are engaged in research and those who continue to make meaningful breakthroughs for our profession. Our keynote speakers showcase the efforts our community is making toward advancing science. Now, more than ever, we highly encourage all our fellow students to pursue research. There are so many exciting opportunities available here at USC—such as exploring how technological advancements can improve benchside research and clinical practice in dentistry, occupational therapy, and biokinesiology/physical therapy. We hope the projects presented in this journal will spark curiosity and interest in pursuing research.

Lastly, we would like to thank everyone who has helped in organizing Research Day. The success of Research Day would not be possible without the immense support we have received from our faculty advisors, Dr. Yang Chai, Dr. Parish Sedghizadeh, Dr. Amy E. Merrill, and the entire Research Day planning committee that have worked tirelessly behind the scenes in order to host Research Day in person and make today a success. We are also very fortunate to have an amazing group of writers, photographers, and leaders in the Student Research Group without whom this journal would not be possible. We hope you enjoy this issue of *The Explorer*!

Thank you so much for all the support, and Fight On!

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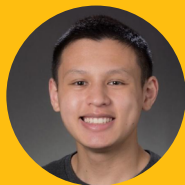Sheiva Hodjati

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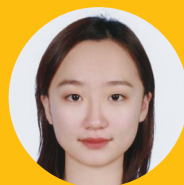
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