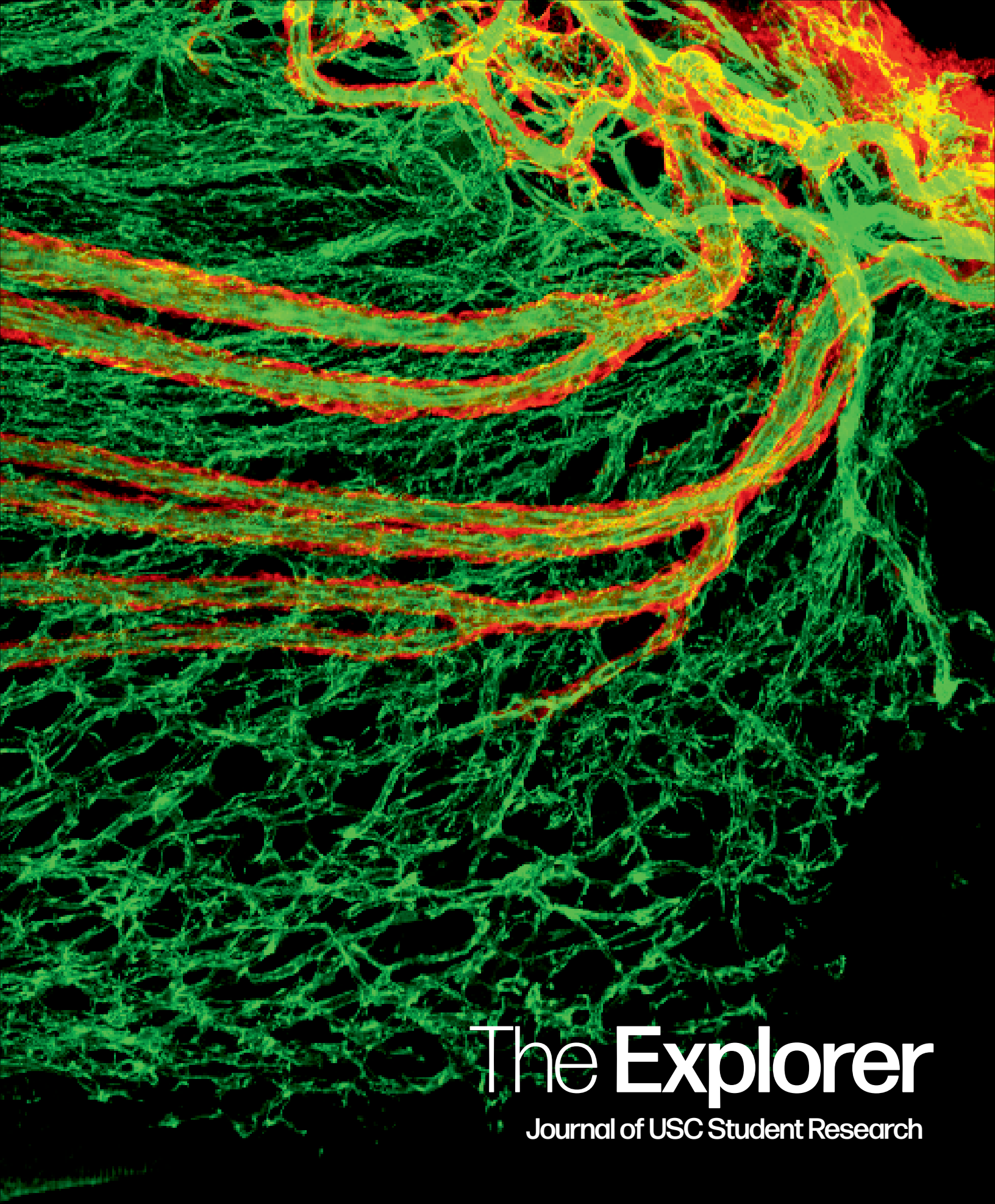

The Explorer

Journal of USC Student Research

Herman Ostrow School of Dentistry of USC

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DIVISION ARTICLES

Avishai Sadan, DMD, MBA
Dean
G. Donald and Marian James Montgomery
Professor of Dentistry

FROM THE **DEAN**

Dear Ostrow Students and Colleagues:

Ostrow's annual Research Day is always an exciting day for our school. For me personally, nothing compares to seeing the unbridled enthusiasm on our students' faces as they share the fruit of their research labors. Even better, I always enjoy reading even more about their studies in our award-winning The Explorer — put together by Ostrow's Student Research Group.

It gives me such pride to see our students committing themselves to our profession's scientific foundations. Students, to be successful in your careers — whether that be in dentistry, biokinesiology/physical therapy or occupational science/occupational therapy — you will need an almost insatiable thirst for new knowledge. You will need to consume cutting-edge research, learn new technologies and adapt your practice to stay apace our ever-evolving professions. It is my hope that during your time with us we impart within you this lifelong love of learning.

As part of a research-intensive university, we have always taken scientific investigation incredibly seriously. Ostrow is No. 3 on the list of top-funded U.S. dental institutions by the National Institute of Dental and Craniofacial Research. This is the highest we've ever appeared on this list, demonstrating the trust that the NIDCR has for our research faculty and staff. Likewise, the USC Chan Division of Occupational Science and Occupational Therapy and the USC Division of Biokinesiology and Physical Therapy retain their high U.S. News & World Report rankings — a true testament to our colleagues' ongoing research and clinical prowess.

I want to congratulate all of our student and faculty researchers for their hard work, long hours and dedication as you completed these research endeavors this year.

Fight On!

(PHOTO/KEN LUND)

INTRODUCTION TO **RESEARCH DAY**

Welcome to our 2023 Research Day at the Herman Ostrow School of Dentistry of USC! Every year we celebrate the tremendous achievements of our students, staff, and faculty in Dentistry, Occupational Science, Occupational Therapy, Biokinesiology, and Physical Therapy. This is my favorite event of the year because the discoveries and inspiring work you will see today give us a preview of USC's impact on addressing societal and health care needs in the future.

It is our privilege as educators to foster an environment for groundbreaking research. Seeing students in our labs and clinics pursue innovative research, perform novel studies, and work together are the favorite parts of my job. The Herman Ostrow School of Dentistry embodies USC's commitment to our unifying values: integrity; excellence; diversity, equity, and inclusion; well-being; open communication; and accountability. Our supportive culture makes USC a rich environment for interdisciplinary collaboration. We are committed to providing the best possible opportunities for our students. Their experience and clinical training cultivate essential critical thinking skills for advancing scientific knowledge. Introducing our students to the joys and challenges of research is crucial for providing them with valuable skills that will be essential in their careers as health care providers, educators, and scientists.

Our students represent the future of our professions, and the outstanding discoveries being presented today make it clear that the future is bright. I am happy to be part of a community that cultivates the next generation of leaders in science.

We hope you will enjoy this year's issue of The Explorer. In this publication, you will learn about new research being conducted by your colleagues, alongside articles sharing the accomplishments by outstanding researchers at the Herman Ostrow School of Dentistry. We are proud to cover a broad range of topics highlighting how research innovation will improve our lives. Please join me in congratulating all of our students and researchers on their successes as we gather to celebrate their efforts on Research Day.

Fight On!

Yang Chai, DDS, PhD
University Professor
George and MaryLou Boone Chair in Craniofacial Molecular Biology
Associate Dean of Research
Director, Center for Craniofacial Molecular Biology
Herman Ostrow School of Dentistry of the University of Southern California

LIFE TAKES MANY TURNS

By Aaron Huang & Katherine Scheker

Dentistry is not a field that can continue to grow and evolve without the support of other branches of study. Dr. Reyes Enciso is a researcher and professor of clinical and instructional dentistry at the University of Southern California's Herman Ostrow School of Dentistry. She is a pillar of support for Ostrow in advancing the knowledge of craniofacial and dental technologies to continue growing the field of dentistry.

Growing up in Spain, Dr. Enciso studied French in middle school and high school, which led her to travel to France as an exchange student during her teenage years, a decision that would later impact her career. She then completed her five years of undergraduate study in computer science in Spain at Polytechnic University of Valencia, Spain. She knew she always liked math and writing. During her undergraduate studies, Dr. Enciso was a student worker helping the journalist at the President's office at Polytechnic University of Valencia. Her passion for writing even encouraged her to start a magazine during her first year in college. However, she chose computer science as her major because it was a new and exciting field during the late 1980s and early 1990s. The world wide web and the internet were not nearly as widespread and developed back then as they are today . In fact, it was rare and almost unheard of for anyone to have a computer at home. Statistics also stood out to Dr. Enciso because her professor showed her how statistics could be useful in real-life situations.

The requirements for a five-year computer science program in Spain included a final one-year project. Unfortunately, none of the research projects that were happening in Spain at that time piqued Dr. Enciso's interest. Because computer science was an experimental field, Dr. Encsio was able to pair her interest in artificial intelligence, an elective class she took during one of her years of undergraduate education, and computer science together. With the mix of the two, she applied to the University of Orsay in Paris to complete her final research project in France instead of at her undergraduate university.

To complete her undergraduate degree, Dr. Enciso was awarded the Erasmus scholarship to study in Paris. She moved from Spain to France and lived in Paris for a year and a half. There, she continued her undergraduate education. She focused her final research project by experimenting with 3D Vision On A Robotic Head. Her research in France corresponded to the Diploma of Advanced Studies (DEA), a year of didactic classes and research before the Ph.D. After her DEA, Dr. Enciso enjoyed her time in France and wanted to continue her education at the University of Orsay. She applied for a Ph.D. scholarship from the Research Ministry in France and was one of the few selected recipients. As a Ph.D. candidate, she moved to the South of France where she researched computer vision/computer graphics, mostly obtaining 3D data from 2D images. She explained to us that her project was similar to how the new iPhones with two cameras obtain data.

In 1996, Dr. Enciso attended a workshop in Denmark where fate introduced her to Dr. Ruzena Bajcsy. Dr. Bajcsy has previously served as the head of Computer and Information Science and Engineering Directorate at the National Science Foundation, the founding director of the Center of Information Technology Research for the University of California, Berkeley, and as a faculty member at the University of Pennsylvania. At that workshop, Dr. Bajcsy invited Dr. Enciso to complete a post-doctorate at the University of Pennsylvania in Philadelphia. Dr. Enciso accepted, and she and her now-husband lived in Philadelphia for nearly two years before finally moving to sunny Los Angeles in 1998. With her relocation, she joined the University of Southern California in May of that year.

In 2001, Dr. Enciso was working on a project at Viterbi School of Engineering and met Dr. James Mah, an orthodontist at the dental school. He brought Dr. Enciso to the dental school as a post-doctoral candidate initially to research cone-beam CT (CBCT) images. Her research objective was to obtain 3D information of teeth, nerves, and other tissues from the CBCT scans. In fact, her first publications relating to the dental field from 2001 to 2011 were on CBCT imaging applied to different topics. These publications included CBCT's ability to differentiate cysts from granuloma relating to the field of endodontics, orthodontics, impacted molars, sleep apnea, and imaging of the airway. She also did research and taught

residents how to use the CBCT at the Redmond Imaging Center in the orthodontics department from 2003 to 2011. Many of the images of this historic opening of the Imaging Center are still displayed proudly on the third floor of Ostrow.

One of the most exciting projects that stands out in Dr. Enciso's mind is the grant that she received from the NIH in 2006 that allowed her to not only conduct research on the influence of the upper airway in sleep apnea patients but also complete a master's degree in Biomedical Clinical Investigations at the USC Keck School of Medicine. When the degree was completed, she continued to work on collaborative research with the dental school including her most cited paper on the differential diagnosis of periapical lesions in 2018. She continues to work on meta-analysis studies and systematic reviews with the students in the Orofacial Pain and Medicine and Geriatric Dentistry Master's programs. Two of their research papers appeared on the front page of the Journal of the American Dental Association in November 2018 "Use of platelet-rich plasma, platelet-rich growth factor with arthrocentesis or arthroscopy to treat temporomandibular joint osteoarthritis" and "Treating Myofascial Pain Syndrome with Botulinum Toxin Type A" in December 2016.

In the future, Dr. Enciso hopes to work on projects relating to opioid prescription and misuse in the dental and medical settings. Studies have shown that patients receiving these prescriptions sometimes do not finish the prescribed amount, leaving these pills around the house to potentially be misused by guests or other family members. The opioid problem is currently on the rise in the US and should be researched and addressed.

When asked about her role models, Dr. Enciso states that her mother was and is a significant inspiration. Her mother was one of the two only females in her class studying physics in Madrid in the 1960s and can be considered a pioneer in the physics field, which encouraged Dr. Enciso to further her education. When Dr. Enciso chose computer science as a major, the program was only 4 years old, but about half of her classmates were women. She was the first one in her extended family to get a Ph.D. and to move abroad. This inspired her brothers and sisters to do the same for their master's. In terms of Dr. Enciso passing knowledge to the next generation by becoming an instructor, Dr. Enciso thinks it is in her genes. Both her parents, as well as all her aunts, uncles, and three grandparents were teachers.

Dr. Clark and Dr. Azen at the preventative medicine department are two memorable mentors that pushed Dr. Enciso to complete her master's degree. They also helped her grow and provided the tools to be the effective collaborative researcher she is today. Dr. Mulligan and Dr. Suarez-Durall also helped her merge into the field of dental public health and geriatric dentistry, influencing her life significantly.

It can be quite hard to get involved in research after graduating, but it can be a very desirable goal to work towards. Dr. Enciso encourages students to be involved in research because it allows them to always follow the latest guidelines in medicine and healthcare to be able to practice evidence-based dentistry and remain informed to effectively answer patient questions.

In the wise words of Dr. Enciso, "Try to find your passion, it might come later in life for some people. Do not settle for a job you do not like, your life will be miserable. Do not compromise your values."

A New Trojan Dentist Stepped into the

World of Academia & Research

By Parinaz Esteghamat Tehrani and Cloris Yidan Zhang

Dr. Kim Honda is currently an adjunct assistant professor of clinical dentistry at the University of Southern California's Herman Ostrow School of Dentistry under the Special Patient Care (SPC) Program. He oversees the rotation and selective students in providing comprehensive dental treatment for special needs patients and assists with developing the clinical protocols for treating patients under general anesthesia. Dr. Honda also works at the LAC+USC Medical Center and the VA Los Angeles Ambulatory Care Center as an attending for General Practice Residency (GPR) residents overseeing, managing, and guiding the operating room treatments for the complex special needs and veterans' dental cases. In addition, he is involved in developing and implementing clinical and didactic educational opportunities for the GPR residents.

Journey to Dentistry

As a third-generation dentist, Dr. Honda followed his family legacy and stepped into the world of dentistry in 2013. Dr. Honda was born in Honolulu, Hawaii, and started his academic journey by earning a Bachelor of Science degree in medical engineering from the University of California, Irvine and a Master of Engineering in biomedical engineering from Boston University.

In 2017, Dr. Honda graduated from the University of Missouri Kansas City School of Dentistry and is a board-certified dentist in both California and Hawaii. Furthermore, he completed an advanced training in comprehensive dental care and treatment of medically complex patients through the GPR program at the LAC+USC/Herman Ostrow School of Dentistry (PGY-1) and the VA Sepulveda Ambulatory Center (PGY-2). It is also notable that, currently, Dr. Honda is pursuing his passion in academia and education at the Special Patient Program at the Ostrow School of Dentistry, the LAC+USC Medical Center, the H. Claude Hudson Comprehensive Health Center, and the VA Los Angeles Ambulatory Care Center.

It's important for dentists to continue learning and staying up-to-date on the latest techniques and technologies in the field in order to provide the best possible care to their patients. As a life-long learner, Dr. Honda decided to explore hospital dentistry through the GPR program because he aimed to gain experience working with the special needs patient populations. Hospital dentistry, provided in a hospital setting rather than a dental office, is usually necessary for patients who have a medical condition that requires more specialized care or for patients who are unable to receive treatment in a traditional dental office due to physical or mental disabilities. In a hospital setting, dentists have access to advanced equipment and a wider range of resources that can benefit patients who require complex or extensive dental procedures, such as surgery or sedation.

Research and Explore

In addition to exploring the fields of dentistry, Dr. Honda's past experience in research and education paved the way for his current career goals and opportunities. During his master's education, Dr. Honda participated in research projects on the topic of infectious disease. Research experience in this area could be relevant and beneficial for careers in fields related to healthcare and biology, such as dentistry or biomedical engineering. Some of his research projects focused on mycobacterium tuberculosis regulatory network and hypoxia and coordinated regulation of acid resistance in Escherichia E. coli. By mapping the transcription factors involved in the disease mechanism and studying the metabolic pathways of bacteria, Dr. Honda gained strong skills in problem-solving, critical thinking, and communication, as well as a passion for advancing knowledge and improving patient care.

Dr. Honda's passion for research is deeply connected to his commitment to patient care, and he is constantly searching for ways to implement his research findings into real-world clinical practices.

In addition to the research opportunities, Dr. Honda received further exposure to academia by serving as a teaching assistant for pre-clinical laboratory courses including Dental Morphology, Dental Occlusion, Complete Removable Prosthodontics, and Partial Removable Prosthodontics. During the laboratory sessions, Dr. Honda was able to apply his knowledge of the topic to facilitate a learning environment and collaborative discussion among the students.

Dr. Honda's experience in academia is not limited to research and teaching; he is also involved in various mentorship programs including the American Dental Education Association (ADEA) Academic Dental Careers Fellowship Program, the Advanced Studies Program in Restorative Clinical Sciences, and the Student National Dental Association/Hispanic Student Dental Association. In the ADEA Academic Dental Careers Fellowship Program, he mentors dental students who are interested in pursuing a career in academia by providing faculty mentorship, research opportunities, and teaching experiences. In the Advanced Studies Program in Restorative Clinical Sciences, he works with the prosthodontics faculty and serves as a mentor for advanced prosthodontic seminars, new technologies learning sessions, and treatment planning for the complex cases. In the Student National Dental Association/Hispanic Student Dental Association, he facilitates the "Explorer's Posts," which is a monthly workshop that is geared towards high school and college students interested in pursuing a career in the field of dentistry. In addition, Dr. Honda organizes various activities and events that prompted community outreach and diversity.

Career Goal Advice

Dentists who are interested in academia and education may choose to teach at dental schools or other educational institutions, or they may pursue research or other roles that allow them to contribute to the advancement of the field of dentistry. It's impressive that Dr. Honda has completed advanced training in comprehensive dental care and treatment of medically complex patients, while continuing to pursue his passion for academia and education.

Dr. Honda highlighted important aspects of the two residency programs at the LAC+USC healthcare facilities from his personal experience. The 12-month GPR Program provides residents with a broad range of dental experiences as they rotate through oral surgery, emergency medicine, anesthesia, care for the disabled, and other disciplines. The program also includes a mix of hands-on patient care and didactic seminars. Approximately 60 percent of a resident's time is devoted to the delivery of oral health care, and the rest will be spent at the didactic seminars. Residents are trained under the supervision of faculty members from both the Ostrow School of Dentistry and the Keck School of Medicine of USC, primarily at the LAC+USC Medical Center and the VA Outpatient Clinic. Some training is also conducted at Rancho Los Amigos National Rehabilitation Center and Ostrow facilities.

The Special Patient Care Clinic, formerly known as the Hospital Dentistry Clinic, provides advanced comprehensive general dentistry for patients with severe medical, physical, and mental problems. This is a very important resource for populations including but not limited to pre- and post- organ transplant patients, cancer patients, immunocompromised patients, and other special needs patients who may have difficulty receiving treatment in a traditional dental office. The clinic's ability to provide dental care under IV sedation in an operating room setting is especially valuable for patients who may require a higher level of sedation or who may not be able to tolerate treatment in a routine dental setting. Dental services are also provided on an emergency basis after hours for both in-patients and out-patients.

Dr. Honda's advice to the dental students and recent graduates is to explore different opportunities and extra-curricular activities in addition to fulfilling the dental school requirements. Dental school provides a strong foundation in the knowledge and skills needed to be a dental professional, but there are many other aspects of the field that can be explored and pursued. By participating in additional activities and experiences, dental students and graduates can learn more about what they enjoy and what they are good at, which can help them identify their strengths and guide their career paths. It can also be a great way to network and make connections in the field, which can be beneficial as they embark on their professional careers.

He specifically pointed out that the recent graduates can further expand their dental skills through different routes such as school-based education (e.g.,GPR, Advanced Education in General Dentistry [AEGD], and specialty programs), dental corporations, private office associateship, and continuing education classes; ultimately, the decision comes to personal preferences and long-term career goals. Dr. Honda highlighted that his reason for joining the LAC+USC GPR program was all about enjoying the attending-resident mentorship relationship when exploring various opportunities such as treatment planning, medical/dental-related rotations, teaching, community service, and research. His recommendation to the GPR applicants is to research the program, visit the program and the residents if possible, and write a truthful application.

Future and Beyond

Dr. Honda's future goal as an educator is to not only dedicate his time and effort in deepening the pedagogical knowledge and teaching effectiveness of faculty, staff, and students, but also support, generate, and disseminate scholastic research. He hopes to pass down the knowledge to his current resident attendees at the LAC+USC Medical Center and the VA Los Angeles Ambulatory Care Center, as well as the dental students of Herman Ostrow at the Special Patient Care Program.

Urbano's Gift to Our Communities

Jessica Kim & Yomna Elkereamy

Professor Justin Urbano is an assistant professor of clinical dentistry with the Division of Public Health at the Herman Ostrow School of Dentistry here at the University of Southern California. In 2010, Professor Urbano received his Bachelor of Science in dental hygiene here at Ostrow. His passion for dental hygiene led him to advance his dental hygiene training through the Registered Dental Hygienist in Alternative Practice (RDHAP) program at the University of the Pacific, Arthur A. Dugoni School of Dentistry in 2013. As he became interested in public health, he furthered his education with a Master's of International Public Health/ International Health in 2015 from the University of Sydney. Currently, Professor Urbano has been active at Ostrow focusing on public health initiatives to open dental care access to our communities.

In high school, Urbano had the opportunity to explore different technical careers through a regional occupational program. He recalled that, of all the careers he was exposed to in specialty offices, he found that dentistry stood out to him the most. After speaking to several hygienists, Urbano was intrigued by not only the enjoyable lifestyle and work/life balance, but also by the many opportunities for personal growth the dental field could provide. Ultimately, Professor Urbano fell in love with helping people improve their oral and overall health. His curiosity helped him pursue dental hygiene at USC. During his education and training, Professor Urbano felt that USC strengthened his passion and prepared him well for his career in dentistry. After USC, he worked with the National Health Service Corps (NHSC) to help build healthy communities where access to care is limited. Urbano enjoyed every moment of serving these populations where dental access is very limited due to barriers like financial and geographical limitations.This is where his interest in public health began.

In dentistry, public health brings oral health care to communities with the goal of achieving optimal oral health through prevention, promotion, and education. Dental public health has been recognized as a specialty by the American Dental Association since the 1950s and is considered a unique discipline focused on improving dental and oral health across populations rather than among individuals. It brings assistance to individuals where access to dental care is limited. Efforts largely target vulnerable communities like students, seniors, and expectant mothers. According to the CDC, these populations are at higher risk of dental issues negatively

impacting their daily lives. For students, there is a risk of lower performance at school. For senior citizens, there is a high risk of decay, gum disease, tooth loss, and other dental issues. For expectant mothers, their health can affect the baby's health too. Addressing oral health at a population level is very important, as oral health is essential to overall health and well-being.

Given Professor Urbano's experiences working in government programs, private practices, and academia, he feels that there are many unique aspects of dentistry where everyone can explore and figure out where they would like to go. Public health is a heavily community-oriented discipline, and efforts in this area are rewarding. Professor Urbano encourages "those who are interested and curious in public health, they should help out in this area to explore what is in store for them."

At Ostrow, there are many efforts led by students, staff, and faculty to bring dental access to the Greater Los Angeles area. Ostrow supports many programs, such as USC Mobile Dental Clinics, USC/Queenscare Mobile Clinic, Dr. Roseann Mulligan Special Patients Clinic, USC/ Union Rescue Mission Dental Clinic, and many more. Many of these programs share the underlying mission of providing care to communities of various demographics. For instance, the USC Mobile Dental Clinic has provided high-quality primary care to local residents within the Greater Los Angeles area for more than 50 years. Moreover, Ostrow works in partnership with QueensCare to provide comprehensive dental care to K-12 students from low-income families, specifically. In terms of assisting patients who are medically compromised or have disabilities, the Dr. Roseann Mulligan Special Patients Clinic works to provide compassionate, comprehensive care according to each patient's specific needs. Finally, the Union Rescue Mission (URM) Dental Clinic, established in 1999, focuses on providing comprehensive care completely free of charge to not only URM guests, but also neighboring shelters and programs serving underprivileged people within the downtown Los Angeles area. Uniquely, URM is the only dental clinic to offer care to children on Skid Row.

In addition, partnerships with hospitals throughout the Los Angeles region have allowed greater efforts to provide dental access. With these large initiatives, USC dental students receive many opportunities to volunteer, rotate, and even become selected to strengthen clinical skills and help lead these programs. Whether it is to screen new patients or deliver newly fabricated dentures, these efforts have provided impactful changes to many Los Angeles residents.

Professor Urbano returned to USC as a clinical assistant professor in 2016. Since then, he has actively been a part of outreach programs. Some of his past involvements include work with the Children's Health and Maintenance Program (CHAMP) and the Dental Transformative Initiative (DTI). He currently works in Ostrow's Special Patients Clinic (SPC) and sometimes at the mobile clinic. A memorable experience for Professor Urbano was the one-month mobile clinic that took place in South LA during the final year of the dental hygiene program. He recalls long nights with students and faculty continuously working on their patients, which really pushed everyone to their limits. He enjoyed seeing people working very hard from sunrise to sunset to provide dental care to the community. From students to faculty to volunteers, everyone had an important role in ensuring that the event was a success. Memories like this inspire him to continue to be actively involved in many outreach programs at USC. Urbano's love and passion for public health initiatives have strengthened USC's involvement with the community's health needs and helped students become more involved and strengthen their clinical experiences in community care. Urbano stated, "Some people find a greater sense of fulfillment in the public health field. For me, this is it."

Professor Urbano has fallen in love with teaching because he enjoys the students' enthusiasm to learn. From the start of clinic to graduation, he watches students become competent leaders. Students have always complimented his excellence in teaching. His mentorship has helped many students, including graduates, to develop a strong passion and to become leaders in public health. Students emphasize their appreciation of his advice on improving ergonomics, instrumentation techniques, behavioral management skills, chairside communication, and much more. At Ostrow, Urbano has gone to great lengths to strengthen students' education. Many people highly praise USC's clinical experience, largely due to these public health opportunities for students to apply their skills and knowledge beyond the classroom and in the real world.

To those who are curious in developing their career interest in any field of dentistry, Urbano suggests getting experience from unfamiliar areas to gain valuable experience. Reflecting on his personal journey, Professor Urbano finds that getting his master's and working at a Native American reservation were among the most memorable experiences that he is ever-grateful for. Urbano emphasizes the importance of becoming involved in different programs, being fluid, and being able to adjust. Lastly, Professor Urbano wants to remind us to take our time and breathe. He advises, "I was a worrier when I was younger. However, I learned that it's okay because everything has a purpose. In the end, I do believe that you will end up where you are meant to be. All your interests, passions, and goals will ultimately come together in time." And to those who are curious about the public health sector, Professor Urbano urges students to just try it out, as he explains, "If you've never tried, you will never know."

Insights from an Orofacial Pain and Oral Medicine Specialist

By Brandon Pham & Courtney Fortier

As an orofacial pain and medicine specialist and owner of Tustin Dentistry, Dr. Roberta Dornan was first intrigued by the field as a high school student when she herself experienced temporomandibular joint (TMJ) locking and limited TMJ movements. After being brought in to the dentist, she was given valium alongside bite adjustment, including a night guard to help hold her jaw forward. At the time, her discomfort was attributed to sleep bruxism, and the theory behind the treatment was that, by adjusting the positioning of the teeth, the disorder would resolve on its own, which is now known to be incorrect. As she was attending Northwestern University Dental School in Illinois, her TMJ issues became more problematic as more bite adjustments were made and a soft splint was placed, which caused TMJ clicking and considerable discomfort; it was this experience that encouraged her to pursue an education in UCLA's Temporomandibular and Facial Pain preceptor program under the section of gnathology and occlusion in 1984. Since then, she joined the UCLA TMJ clinic as a faculty member to supervise new students treating patients in the TMJ clinic and to participate in clinical research. Currently, she teaches residents at the USC Orofacial Pain and Oral Medicine Clinic as the Clinical Associate Professor.

Dr. Dornan feels that her experience as an orofacial pain and oral medicine specialist also makes her a better general dentist. Specifically, she highlights that her involvement in the specialty has emphasized the importance of "treating the whole person" rather than focusing on any particular tooth or procedure. Diagnosing an orofacial pain issue is akin to being a detective solving a case, and though this diagnostic detective work is a part of general dentistry as well, it is essential in orofacial pain. Whenever she is approached with a case, such as one of jaw pain, she must consider a myriad of clues to find the cause. First, she lets the patient recount their history with trauma, their habits, and the nature of the problem's onset. For example, throughout the COVID-19 pandemic, she noted that there was an influx of patients who experienced pain in the area surrounding their TMJ; upon further inspection, she found that pandemic-related life stressors were contributing to the onset of orofacial pain. She determines the quality (burning, aching, sharp, etc.) and localization of any involved pain. Additionally, she tracks the frequency of the pain's presence, if there is a pattern to its occurrence, and whether or not this aligns with the patient's habits. Once she determines the nature of the pain, she can then proceed with an examination, where she will then determine the pain's origin. For instance, limited opening of the mouth is a common complaint, and if one of her patients can only open their mouth halfway, but they have the ability to move their jaw from side to side, then normal condyle function is indicated; therefore, the issue would likely be related to a muscle group. Determining the cause and the source of pain is a lengthy process that is crucial in providing a formal diagnosis and effective treatment, and this is a procedure at which Dr. Dornan excels.

In terms of treatment for patients with myofascial pain, there are various noninvasive and minorly invasive treatment modalities that can be used. The reasoning behind the pain is that muscles rely on aerobic metabolism to produce ATP for energy, but if there is sustained isometric muscle contraction (such as from stress or tooth grinding), then this will impede blood flow, causing muscles to switch to anaerobic metabolism. It is this process that results in the production of irritating metabolites, which can cause nerves to be irritated and trigger points to form. For patients presenting with trigger points in their facial muscles (otherwise known as "knots" or taut bands), Dr. Dornan first begins with stretching exercises and heat treatments in an attempt to pull on the bands and return blood flow to the muscles. Typically, a follow-up appointment would show some improvement in the area, but should the pain persist, only then would she apply a trigger point injection to the area using lidocaine in an attempt to cause localized injury to the muscle, which results in further stretching of the muscle and increased blood flow. Moreover, she specifies that stretching exercises must be used in conjunction with the injections, so as to help eliminate the bands and to create longer-lasting relief for the patient.

Being an individual who had previously suffered from the symptoms of nocturnal bruxism, Dr. Dornan's research has been focused on devices that can reduce or eliminate the habit of tooth grinding. One such device that Dr. Dornan has looked into involves the use of electrical stimulation as a means of decreasing the activity of jaw-elevating muscles, effectively serving as a counter-stimulant for bruxism. Current studies have shown that electrical stimulation of different nerves, especially the mental nerve, can decrease electromyographic (EMG) activity (which is responsible for grinding at night). While this therapy is not yet 100% efficient at eliminating nocturnal bruxism, this is a good treatment modality for individuals who are known to grind through their acrylic splints due to the greater severity of their bruxism. Because bruxism is a common condition experienced by many and can result in occlusal wear (which can then lead to tooth sensitivity), Dr. Dornan believes that the development of over-the-counter medical devices is crucial to the success of reducing or even eliminating these grinding behaviors. For general dentists and dental students wanting to learn more about orofacial pain, Dr. Dornan advocates for seeking out continuing education courses. It is common for general dentists to come across jaw problems in practice and she feels that knowledge of these problems will allow for quicker and more efficient treatment. She believes that it would be most helpful to understand how joints move and function, and how to distinguish between normal and abnormal joint behavior. Moreover, Dr. Dornan puts emphasis on how individuals who don't experience any symptoms may still have an underlying condition. For instance, she reports an MRI study of patients who experienced orofacial pain alongside patients who had no symptoms, and in 25-33% of the patients, it was observed that there was displacement of the articular disc, although they did not experience any pain, clicking, or popping in their TMJ. As a dental provider, especially one who treats jaw pain, it is imperative that one should fully understand the anatomy of the region encompassing the TMJ and treat patients subjectively. In other words, if it is known that an abnormality is present, then it should be treated only if it is responsible for causing pain.

Dr. Dornan encourages dental students to consider specializing in orofacial pain and medicine, and states that if she had to attend dental school again, she would absolutely repeat her choice to go into the specialty. Though someone new to the field would need to learn the intricacies of billing to medical insurance rather than dental insurance, Dr. Dornan believes that this is worth the effort as she finds the work incredibly satisfying and enjoys the variety it adds to her life and profession. According to Dr. Dornan, starting out as a specialist in orofacial pain and medicine is significantly easier due to the decreased overhead. As only a clinical examination room is needed, other specialties may require more equipment, staff, and space. The jaw pain of the patients she treats can be difficult to diagnose and affect their ability to function normally in their daily lives. She feels that providing the correct diagnosis and helping patients to move past their difficulties is rewarding in the sense that many treatment options are relatively inexpensive and noninvasive, and with the cooperation of her patients in adhering to prescribed stretches and practicing good habits, she has the ability to give patients swift relief from their pain.

The Future of Prosthodontics: **Digital Quality Control**

By Ara Hartounian and Austin Nahouray

Dr. Alexis Pawlak was born in southern California but moved to Arizona at a young age. She earned her undergraduate degree in biology with an emphasis in pre-medicine as she worked toward pursuing her ultimate goal of becoming a dentist. As a distinguished student, Dr. Pawlak was the first graduate of the Honors Institute at Grand Canyon University in Arizona, leaving her mark on campus. After graduating, she went on to the University of Pennsylvania School of Dental Medicine (UPSDN) and earned her Doctor of Dental Medicine degree in 2020 with honors.

Dr. Pawlak has been a dedicated advocate for providing quality oral health care to underserved communities. Despite her busy schedule throughout dental school, she dedicated herself to mission trips to La Zona Fuego Nuevo Church in Mexico City for three consecutive years. During these trips, she fostered relationships with the local community and taught them life skills. The healthcare environment struck her attention as the dental clinic was established in the church, which created a unique healing environment within a spiritual space. She also worked alongside local dentists to provide oral hygiene instruction and products. Dr. Pawlak served as a volunteer oral health educator in Philadelphia. She maintained active roles in several community outreach organizations such as the Penn Smiles program, Living Independently for Elders (LIFE) center, and UPSDM Birth to Age Five Program at the Philadelphia FIGHT clinic. She worked alongside fellow volunteers to provide comprehensive care, focusing on work with primarily removable prostheses, as well as care for medically complex elderly patients. She also provided anticipatory guidance to parents regarding their children's oral health along with effective preventative techniques. Dr. Pawlak has been honored to partake in several public health events to provide oral health screenings and cleanings in an effort to promote an improved quality of life for all, especially those in underrepresented communities.

Dr. Pawlak maintained several leadership positions during her dental training such as serving as the Co-President of the Penn Dental Christian Fellowship, which encouraged faith-building with the dental school community. She found that her extracurriculars made dental school more enjoyable and provided her with many opportunities to make connections with the community. Dr. Pawlak is also grateful for her experience as a waitress while in dental school because it allowed her to explore the city, learn about its culture and people, and gain a more comprehensive understanding of customer service. This experience has been invaluable to her career as a dentist, and she is thankful for the opportunity to have had it.

Dr. Pawlak's interest in prosthodontics was sparked by her preclinical courses when she did her first crown preparation. Dr. Pawlak was drawn to the challenge of prosthodontics and the ability to create beautiful and functional prostheses. She was intrigued by the idea of being able to restore a patient's smile and improve their quality of life. She found that prosthodontics allowed her to combine her artistic eye with her technical skills to create aesthetically pleasing and functional restorations. Maintaining her role as the vice president of the Penn Prosthodontics Club also had a significant impact on her decision to pursue a specialty degree in advanced prosthodontics. She attended Academy of Prosthodontics meetings and participated in several national prosthodontic events. Dr. Pawlak recommends current dental students get involved in organized dentistry early in their dental careers as a means to gain exposure to various specialties. Her second piece of advice for students looking to specialize is to shadow local specialists to get hands-on clinical experience and discover one's own passions.

Following graduation, Dr. Pawlak was eager to follow her dreams and joined the Advanced Prosthodontics program at the University of Southern California. She was excited to be back on the West Coast, enjoying the warm weather and all the opportunities the area had to offer. She was determined to make the most of her time in the program and gain the knowledge and skills necessary to become a successful prosthodontist. Dr. Pawlak enjoys volunteering her time to teach pre-doctoral students basic prosthodontic principles and implant techniques at the Herman Ostrow School of Dentistry of USC. She takes pride in enhancing the academic experience of her colleagues which facilitates the reinforcement of her own knowledge.

Throughout her time in the program, she has consistently sought to learn the latest techniques and technological advancements, as well as the best practices for patient care. Dr. Pawlak has taken advantage of the many resources available to her and focused her research on soft tissue collapse in implant dentistry. Dr. Pawlak has written an article about an innovative technique she has developed that prevents soft tissue collapse which is approaching publication. The fundamental concept of her technique is to use PVS impression material to maintain soft tissue contours during the removal of implant restorations to prevent the common phenomenon of soft tissue collapse which may occur in seconds. The most common alternatives to her method are to place healing caps or to let the tissue be; however, she has found these alternatives to lack support for the tissue.

The goal of her research is to facilitate clinicians' efforts in minimizing patients' pain, chair time, and other complications that are often associated with soft tissue collapse. Dr. Pawlak has made use of the new Geomagic Control X software available for the Advanced Prosthodontics program to analyze her data by overlapping different scan files in order to see the dimensional change between the experimental and control groups. Surprisingly, she found that her father's work in aerospace engineering also uses a similar analog technology of Geomagic Control X for quality control. She hopes that the low-cost technique she has developed will become more widely used in the dental community to provide faster and less painful procedures for patients globally.

When Dr. Pawlak is not treating patients, she enjoys yoga and watching Netflix, both of which rejuvenate her. She is always looking to expand her palate through tasty, exotic cuisines.

Figure 1. An initial photograph depicting the maxillary soft tissue immediately when the provisional was removed (with no tissue collapse).

Figure 2. Photograph of PVS injected which provides support in order to prevent tissue collapse.

Figure 3. A final photograph depicting 10 minutes post-PVS injection when PVS was removed. Minimal tissue shrinkage is evident as opposed to not having used PVS to support the tissue.

Perseverance and Positivity in Periodontology

By Arya Sahabi & Jason Chang

Dr. Marwa Abulhasan's journey to periodontology began at an early age. Though she cannot pinpoint what triggered her passion for dentistry, she fondly recalls a journal entry she had written when she was just 12 years old, expressing her desire to become a dentist.

Building on this dream, Dr. Abulhasan left her family in Kuwait and earned her Bachelor of Science and Doctor of Medical Dentistry degrees at the University of Pittsburgh College of Arts and Sciences and School of Dental Medicine, respectively. She then began practicing as a general dentist in Kuwait, before returning to the United States to pursue a Certificate in Advanced Periodontology and Master of Science in Craniofacial Biology, at the Herman Ostrow School of Dentistry of USC.

After earning her Certificate in Advanced Periodontology, Dr. Abulhasan moved back to Kuwait, becoming the first female periodontist at the Al Jahra Dental Specialty Center. There, she was able to gain valuable clinical and life experiences, learning from her fellow clinicians and patients alike.

Currently, Dr. Abulhasan is a clinical assistant professor of dentistry, in the Division of Periodontology, Diagnostic Sciences, and Dental Hygiene, at the University of Southern California's Herman Ostrow School of Dentistry, splitting her time between teaching resident periodontists and treating her own patients in private practice. Upon returning to USC as a member of the faculty, Dr. Abulhasan took up the opportunity to receive her Master of Medical Management degree at USC's Marshall School of Business. This program initially only accepted medical doctors; however, Dr. Abulhasan did not let that stop her from continuing her learning and achieving her academic goals. She became the first non-medical doctor to complete the program. Throughout her career, Dr. Abulhasan's clinical experiences have been supplemented by teaching at various levels of dental education. She has taught dental students in both Kuwait and the United States, finding an appreciation for the balance between dental education and private practice.

In addition to blazing trails in healthcare and dentistry, Dr. Abulhasan enjoys spending time outdoors, going on hikes, traveling, hanging out with family and friends, and eating good food.

Honing in on her strengths in surgical dexterity and finesse, Dr. Abulhasan set out to explore options in oral surgery and periodontics after graduating from dental school. During her final year at University of Pittsburgh's School of Dental Medicine, Dr. Abulhasan was involved in an anesthesia elective and also did an oral surgery externship at Montefiore Hospital in Pittsburgh, Pennsylvania. While she was inspired by the complexity of oral surgery cases and the working environment of a hospital, she ultimately preferred the more delicate, smaller-scale plastic surgery procedures of periodontics.

Dr. Abulhasan was fascinated by periodontal procedures requiring a combination of very intricate surgical skills — of which, soft tissue augmentation and grafting are her favorites. She found these procedures to be very technique sensitive, but also highly predictable when done correctly.

When discussing the major challenges of periodontal procedures, Dr. Abulhasan emphasized the importance of properly preparing the working environment. She stated that no single procedure is challenging, rather the circumstances surrounding the procedure may increase the difficulty. Such factors include patient comfort, access to the area of interest, assistants' help, and even one's own mindset going into a complicated procedure. Dr. Abulhasan states that even a simple procedure can prove a challenge if the environment is not suitable.

After completing the Advanced Periodontology residency program at USC, Dr. Abulhasan worked as an independent contractor in a range of private practices, mostly within Los Angeles County. Recently, however, she has been expanding her expertise to offices in Las Vegas, Nevada. Dr. Abulhasan shared that one of the major contributors of a successful practice is to have an excellent team of assistants and other staff members. She emphasized that, as a dental practitioner, it is most important to cherish, value, and take care of the staff. With a periodontics practice in particular, Dr. Abulhasan highlights the importance of developing strong relationships with referring general dentists. Another key duty of periodontists is to spread awareness to both general practitioners and patients of the importance of periodontal procedures, which mainly help to repair a foundational component of oral health that is the periodontium. Focusing more on the business side of private practice, Dr. Abulhasan noted another inevitable challenge: dealing with different insurances.

Dr. Abulhasan's professional journey brought her back to USC in 2019 where an opportunity arose for her to join the same residency program from which she had graduated in 2012, but this time as a faculty member. For Dr. Abulhasan, it was an honor to work alongside the same professors who had taught her. She is thankful to all of them, especially Dr. Kian Kar who is the current clinical director of advanced periodontology. He has been a mentor during residency and still is. As a clinical assistant professor in the Advanced Periodontology Clinic, Dr. Abulhasan supervises surgeries and provides guidance to the advanced periodontology residents during their cases. She has found her experience as an educator highly rewarding. Every day that she spends in the clinic, she learns something new from her residents and from her fellow faculty. She noted that most of her learning comes from the way her residents develop their treatment plan and the way in which they interact with their patients. For current dental students interested in specializing in periodontology, Dr. Abulhasan highly recommends shadowing and assisting at the Advanced Periodontology Clinic at Herman Ostrow.

Looking forward to the future of periodontology, Dr. Abulhasan sees major changes in the implant world and the realm of digital technology. However, Dr. Abulhasan is an advocate for understanding the foundational basics of periodontology and implantology. She affirms that having a solid foundation of the basics allows one to solve issues during a procedure in the case where technology fails to operate properly. She stated that new technology takes many years to develop, such as the case of dental implants that have been researched for more than twenty years before being used commercially.

In addition to her work in education and private practice, Dr. Abulhasan is also involved in humanitarian outreach. She has participated in medical and dental relief trips to Mavis Bank, Jamaica; Gales Point, Belize; Port au Prince, Haiti; Rio Guasaro, Panama; Visakhapatnam, India; Nan Province, Thailand; Kenya; and to Syrian refugee camps in Jordan.

Her passion for outreach began in dental school. As a dental student, Dr. Abulhasan took opportunities to travel to Jamaica and Belize on humanitarian aid missions. These trips quickly became a highlight of her time in dental school. On these missions, she was able to serve alongside her peers and faculty in a no-frills, impromptu, healthcare setting. She fondly recalls her time providing care to those underserved populations: "Though you're giving a lot, you're actually gaining much more." No matter how heavy the workload was, no matter how busy the clinics were, she found peace in the work being done and people being served.

After graduating dental school, her participation in humanitarian aid missions continued. Each trip came with its own enriching experiences. In Panama, she and her team established a medical and dental clinic at a naval base in the middle of the jungle. Though there was a language barrier between her team and the Panamanian sailors, both parties had the same goal: providing healthcare access to those who needed it most. This transcended any barriers they may have had and allowed them to work harmoniously to achieve their shared goal. In Jordan, she was touched by the selflessness displayed by the refugees. Some gave up their camps for the makeshift dental clinic; others offered as much as they could to assist the clinicians in their efforts. In Thailand, the people's kindness left a lasting impression.

Inspired by these experiences, Dr. Abulhasan founded Raise to Relief, an organization that promotes humanitarian relief work and provides a domain for fundraising that aids this work. It is a platform that raises awareness and funding for medical and dental relief trips that provide crucial healthcare services to underserved populations, throughout the world.

Dr. Abulhasan's journey to periodontology is one of perseverance and optimism. Dr. Abulhasan took on each next step of her life with the mindset of blazing her own trail and picking herself right back up in the face of any challenge. Having been raised amongst three other brothers, she grew up tough and on her toes. While she faced challenges becoming accustomed to new environments, such as her move from Kuwait to Pittsburgh as a student or from Kuwait to USC as a clinician, she never backed down and always embraced challenges head on.

Dr. Abulhasan is a firm believer of being one's own number one supporter: "You make your own opportunities. I definitely think that's based on you. You don't need anyone to push you. You don't need anyone to be like, 'Hey, you did good.' In times of struggle, you can cry and hide under the bed, that's fine! But you have to get back up! You have to be your own motivation."

Applications of Periodontal **Regenerative Research to Endodontic Treatment**

Catherine Choi & Richard Lengkong

Dr. Khalid Al-Hezaimi, DDS is a clinical professor in the endodontics department at the University of Southern California's Herman Ostrow School of Dentistry. Dr. Al-Hezaimi began his dental school training by pursuing his Bachelor of Dental Surgery degree at the King Saud University in Riyadh, Saudi Arabia. He then arrived at Ostrow to pursue his training in endodontics, obtaining his Certificate in Endodontics in 2003. After working in private practice and as a part-time faculty member for a couple years, Dr. Al-Hezaimi continued his training in periodontology at the Tufts School of Dental Medicine in Boston, Massachusetts, during which he also obtained the Royal College of Dental Fellowship in Endodontics. Dr. Al-Hezaimi became a diplomate of the American Board of Periodontology in 2008, as well as of the American Board of Endodontics in 2012.

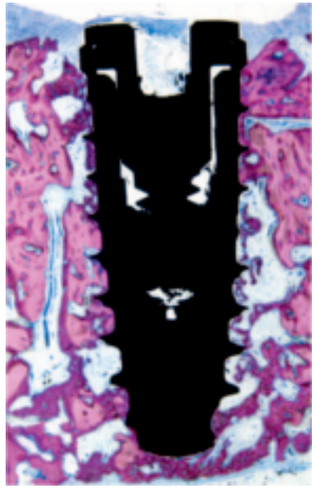
Dr. Al-Hezaimi's dual training in endodontics and periodontology was initially motivated by his time in the endodontics clinic. He recalled his time in private practice in Ottawa, Canada, where he found that he was often faced with a dilemma when it came to treatment planning: should the tooth be saved with root canal treatment, or should it be extracted and replaced with an implant? Dr. Al-Hezaimi also recognized the unparalleled advanced research conducted in the field of periodontology, specifically on the topic of regenerative dentistry. By pursuing both specialties, Dr. Al-Hezaimi found that he was able to take the concepts of regeneration and apply them to endodontics, allowing him to improve his clinical judgments and make more informed decisions.

A common theme in Dr. Al-Hezaimi's research is translational research that has direct implications on patient care, as well as an overlap between the fields of periodontology and endodontics. One of Dr. Al-Hezaimi's primary research interests developed from his training in periodontics is on platelet-derived growth factors (PDGF) and pulp revitalization. PDGF is a major mitogen and chemoattractant for connective tissue, including osteogenic cells of mesenchymal origin. PDGF has been shown to play an important role in promoting fracture repair and inducing new bone formation. Dr. Al-Hezaimi's work revealed that PDGF has similar bone volume formation activity when used in conjunction with mineralized bone allografts and xenografts within calvarial and dental alveolar ridge bone defects. Specifically, he found that recombinant human PDGF regulates the cell proliferation and migration of osteoblasts and fibroblasts, aiding in the regeneration of bony tissues in periodontal diseases and osseointegration of dental implants.

Subsequent studies further highlighted the significant impact of bridging his training in periodontology and endodontics. In a randomized controlled human clinical trial, Dr. Al-Hezaimi investigated the effects of PDGF on dental pulp using histomorphometric and microCT analyses. He found that PDGF, in combination with mineral trioxide aggregate (MTA) as a matrix, promoted dentin-like regeneration over the dental pulp. This increase in structural and reparative material promoted the healing capacity of the pulp by sealing the pulpal space following pulp capping procedures.

Dr. Al-Heizami

Dr. Al-Hezaimi's clinical observations of implant failures fueled additional research questions; specifically, he encountered patients taking selective serotonin reuptake inhibitor (SSRI) medications who experienced failed implants with no known explanation. SSRIs are the most commonly prescribed antidepressant medications. Dr. Al-Hezaimi's recent work, slated for submission shortly, focused on the impact of SSRIs on bone density as well as bone volume. Using real-time microCT scanning of rat models with calvarial defects, Dr. Al-Hezaimi found that the bone mineral density of the animals taking SSRIs did not increase as much when compared to the control group. To follow up on this finding, Dr. Al-Hezaimi conducted translational pre-clinical trials in human patients. In addition to the impact on bone density as observed in the animal studies, he also found that human subjects' bone volume was also reduced in patients taking SSRIs when compared to normal subjects.



The findings of the SSRI studies have impacted the way Dr. Al-Hezaimi thinks about and cares for patients when they are taking SSRIs during implant treatment. In particular, he identified two implications on the quality of care for these patients: the first is increasing the waiting time to permit sufficient bone regeneration to compensate for the SSRI-induced decrease in bone density, and the second is adding bone grafting materials when placing implants in order to augment bone volume.

Dr. Al-Hezaimi has incorporated his research experiences into various clinical settings and leadership positions. Between 2009 and 2020, he had a private practice in Ottawa, Canada, and also led research efforts at a research center in Saudi Arabia. In addition to research in growth factors and regeneration, Dr. Al-Hezaimi assisted the research center in Saudi Arabia with 3D advanced imaging.

Dr. Al-Hezaimi's extensive research studies along with his experiences in periodontology and endodontics have allowed him to identify three key elements of research. The first element is formulating and establishing a hypothesis. Especially for clinically relevant translational research, Dr. Al-Hezaimi finds that many research questions come from encountering a particular problem or difficulty in the clinical setting. In thinking about how to solve the clinical problem, Dr. Al-Hezaimi develops a translational research question.

The second element of research Dr. Al-Hezaimi has identified is the research methodology and design. He believes that putting careful consideration into how a research study is designed and implemented is critical for answering the research question.

Third, Dr. Al-Hezaimi believes that teamwork is an essential component of research. He finds that finding a team to work with and listening to others' critiques and ideas are what spark other ideas and answers to research questions. This collaborative environment in which ideas are shared and listened to promotes a rich research process.

For Dr. Al-Hezaimi, the one thing that encompasses all three of these elements is finding great mentors. His decision to relocate with his family to California and join the Department of Endodontics at Ostrow was, in large part, driven by the numerous mentors and collaborators. He expressed gratitude to the many mentors he had met over the years: Dr. Casey Chen, Chair of Periodontology; Dr. Ilan Rotstein, Chair of Endodontics; and Dr. Jim Simon, former Advanced Endodontics program director; as well as additional mentors both at Ostrow and on the East Coast.

When asked for advice to Ostrow's dental students who are interested in doing research, Dr. Al-Hezaimi emphasized the importance of mentorship. He believes that hard work, dedication, and finding the right mentor are very important to progress in the world of scientific research. The right mentor for each person is different, and the joy of learning and inspiration will be achieved by finding the right mentor. Dr. Al-Hezaimi strives to model a type of mentorship for his current students at Ostrow that inspires learning and joy in the process. After each session, he asks his students, "Did you learn today?" and, "Did you enjoy what you learned today?" He believes that the enjoyment of learning is key for junior researchers to explore and make scientific discoveries. Dr. Al-Hezaimi concluded with these final words of encouragement: "Enjoy what you learn, because this will unfold your capabilities and potential. If I can make it, everyone can make it."

Oral Health Beyond the Dental Office

By Merna Ghallab & Mailynh Nguyen

Introduction

At only the age 20, Dr. Nineli Zadourian moved to the United States with the mindset of using her skills and experiences to change lives and give back to her community. Dr. Zadourian completed university in Armenia and came to the United States with her heart set on contributing to the healthcare field. She began her search by exposing herself to different settings of what she believed to fulfill her expectations of helping people. During her undergraduate studies at the University of California, Irvine, she attempted to find her calling in research by assisting in an Alzheimer's disease research study, yet there was still something missing. She began branching out and working in children's hospitals along with dental offices and quickly realized that her efforts in dentistry truly reflected the scale of impact she anticipated with her work. She was continuously inspired by the potential dentistry had to make a difference. She now pushes her students to expand their experiences outside of what school teaches in order for them to understand the true meaning of giving back in dentistry and discovering what they are truly passionate about.

Community Outreach Programs

Dr. Nineli began her dental school journey and joined the USC Herman Ostrow family in 2012. She took advantage of existing school community outreach programs including AYUDA Clinic and the USC Dental Humanitarian Outreach Program (DHOP). AYUDA introduced her to student and faculty volunteering and the opportunity to provide monthly dental treatments and services to children of underserved communities across the Los Angeles and Orange County areas. Dr. Zadourian notes how this was the turning point in her career; she quickly knew that community dentistry was where her heart belonged. These experiences pushed her to realize the difference and importance of working with underserved communities versus working in preclinical classes. She remembers how she thought one day she would complete dental school, graduate, and work in an office. However, these outreach programs revealed to her how greatly these underserved communities are in need of a new generation of dentists that put their heart and soul into their work.

In her second year of dental school, Dr. Zadourian joined DHOP. DHOP is a student-run community outreach program that travels to different locations around the world to provide free dental care for underserved communities. The program started off as a small group of a few dental seniors and has now expanded to be one of the most anticipated dental outreach programs of the year. The trip included six full-time days of clinic where students completed endodontic procedures, extractions, restorative treatments, and prophylaxis. Dr. Zadourian recalls her first time on the DHOP trip, as a student, being one of the most fulfilling experiences. She enjoyed working with the children in the Philippines and feeling the honor of being able to help others feel better about themselves and encourage beautiful smiles. The second time Dr. Zadourian visited the Philippines, she was faculty advisor and assisted the group in providing about $200,000 worth of dental care to more than 350 patients. Dr. Zadourian's commitment and passion for community dentistry was evident, and, after 10 years of service, Dr. Sunny, the director of DHOP, passed over the role to Dr. Zadourian. Dr. Zadourian expresses great gratitude for the heartwarming opportunity to shift from being a student to a faculty advisor and experiencing both sides of the trip. Recently, Dr. Zadourian has been very busy organizing the upcoming trip to the Bahamas. After a two-year hiatus due to COVID restrictions, DHOP is up, running, and ready for a great trip.

In addition to her work with DHOP, Dr. Zadourian also serves as a member of the renowned USC mobile dental clinic. The mobile clinic has been around for over 50 years, aiding

underserved children and communities including veterans. The mobile clinic provides an extra layer of giving back and reminds Dr. Zadourian of how much she loves working with children. She explains that the clinic usually runs for 10 days in different schools (depending on the sponsors), and patients are brought in and screened. Over the weekends, treatment plans are created, x-rays are taken, and cleanings are completed while the weekdays are reserved for treatments. Dr. Zadourian advocates for the importance of emphasizing oral hygiene instruction and providing the appropriate supplies needed to maintain oral hygiene. She understands that patients may not always have time to go back to the dentist due to different circumstances; however, she believes that providing this education will lead to better health outcomes. She urges students to break away from the sim-lab bubble and put themselves in situations where they are exposed to different people, places, and situations. Furthermore, she advises students to put in the effort to seek opportunities to serve the underserved communities because it may change their entire outlook on their dental career just as it did with Dr. Zadourian.

Because Los Angeles is home to the infamous Skid Row, a 54 block with a very large homeless community, many of whom lack proper access to dental treatments and healthcare, the Union Rescue Mission (URM) was created in 1999 to help provide dental services to low-income communities. The URM dental clinic started out with only one dentist and one supervising dentist, but, today, it is directed by Dr. Mehdi Mohammadi and is a crucial rotation for fourth-year dental students in the Los Angeles area. Dr. Zadourian is an attending faculty member who oversees and supervises the students as they complete their treatments ranging from basic OHI to completing endodontic procedures. Dr. Zadourian works as one of the four attending faculty to oversee four of the eight chairs depending on the schedule. She encourages students, especially those who are in their first or second year of dental school, to join in order to expand their experience with real-life dentistry.

Dr. Zadourian notes that one challenge she is learning to overcome is finding the balance of working with her students and with the patients receiving the treatments. It is important for her to make sure everyone feels comfortable, including both the students providing the dental services and the patients receiving quality treatments. She says it's crucial to be flexible, adjustable, and understanding of everyone's point of view and learning style. Dr. Zadourian acknowledges the differences in each generation and how this contributes to providing different learning styles and experiences in order to achieve the highest quality of care. She believes that teamwork also plays a significant role, as she is exposed to many different students, faculty, and patients, and it is important to collaborate in order to make a change.

Dr. Zadourian has truly found her calling in community health dentistry. She has proven time and time again to shine in all aspects of dental public health programs. From working in the mobile clinic, to being an attending faculty of URM to leading one of the most coveted overseas trips of the year, Dr. Zadourian is an inspiration to us all. Even with a full schedule, she puts her students first and advocates for the highest quality of care for each and every one of her patients. She encourages students to break away from their normal routine and give back to their community. It is so important for her to have her students expand their experiences because the real world is so much more than working a 9am-5pm job; it is about feeling content with the work we are providing and growing as caregivers and clinicians. Dr. Zadourian notes that one thing she regrets not doing in her dental career is not starting her community dental health services earlier. However, she appreciates every opportunity she has had and acknowledges that certain challenges along her journey were crucial in order for her current success in her dental career.

Digital Dentistry:
The Beginning of a New Era

By Puneet Kumar & Bahar Khalilian

Dr. Sarah Alsaleh and Dr. Nazanin Forghani are both faculty members in the operative dentistry department at the Herman Ostrow School of Dentistry of USC, who obtained their degrees from the Advanced Operative and Adhesive Dentistry program and an additional Master of Science degree in Biomaterial and Digital Dentistry.

Dr. Forghani is originally from Iran and started her dental journey as a Doctorate of Dentistry and Oral Surgery (DDS) -Azad Islamic University, Tehran Dental Branch. She is a versatile and knowledgeable Doctorate of Dentistry graduate who possesses a strong aptitude and superior capabilities within the dental field. From the initial stages of her dental journey, she has been keen on research. Before coming to Canada to pursue her career in dentistry and pass exams, she worked for six years in private dental clinics. Her hunger to gain knowledge and become the highest in the field brought her to the United States of America. She has published many research articles on various and significant topics in dentistry. She has also presented the following papers at the 2nd International Hippocrates Congress on Medical and Health Sciences in 2019: 'The Importance of the Height of Sinus Floor to Ridge Level and Related Factors in Applicants' and 'The Importance of the Correlation between the Form of the Face and Upper-Central Teeth in Prosthodontics.'

Dr. Alsaleh was born in Saudi Arabia, where she received her bachelor's degree in dental medicine and surgery at Alfarabi College. Afterward, she started working as an intern leader in Alfarabi College's dental clinic, where she was responsible for coordinating fellow interns in the emergency room and providing weekly presentations on different oral surgery techniques. This unique opportunity helped her fine-tune her management and patient skills, and it also taught her how to work under pressure. In 2019, she completed a research project and poster presentation entitled "Attitudes toward Social Media among Practicing Dentists and Dental Students in Clinical Years in Saudi Arabia", which was published in The Open Dentistry Journal and was presented at the 16th Makkah Dental Conference. Due to her qualifications, she was able to receive a scholarship to continue her education in the United States. As part of the requirements for her scholarship, she attended English courses at Kaplan International English in Chicago.

In the Summer of 2020, Dr. Alsaleh and Dr. Forghani started their education at USC through the Advanced Operative and Adhesive Dentistry program and started their Master of Science in Biomaterials and Digital Dentistry degree in the Fall of 2020. When asked what they enjoyed the most about their education at USC, they mentioned that the emphasis on being minimally invasive in preparations stands out. Minimally invasive preparations can be helpful in conserving tooth structure and lengthening the lifespan of a tooth while also allowing the dentist to design restorations that do not compromise the required esthetics, form, and function. This program also allowed them to better understand the advancements within the field, such as digital dentistry, and how they can be incorporated into the daily life of dentists. Their inclination to digital dentistry directed them towards working with computer-aided design/computer-assisted manufacturing (CAD/CAM) subtraction and addition techniques.

"Digital dentistry has been a turning point in my life," Dr. Forghani says. This process plays an important role in the contemporary practice of dentistry and treatment that provides natural esthetics. With the help of digital impressions, digital wax-ups, 3D printing, and CAD/CAM technology, the process of fabricating and delivering restorations has become considerably faster than before with increased accuracy. Using different types of software, they are able to complete smile analysis where they digitally manipulate the smile alignment compared to the face, shape, and color of restorations, among other factors, and create mockups. Comparison of the digital mockups with the patient's current smile can help the patients to visualize the restoration before it is delivered and decide more accurately, which increases patients' acceptance of the final restoration. This also decreases the length and number of appointments, making the process more comfortable for both the patient and the dentist. Compared to the traditional methods, "the digital process is immensely enjoyable for the patients and encourages them to come back and finish their treatment," according to Dr. Alsaleh.

Following their passion for digital dentistry, Dr. Alsaleh and Dr. Forghani decided to research the material currently available for restorations through CAD/CAM technology. Dr. Alsaleh's research focused on four different lithium disilicate reinforced glass ceramics (IPS e.max CAD, Amber Mill, Initial LiSi Block, and n!ce), while Dr. Forghani analyzed three Zirconia material with different Yttrium concentrations (3Y, 4Y and 5Y) . In their research, they both measured Biaxial Flexural Strength (BFS) using a universal testing machine. In this test, each material is milled into a cylindrical block and sectioned into circular discs with specific measurements. The disk samples are fired and placed on three balls arranged into a circular shape. A controlled force is applied using a piston until the sample fractures.

Specifically, Dr. Alsaleh's measurements were concerned with 0.5 mm and 1.0 mm thicknesses the four materials after baseline, one, three, and five firings. The analysis of the biaxial flexural strength data was performed using the parametric test ANOVA as well as Weibull analysis to find the statistically significant results and determine the reliability of the tested materials. The different materials had varying biaxial flexural strengths, with e.max and Amber Mill as the highest BFS, followed by LiSi and n!ce. Dr. Alsaleh believes this difference is due to the amount and size of lithium disilicate crystals. Materials such as e.max and Amber Mill are called lab-side because they are milled in the green state and need an additional firing. On the other hand, LiSi and n!ce are called chair-side materials because they can be delivered after milling and do not require additional firing, according to the manufacturers. Lab-side materials had a higher BFS because, after their baseline firing, they have a higher lithium disilicate content. Finally, each material had a higher strength with a higher thickness compared to a smaller thickness. The clinical implications of Dr. Alsaleh's research go back to how the choice of material and its processing can affect the strength of the final restoration. Dr. Alsaleh mentions, "Clinicians and technicians may repeat firings multiple times for adding stain or glazing, but we need to be careful. Where is the threshold? Where do we stop?".

Similar to Dr. Alsaleh, Dr. Forghani has been intensively researching on biaxial flexural strength of CAD/CAM material. In particular, the main objective of her study was to examine the influence of yttria content, surface treatment, and artificial aging on the biaxial flexural strength of zirconia. Three zirconia materials [Bio ZX^2 (3Y-TZP), DD cube One(4Y-TZP), and DD $cubeX^2$ (5Y-TZP)] (12 mm diameter, 1.2 mm thickness) were divided into aged and non-aged groups and subclassified based on surface treatments: none, wet and dry abrasion (n=15). For disk fabrication, cylinders (ø 15 mm, length 14 mm) were milled from round blocks using a milling machine. The cylinders were attached to CAD/CAM block metal sprues and sliced into 1.4 mm thicknesses using a low-speed precision saw. Disks were polished to 1.5 mm thickness and sintered according to the manufacturer's recommendations. An accelerated aging test was performed using steam at 134±2°C under a pressure of 0.2 MPa for 5 h. Wet and or dry particle abrasion was performed by 50 µm Al_2O_3 particles. A universal testing machine was used to evaluate BFS using the piston-on-three-balls technique. Data were analyzed by Three-way ANOVA and Weibull analysis.

The results of this research study were highly clinically significant as they indicated that yttria content significantly impacted BFS, with the highest for 3Y and the lowest for 5Y. Particle abrasion increased the BFS of all materials. Wet abrasion resulted in a lower Weibull modulus and showed higher dispersion of the measured data than dry abrasion. Aging had an insignificant effect on BFS of 3Y and 4Y, but it decreased BFS of 5Y. In conclusion, Particle abrasion and decreasing the yttria content can increase BFS of zirconia materials.

During the process of their research projects, both Dr. Alsaleh and Dr. Forghani completed the coding required for analyzing the data by ANOVA and Weibull analysis, as well as creating plots. This was an interesting experience for both as neither had much previous experience in computer science. The benefit of the struggle, Dr. Alsaleh says, was that "now we truly understand our data because we analyzed it ourselves".

After working with each other for two and half years, Dr. Alsaleh and Dr. Forghani have become great friends and co-workers. Both Dr. Forghani and Dr. Alsaleh are gifted with excellent critical thinking, clinical, and interpersonal skills. Their passion and dedication towards operative dentistry and their research are intriguing, and we wish them the best in their future endeavors.

A Passion for
Oral Cancer

Wenshuai (Katherine) Mu, Justin Matian

Dr. Dechen Lin joined the Ostrow family at the Center for Craniofacial Molecular Biology in early 2022, coming to us from Cedars-Sinai Medical Center. He is an Assistant Professor at USC's Herman Ostrow School of Dentistry and an Associate Director at the USC Head and Neck Center. He attended Nanjing University in China where he received his Bachelor of Science in Biology, later going on to pursue a Ph.D. in Cell Biology at the Chinese Academy of Medical Sciences.

As an undergraduate, Dr. Lin found himself interested in cancer research. By that time, he had begun to explore fluorescence in situ hybridization (FISH), a technique used to detect specific DNA sequences in cells. FISH involves the hybridization of fluorescently labeled probes to specific regions of DNA within the cell, which allows for the visualization and localization of specific genetic sequences. In cancer cells, FISH is often used to detect specific genetic changes, such as amplification or deletion of oncogenes or tumor suppressor genes, which can aid in the diagnosis and treatment of cancer. Therefore, instead of only having two copies of the genome, there will be a hundred copies of the genome in the cancer cells.

While Dr. Lin's research continues to focus on analyzing cancer genomes, he now uses more advanced methodologies and technologies, such as next-generation sequencing (NGS). NGS allows for the simultaneous analysis of hundreds or even thousands of genes across multiple samples, making it a powerful tool for cancer genomics. NGS can be used for a variety of applications in cancer research, such as identifying mutations and structural variations in cancer genomes, characterizing the transcriptome and epigenome of cancer cells, and identifying new therapeutic targets. Dr. Lin discussed how the use of NGS greatly enhances the efficiency of cancer research. He recalled that, during his Ph.D., it took him 3-4 days to sequence one gene for one patient. Now, it only takes him 8 hours to analyze the whole genome of over a hundred patients.

One of his current projects focuses on oral cancer and its early detection. Oral cancer can be divided into two categories: HPV-positive and HPV-negative. HPV-positive oral cancer is caused by infection with the human papillomavirus (HPV). This type of oral cancer is on the rise, particularly in developed countries, and is most commonly found in the back of the throat. HPV-negative oral cancer is caused by factors such as tobacco use, alcohol consumption, and other environmental factors. This type of oral cancer is more common in the lips, tongue, and floor of the mouth. Dr. Lin notes, "It is interesting that HPV-positive and HPV-negative oral cancer have very different biology." HPV-positive oral cancer tends to have better response rates to treatment and improved survival outcomes compared to HPV-negative oral cancer; however, HPV-positive oral cancer is often diagnosed at a later stage and has a higher incidence of recurrence and metastasis.

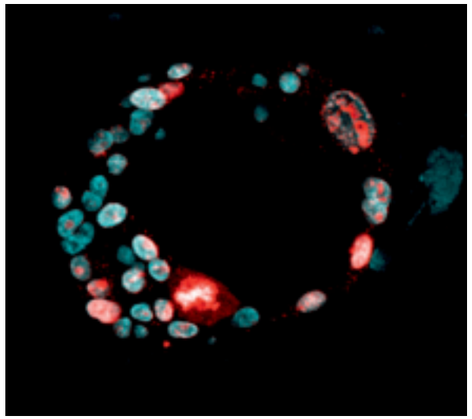
Dr. Lin emphasizes the importance of oral cancer research, given that, "oral cancer can have a significant impact on a person's quality of life". Treatment for oral cancer often includes surgery, radiation therapy, and chemotherapy, which can cause side effects such as pain, swelling, changes in appearance, and difficulty eating and speaking. The treatment can also lead to long-term side effects such as dry mouth, difficulty swallowing, and nerve damage. The psychological impact of oral cancer can be significant. The treatment process can be physically and emotionally draining, and many people struggle with feelings of anxiety and depression as they go through treatment and recovery. Oral cancer can lead to disfigurement, as the treatment may require the removal of parts of the jaw or tongue, which can change the patient's appearance and affect their self-esteem and social interactions. Dr. Lin further elaborated that "the suicide rate for patients with oral cancer is one of the highest as a lot of them have had their tongues taken out." As a result, it is essential to find a reliable method to detect oral cancer in an early stage since it would create significant differences in patients' quality of life. To achieve that goal, Dr. Lin and his team are developing various methods to aid the understanding of oral cancer detection and treatment.

Cancer represents the second leading cause of death globally, accounting for one in six deaths according to the World Health Organization (WHO). In the past decade, significant advances have been made in cancer research. One of the promising advancements regarding tumors was highlighted in the interview with Dr. Lin. Dr. Lin spoke about diving more deeply into white lesion biopsies in the hopes of understanding how these white lesion samples become tumors and what really happens. Dr. Lin emphasized the importance of making this scientific achievement because there are hundreds to thousands of changes along the genome in gene expression and protein expression that we do not yet fully understand. With better knowledge and information, we can catch the genes and proteins that change most dramatically and most consistently among patients. With this information, we hope to create biomarkers to predict the change from white lesion to cancer. Dr. Lin went on to state,"If we are able to get these biomarkers, then clinicians will have a way to tell which lesions are capable of becoming a tumor and which lesions are not."

The interview with Dr. Lin continued on the premise of cancer cloning. The path to cancer is often a long process with many mutations. It takes the right combination of mutations for a tumor to become malignant and begin to grow. In clonal evolution, there are two main models. The first model is linear and the second is branched. In linear evolution, there is a driver mutation or a pinpoint mutation that enables a clone to outcompete cells that do not have a mutation. These mutations assemble and gather together in a stepwise or cumulative fashion as each new clone replaces the one before it. Meanwhile, branched evolution is where tumors may go through a process in which different independent cells gain a mutation - often referred to as subclonal mutation - that benefits a competitive advantage. Unlike linear evolution, branched evolution does not follow the principle that each new clone replaces the one before it. Instead, a number of subclones evolve in parallel unison. As a result of this process, a type of intratumoral diversity is created over time.

With cancer being the global problem that it is, a large issue that arises is discovering that you have it. Dr. Lin expressed his concern with how so many patients do not know they have oral cancer until it is too late. Dr. Lin said, "These lesions are under the skin when they are small and because they are not evident until an X-ray or CT scan, many patients think they are healthy when in fact it is a matter of time until cancer grows." One of the outstanding precursors to oral lesions and oral cancer is smoking and drinking. Cigarette smoke is a complex mixture of more than 5,000 chemicals including oxidants, carcinogens, and toxins. Influences such as carbon monoxide, oxidizing chemicals, volatile organic compounds, particulates, heavy metals, and nicotine are just some of the many components within a cigarette that damage our cells. The risk of being diagnosed with oral cancer is about 5 to 10 times greater among smokers when compared to individuals who do not smoke. The thousands of chemicals in tobacco smoke help initiate and promote genetic changes in the mouth cavity's cells, which can lead to the development of oral cancer. Because the use of cigarettes - especially tobacco - increases the risk of oral cancer by exposing the mouth to these carcinogenic chemicals, patients who smoke should check their oral health more often.

Dr. Lin emphasized his love for the field of cancer research and specifically oral cancer because he is a firm believer in discovering these tumors early and always wants to help. Dr. Lin is an example of true human excellence and humanity as health promotion is his true passion.



A Passion for **Operative Dentistry**

By Puneet Kumar & Bahar Khalilian

Dr. Goercke

Dr. Andrea Ramirez Goercke was born in Ecuador. She graduated from the University of Cuenca School of Dentistry in 2017, after which she completed a master's in esthetic dentistry in Madrid, Spain. This program not only enhanced her general knowledge of esthetic dentistry but also opened her eyes to new possibilities in dentistry such as digital dentistry. While completing her master's degree, Dr. Ramirez Goercke realized the importance of photography in the documentation of cases as well as communication with the patients about their oral condition and treatment plan. Therefore, she decided to take a course in basic photography to add to her skill set and better help her patients. In these years, she also completed multiple poster presentations, including one in Barcelona, Spain, where she presented a case of veneer and crown with high esthetic demands. Such experiences familiarized her with the world of research and how different researchers carry out their projects.

Her hunger and devotion to knowing more about operative dentistry brought her to the United States, where she attended both the advanced operative program and worked on her master's in biomaterials and digital dentistry at USC's Herman Ostrow School of Dentistry at the same time. Her education at USC gave her a deeper perspective on the nature and composition of the material used in operative dentistry, which has helped her gain a more profound understanding of the use of each material in a clinical setting. During this time, she was also a faculty member in the pre-clinic operative courses. Her first teaching experiences were teaching and tutoring English, biology, and German; these were excellent opportunities to continue her enthusiasm for teaching in the field of dentistry.

While at USC, Dr. Ramirez Goercke decided to further pursue her passion for restorative dentistry as an art and science through a research project on dental materials used for computer-aided design/computer-assisted manufacturing (CAD/CAM). "This is the era of digital dentistry and CAD/CAM dentistry has been a big part of it," Dr. Ramirez Goercke says. One of the popular products used for indirect restorations has been e.max lithium disilicate blocks. When the patent for this material expired in 2019, other companies were allowed to use the formula to produce their own lithium disilicate products. This gave clinicians more diverse options to choose from. At the same time, each material had its own specific properties, which can affect the final restoration delivered. In clinical practice, each block may be fired two or more times even after crystallization for staining and glazing of the final product. Each firing cycle may change the color and translucency of the material, which can lead to a restoration with different esthetic properties compared to the intended results. Therefore, Dr. Ramirez Goercke's research focused on the changes in color and translucency that can happen with different materials and firing cycles.

She worked on four different lithium-disilicate reinforced glass ceramic blocks: e.max CAD (EX; IPS e.max CAD, Ivoclar Vivadent, Schaan, Liechtenstein), n!ce (NC; Straumann, Freiburg, Germany), Initial LiSi Block (LS; GC, Tokyo, Japan), and Amber Mill (AM; HASSBIO, Kangreung, Korea). Each lithium disilicate block was sectioned into smaller specimens with specific measurements with a thickness of 0.5 mm or 1.0 mm. The e.max and Amber Mill blocks were fired based on the manufacturer's recommendations as these blocks were provided in their green state. No pre-firing was required for the n!ce and LiSi blocks, as they were already crystalized by the company. Afterwards, each block was polished to minimize the scratches present on the specimen. This was to prevent scratches from affecting light reflection. Each block was thereafter subjected to 5 more firing cycles based on the manufacturer-recommended protocol for staining and glazing. To understand color and translucency, Dr. Ramirez Goercke needed to measure three different parameters of L, a, and b using the spectrophotometer. The parameters L, a, and b are part of CIELAB color system, where L represents lightness and a and b are chromaticity coordinates. These three parameters helped her calculate the ΔE00 and translucency parameters, which respectively signified the color and translucency change of each block after firing. Based on her findings, Dr. Ramirez Goercke has the following suggestion for the maximum number of firings for each material to achieve excellent esthetics: e.max four firings, n!ce three firings, LiSi five firings, and Amber Mill one firing. Firing more than these recommendations can negatively affect the esthetics of the final restoration. Moreover, thicker specimens had more pronounced changes in color with the firings. Therefore, all the aforementioned factors (i.e., material, thickness, and number of firings) need to be considered when completing multiple firing cycles.

Dr. Ramirez Goercke mentions that, as new dental products come to the market, each has slightly different characteristics, and it is important to investigate each accurately and carefully. Understanding the properties of each material will ensure their appropriate use in the clinic and the best outcome for our patients. The research journey has been long and time-consuming, but at the same time, an extremely rewarding one according to Dr. Ramirez Goercke, and she highly encourages any student interested in research to pursue it.

After finishing the final steps of her research project, Dr. Ramirez Goercke is looking forward to teaching as a faculty member in her home country. In addition to working at the dental school, she will be opening her private practice, where she can apply the valuable knowledge she has gained through her research to provide her patients with the best treatment. The most memorable moments for her as a clinician have been the final appointments where the treatment is completed, and she can enjoy the satisfaction of her patients with their new, healthy, and esthetic smile. Dr. Ramirez Goercke's dedication and passion for operative dentistry are admirable, and she will no doubt continue to thrive in her field.

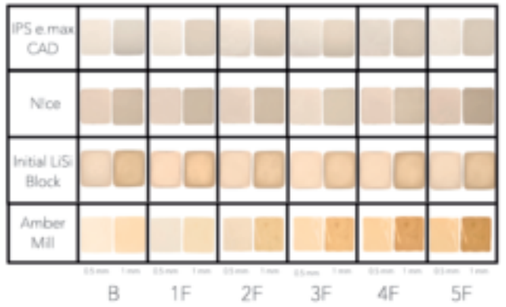


Figure 1: Lithium Disilicate Materials after multiple firings (B: Baseline; 1F: first firing; 2F: second firing; 3F: third firing; 4F: forth firing; 5F: fifth firing

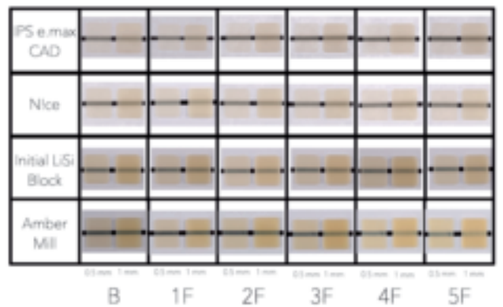


Figure 2: Lithium Disilicate materials' translucency after multiple firings

A Transformative Approach to the Care and Management of Orthodontic Patients

By Greg Park & Haeseong Lee

Dr. Alice Shen was born in Taiwan and received her dental education from the School of Dentistry at Taipei Medical College. She completed her training at Chang Gung Memorial Hospital in Taipei, where she shadowed craniofacial reconstructive surgery under the orthodontics team. For her, it was breathtaking to see how orthodontists could serve in such a unique capacity and contribute meaningfully amongst a group of plastic surgeons, orthopedic surgeons, radiologists, speech therapists, geneticists, general dentists, and prosthodontists. A variety of different specialists had come together to synergize their expertise and provide excellent clinical treatment for cleft palate patients.

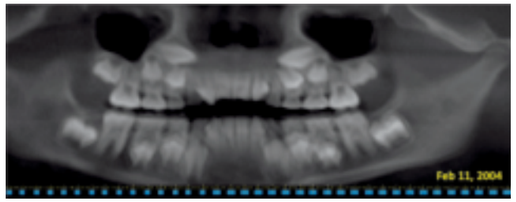
The orthodontics team played an indispensable role. Specifically, cleft palate patients require a bone graft procedure in the cleft site prior to the eruption of the maxillary canines. The bone grafting can only be performed after the completion of maxillary arch expansion, which opens the cleft site and allows for the successful placement of the bone graft material. Ultimately, Dr. Shen was intrigued and inspired by the significant impact multidisciplinary team efforts have and how they remarkably transform the lives of individuals. Eager to become involved herself, Dr. Shen applied and matriculated at Ohio State University's orthodontics program in 1979.

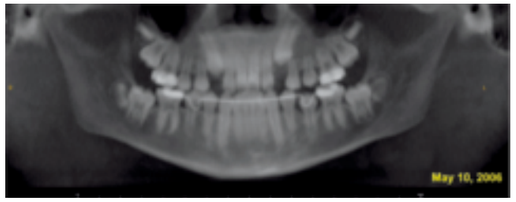
After finishing her orthodontics residency, Dr. Shen decided to pursue formal dental training in the United States, in hopes that it would help her communicate better with other U.S.-trained dental specialists and professionals. She completed the Advanced Standing Program for International Dentists (ASPID) in 1984, receiving her Doctor of Dental Surgery (DDS) degree from USC. Afterwards, she began teaching orthodontics to USC predoctoral students then to postdoctoral residents in 1991, after becoming American Board of Orthodontics (ABO) certified.

Dr. Shen sought to apply the knowledge she had garnered through her years of dedicated training to fulfill her dream of transforming lives and serving cleft lip and palate patients. She joined the reputable craniofacial team as the team orthodontist at Rancho Los Amigos Hospital in Downey, California, where she experienced exponential professional growth through frequent communication with colleagues from different specialties. She cherished the rich dialogue she had with groups of various experts and specialists in her team and enjoyed growing through the multidisciplinary exposure and teamwork that was required to treat complex cleft lip and palate patients. As Dr. Shen stated, "There is a sense of fulfillment in transforming the lives of cleft lip and palate patients."

Labeled by many as an expert in impacted canines, Dr. Shen has also had a profound impact on the prevention and clinical management of impacted cuspids. While teaching at USC, she noticed there were several papers discussing impacted canines in the context of surgical exposure technique, orthodontic biomechanics, in moving the impacted cuspid into the oral cavity, and adverse effects of moving the impacted cuspid, such as root resorption, ankylosis, devitalization, and bone loss. However, scant research had been done on the prevention of impacted cuspids. She recalled her specialty training at Ohio State University, where the orthodontics program chairman, Dr. Benjamin Williams, had a collection of dry skulls. These skulls clearly demonstrated the eruption pathway of cuspids during the ages of 5-12. Dr. Shen received slides of these dry skulls from Dr. Williams and began to analyze and cultivate her interest for upper cuspid impaction.

Further investigating the topic, Dr. Shen came across Contemporary Cephalometric Radiography by Dr. Kunihiko Miyashita, who had amassed a collection of approximately one hundred skulls. Eager to learn more and study the skulls for herself, Dr. Shen visited Dr. Miyashita in Tokyo, and evaluated the skulls in his office. She was fortunate enough to find a skull with a palatal impacted cuspid. Using the resources available to her through the USC Orthodontics Department, specifically, the Redmond Imaging Center, Dr. Shen utilized cone-beam computed tomography (CBCT) to diagnose the location of the impacted cuspid in some clinical cases. Synthesizing all the information from her exhaustive study of dry skulls as well as the results of the CBCT, along with input from Dr. Williams, Dr. Shen presented a paper "Maxillary Cuspid Impaction: Can the Problems Be Prevented?" at the Edward H. Angle Society of Orthodontists meeting in Quebec City, Canada. During this decisive moment, Dr. Shen recalls how Dr. Williams spent hours going over her presentation material. He dissected the cases that she was going to present, helping her prepare for one of the most important





presentations she would give in her academic and professional career. The response at the meeting was overwhelmingly positive due to the treatment outcome of the cases.

"The philosophical belief is that most teeth will erupt if all bony or soft tissue impingement or any other obstructions are removed from the path of eruption. Sequential extraction is the treatment protocol. The first step is extracting the deciduous first molars to speed the eruption of the first bicuspids. Retract the first bicuspids to give the cuspid room to erupt after the extraction of primary cuspids. The sequential extraction of the deciduous first molars and then extraction of the deciduous cuspids allow a better path of eruption of the permanent cuspids."

It did not take long before Dr. Shen's commitment to academic excellence, compassionate patient care, and dedicated leadership was noticed by the very best in the orthodontics community. In 2021, Dr. Shen was named the first female president of the Edward H. Angle Society of Orthodontists in Southern California, the most prestigious orthodontics society in America. Prior to such honor, she had been one of two female board members in the Angle Society and had served on the board for fourteen years. She recalls presenting five cases to the board to become an affiliated member of the society in 1990 and ten cases two years later to obtain full membership into the Angle Society. She had taken constructive criticism from members and thoroughly corrected her mistakes to improve. With her dedication to perfection and excellence, Dr. Shen was granted full membership to the most prestigious orthodontics society in 1992, which she now leads as the president. Dr. Shen has mentioned how honored she is to take on such a role and appreciates the board members who have been of great support for over 20 years.

Dr. Shen has demonstrated a commitment to exercising proper care and management of patients. She highlights communication as the first key element in doing so: "We need to fully understand the needs of the patients and explain whether orthodontic treatment can meet the patients' needs." She adds that clearly describing the pros and cons of different treatment plans is fundamental to establishing the second key element, which is relationship building. The process of building relationships involves taking certain steps to let patients know that orthodontists will be there for them and comfort them in troubling times. Dr. Shen would purchase several cans of protein shakes for her patients following orthognathic surgery and follow up with them and their parents to ensure they were following post-operative instructions properly. She mentions that the third key element to the successful care and management of patients is problem solving. Problem solving and re-evaluation of the treatment plan are both important habits to consider, as the treatment may not proceed as intended, whether that be from failure to comply with the treatment or unexpected events that change the course of treatment. Dr. Shen underscores the importance of keeping an open mind and being flexible to the possibility of alternative treatment options. For instance, if a patient with Class II molar relationship refuses to wear the headgear appliance, and they are still in Class II molar relationship after 9 months of treatment, the treatment plan may need to be modified to an extraction approach. Dr. Shen states, "It is better to alter the treatment plan during the orthodontic treatment. It might be too late to wait until the end and settle with a compromised result."

Dr. Shen has proudly served nearly 40 years as a volunteer faculty for the USC Graduate Orthodontics program and continues to be a guest lecturer at several study clubs in the Greater Los Angeles area. Her desire to impart knowledge extends beyond the academic space, as she spends time educating general and pediatric dentists regarding tooth impaction, orthodontic screening, and the importance of early referrals to the orthodontist. Using her protocol for the prevention of canine impaction, Dr. Shen continues to host lunch and learns and has raised awareness on the importance of early teeth screenings and their role in the interception of canine impaction: "One of the key factors is the timing of examining the patients. Educating the referring pediatric dentists is crucial. I recommended screening the patients at the age of eight."

Dr. Shen has been a charitable clinician, determined leader, and passionate educator throughout her life. Her impact and footprint extend well beyond the field of orthodontics, as she continues to inspire the next generation of health care providers through her passion for helping others, teaching, and transforming lives. As she stated, "Transforming patients' lives is something special orthodontists can do for people."

From Crop to Cartilage:

The Journey towards Preventing Osteoarthritis

By Luke Aguilar & Kaveh Mahdavi

Dr. Zhaoyang Liu's research journey towards craniofacial and molecular biology begins with something different: plants. In 2006, she became an undergraduate researcher at the Nanjing Agricultural University in China. There, Dr. Liu investigated how plants respond to environmental stress and the effect of this stress on lateral root formation in crops. She continued to use a plant model during her master's study when she immigrated to the United States and, in 2008, achieved admission to the Department of Cell, Molecular, and Structural Biology at Miami University in Ohio. Dr. Liu studied the mechanisms of alternative mRNA processing and elucidated that various genes and environmental stimuli could affect the processes of alternative RNA splicing and polyadenylation, leading to differential outcomes for mRNA products in plants such as Arabidopsis thaliana.

After completing her master's degree, Dr. Liu wanted to apply her molecular and cellular knowledge towards something more directly relevant to human health. Upon beginning her Doctor of Philosophy at the University of Rochester Medical Center in New York in 2010, she started utilizing a vertebrate animal as a study model. In the Center for Musculoskeletal Research (CMSR), Dr. Liu used mouse models to study the role of Notch signaling ("Notch" referring to a highly conserved signaling pathway that is crucial in development) in the maintenance of articular cartilage.

At this point, Dr. Liu became captivated by tissue cartilage and osteoarthritis. For Dr. Liu, cartilage is an intriguing type of tissue. It is important for long bone formation because it serves as a template on which osteoblasts (specialized bone cells) can deposit bone matrix. As long bones grow, cartilage is replaced by bone tissue, and only articular cartilage - serving as "joint cartilage" - is maintained for the remainder of life. The homeostasis of joint cartilage is important for supporting the movement of the body. There are joint cartilages all over the body at different joints, including the temporomandibular joint (TMJ) in the jaw, the intervertebral discs (IVDs) in the spine, and the knee and hip joints in the long bones.

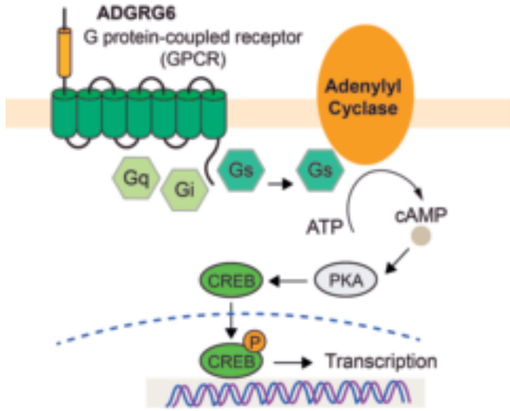
Osteoarthritis is one the most common degenerative joint diseases in the world. Over 50% of humans by the age of 65 have some form of joint osteoarthritis-related phenotypes. Thus, osteoarthritis is one of the leading causes of disability and causes a large financial burden to both those afflicted by it and those treating it.

Treatment of osteoarthritis is important, but what if we could prevent it from happening? To answer this question, we need to have a comprehensive understanding of how cartilage maintains itself and responds to stress and injury. With her research as a postdoctoral fellow at the University of Texas at Austin, Dr. Liu aimed to explore the molecular mechanisms that maintain cartilage homeostasis. At this time, she focused on the IVDs, which are fibrocartilaginous joints that play a crucial role in the movement and stability of the spine.

Dr. Liu discovered that a G-protein-coupled receptor (GPCR) named ADGRG6, plays a crucial role in spine alignment via the maintenance of both cartilaginous tissues such as the IVDs and the connective tissues such as ligaments and tendons in the spine. Research has shown that mutations in the gene that codes for ADGRG6 lead to a disease called scoliosis, which manifests as abnormal curvatures in the spine. The onset of this disease is sudden and typically occurs in adolescents. In addition to being very painful at times, scoliosis can truly affect a patient's quality of life. Dr. Liu's research shed light on the development of therapeutic approaches to diagnose and hopefully prevent scoliosis.

Liu

From this point on, Dr. Liu honed her research focus on the role of GPCRs - especially ADGRG6 - in joint cartilaginous tissues. Dr. Liu aimed to see if ADGRG6 plays a role in cartilage maintenance. She describes this in her research on mice:



ADGRG6 signaling pathway

"We generated a genetic mouse model of osteoarthritis (OA) by knocking out the gene Adgrg6 in mature articular cartilage. As these mice age, they exhibit OA-like joint phenotypes. We also have an injury-induced mouse model that mimics post-traumatic OA (PTOA), by destabilizing the ligaments and meniscus within the mouse knee joint."

She isolated two downstream effectors of ADGRG6: cyclic AMP (cAMP) and STAT3. These two effectors crosstalk with each other and play a role in the maintenance of articular cartilage. These research efforts enabled Dr. Liu to achieve the highly competitive K99/R00 award supported by the National Institutes of Health (NIH) to promote the independent career development of postdoctoral fellows. After receiving this award, Dr. Liu started working at the University of Southern California's Center for Craniofacial and Molecular Biology (CCMB) in 2022.

Dr. Liu's current research focuses on the role of ADGRG6 in cartilage and joints. Her hypothesis is that cAMP pathways protect cartilage under physiological conditions while the STAT3 pathway interacts with catabolic factors that have the potential to harm cartilage under pathological conditions. ADGRG6 might help to promote protective pathways and inhibit catabolic pathways. Her team is trying to figure out the exact targets of these two signaling pathways in articular cartilage and how they are targeted. As Dr. Liu's research reveals these pathways, future clinical implications could include stimulating cAMP signaling or other specific downstream factors - specifically within cartilage - to promote the maintenance of articular cartilage during aging or injury. STAT3 signaling is involved in the inflammatory response, so there is potential to use small molecule inhibitors of STAT3 signaling to protect cartilage after injury.

Dr. Liu recognizes herself as an orthopedic researcher, so joining CCMB has provided her with the unique opportunity to integrate craniofacial biology into skeletal biology to mutually benefit those two fields. At USC, Dr. Liu hopes to apply her cartilage research to the craniofacial region and to expand her expertise toward TMJ and temporomandibular disorders (TMD).

A background in orthopedic research is not the only thing that makes Dr. Liu unique. She is pioneering and establishing a proper protocol to apply spatial transcriptomics, a cutting-edge technique to analyze gene expression, to skeletal tissue research. Spatial transcriptomics is used to integrate gene expression information with morphological information. This groundbreaking technique reveals exactly where genes are expressed within a tissue. Spatial transcriptomics has been applied to soft tissue such as in the spinal cord, brain, and solid tumors, but it has not been applied to skeletal tissues because it is hard to manipulate once the bone becomes mineralized. Dr. Liu is changing this to apply the invaluable technique to mineralized tissues. Her pioneering work with this technique will not only aid her in discovering the specifics of GPCR-related pathways but also has the potential to benefit the broader research community's work on mineralized tissue.

When Dr. Liu feels she needs to be refreshed and refocused during her research, she does calligraphy. During our interview, she readily held up a notebook page full of the beautiful script, displaying her regular use of this technique to refresh her thought process. In her free time away from lab work, she also practices traditional Chinese engraving using a knife on soft stone.

As Dr. Liu traveled across the world for her research, she also traveled between areas of research. Moving from plants to long bone cartilage and spine cartilage has allowed her to pioneer techniques and join adjacent academic fields to strengthen the research community. As she elucidates the pathways involved in ADGRG6 receptor signaling, she is increasing the understanding of joint homeostasis and the pathophysiology of osteoarthritis. Her position at CCMB will allow her to integrate this achievement with temporomandibular joint maintenance and development. At each stop in her journey, Dr. Liu has contributed significant knowledge to her field, and her continued willingness to explore ensures that this contribution will continue.

Interview with Pediatric Faculty
Dr. Philip Yoong

By Daniel Kohanghadosh and George Parisis

Dr. Philip Yoong was born and raised in Southern California and received his Bachelor's of Science degree in General Biology from the University of California, San Diego. During his undergraduate schooling at the University of California, San Diego, Dr. Yoong had the unique opportunity to volunteer on a dental mission trip in Africa. During this dental mission trip, he helped provide dental care to patients who would not otherwise have had the opportunity, or even the finances, to receive much-needed dental work. During this time, Dr. Yoong witnessed the potential for leaving a memorable and positive impression on the individuals and community at large that these dental practitioners were so fortunate to serve through providing patients with personalized knowledge of their oral conditions, hygiene, and health. Ultimately, he helped foster an environment that empowered these underserved patients while helping address their operative, periodontal, and surgical needs, which was gratifying in and of itself. While pursuing his undergraduate studies at the University of California, San Diego, Dr. Yoong discovered his passion for dentistry when he learned that dentists have the unique capability to diagnose and treat patients on the same day, if possible, and alleviate pain. Dr. Yoong is a first-generation dentist who went on to pursue his dental degree at the University of Michigan School of Dentistry where he graduated in 2019. Despite having a traumatic childhood experience at the dentist, he witnessed the positive impact of early dental intervention on an individual's oral health, and this inspired him to pursue the specialty of pediatric dentistry. In 2021, he completed his pediatric dental residency at the Herman Ostrow School of Dentistry, after which he received his certification in pediatric dentistry.

Dr. Philip Yoong is currently an adjunct assistant professor of clinical dentistry at the Herman Ostrow School of Dentistry at the University of Southern California; he is an attending for pediatric residents and the course director for the pediatric module taken by second-year predoctoral students. As a course director, Dr. Yoong prepares course curriculum, specifically lesson plans and hands-on course work, for the students as he helps instruct them on the importance of proper dental care for pediatric patients. Dr. Yoong provides invaluable teaching to his second-year students by sharing his first-hand experience as a pediatric dentist during case discussions. Furthermore, he works in a private pediatric practice in Orange County and is a hospital provider at the Children's Hospital of Orange County where he once made rounds as a pediatric dental resident. At Children's Hospital of Orange County, Dr. Yoong provides care to the pediatric special patients with challenging medical conditions and is able to put his passions for interprofessional collaboration and alleviating care barriers into practice.

At the University of Michigan, Dr. Yoong helped establish a nonprofit called Bridge of Disciplines. The Bridge of Disciplines created meaningful collaborations between different disciplines such as medicine, nursing, pharmacy, and social work all while keeping the dental field as the centerpiece. In this collaboration. Dr. Philip Yoong worked with 17 project directors who led the collaboration between each of the departments including social workers who worked with the Ann Arbor community. Additionally, he worked on completing the following projects: creating a pediatric fluoride treatment campaign for children in the area, promoting dental awareness to the different discipline areas such as the medicine and nursing, creating opportunities for elementary and middle school students

to learn about oral health, and allowing for the ear nose throat physicians to provide head and neck screenings for cancer.

Dr. Philip Yoong started his dental research at the University of Michigan School of Dentistry where he was part of a research group that won a grant valued at $15,600. The research team ultimately decided to put all the grant money they received towards the student-run dental and medical clinic. They selected this clinic due to the interdisciplinary methodology they incorporated where students used their head and neck anatomy knowledge to enhance their education in this interprofessional environment.

Dr. Yoong sought for more and continued his research at the Herman Ostrow School of Dentistry at the University of Southern California while completing his pediatric residency. During his pediatric residency, he provided comprehensive systemic care to a patient population in a free clinic setting that incorporated the dental aspect into an interprofessional collaborative study between medical, social work, nurse practitioner, and pharmacy students. In addition, Dr. Yoong conducted research with the Suzanne Dworak-Peck School of Social Work at USC where he studied cases with general anesthesia, investigated patients' stress levels throughout the treatment, and used different levels of intervention through video and/or narratives. Although research studies became harder to conduct due to the COVID-19 pandemic, Dr. Philip Yoong and the team still continued to push forward with their research. As a result of their hard work, the research revealed that there was a positive correlation for patients being less stressed and feeling more comfortable when they had video interventions for the procedures with general anesthesia. Through his collaboration with the Suzanne Dworak-Peck School of Social work, Dr. Philip Yoong learned the importance of collaborating with social workers in a medical setting to make an impact on the areas that are usually not spoken about by physicians.

Dr. Yoong envisions a future for dentistry that has more interprofessional collaboration among medical doctors, social workers, nurse practitioners, pharmacists, and other case relevant health care professionals. He believes that pediatrics is a unique field where it is important to have an open mind, and he encourages collaboration between the dentist, the physician, the patient and the parents or guardians of the patient. Dr. Yoong strongly believes that this effective and efficient communication and personalized care can make a huge impact on the present and future quality of lives of our patients. Dr. Yoong has found pediatric dentistry to be very rewarding as it has enabled him to change many pediatric patients' preconceived ideas about the dentist and their overall dental experiences from those that are based in fear and anxiety into ones that elicit emotions of safety and positivity. As former students in the second-year pediatric dentistry module taught by Dr. Yoong, we have experienced first-hand how he motivates and inspires students to become outstanding clinicians; Dr. Yoong encourages dental students to look for more in their dental education in order to ensure proper pediatric patient care for the future. He says it is valuable for all dental students to get exposure in handling not only pediatric patients, but in successfully managing and ultimately educating the parents of patients with empathy and understanding. Dr. Yoong emphasizes that it is so important to take advantage of the unique opportunity we have here at the Herman Ostrow School of Dentistry at the University of Southern California to work with pediatric dentists and pediatric patients because it may very well impact and positively influence the dental care that they are providing and will provide in the future.

Opening the "Gaits": Rehabilitating Patients with Motor Neurologic Injuries

By Brandon Pham and Courtney Fortier

As an assistant professor in the Division of Biokinesiology and Physical Therapy, Dr. Kristan Leech directs the Gait Rehabilitation and Motor Learning (GRML) Lab, with the goal of "enhancing the recovery of independent walking in individuals with gait dysfunction after a neurologic injury." Her overall mission is to reduce disability in older adults by addressing gait dysfunction, with an emphasis on patients who have previously suffered from a stroke. The lab achieves this by utilizing different forms of motor learning via physical therapy interventions so that these individuals may regain their mobility and independence.

Part of the reason why Dr. Leech was drawn to physical therapy included being able to spend time with patients. This time allowed her to build rapport, to learn what motivates and demotivates them, to better understand their goals and passions, and, ultimately, to combine all of the above into a treatment plan, forming a "therapeutic alliance" with her patients. While studying physical therapy, Dr. Leech gained interest in combining the disciplines of physical therapy and neuroscience. She discovered a passion for treating patients with neurologic injuries due to the complexities of presentation and treatment associated with cases of this nature. Unsatisfied with the current level of knowledge on treatments that could help these patients return to their daily activity, she turned to research to answer the questions she encountered during clinical practice. By understanding the nervous system (how it functions and how it can lead to dysfunction), Dr. Leech realized that the ability of the nervous system to respond to damage can be used as "leverage" for physical therapists to correct existing defects, whether they may be congenital or induced by trauma.

In her PhD research, Dr. Leech investigated the mechanism by which high-intensity exercise can be beneficial to motor function in individuals with incomplete spinal cord injuries. Even though it was known that high-intensity exercise correlated with higher changes in neuroplasticity, the exact cause remained unclear. Her dissatisfaction with the current literature led her to explore how high-intensity exercise may be beneficial for spinal cord injuries. The research demonstrated that high-intensity walking (enough to increase one's heart rate) led to an increase in the expression of neurotrophins that promote and foster changes within the nervous system. In fact, this research has contributed to the change of clinical practice guidelines, now stating that high-intensity exercise is the mode of treatment that should be utilized for patients with gait dysfunction.

Her postdoctoral research focused on motor learning mechanisms in four different areas of the brain, with varying degrees of cognitive demand, which are categorized as use-dependent, instructive, reinforcement, and sensorimotor adaptation-based motor learning; it was during this time that she realized there was a gap that existed between the motor learning research community and the clinical physical therapy community: the research simply was not being translated into clinical practice. As shown in her paper, "Updates in Motor Learning: Implications for Physical Therapist Practice and Education," she emphasizes how using the four types of motor learning can aid physical therapists in designing treatment interventions; while she does not claim it to be original research, she acknowledges that it was an important piece that is now gaining traction within the community.

Currently, her research has two main focuses. The first is centered on applying forms of physical therapy reliant on motor learning principles in the context of high-intensity gait training. Dr. Leech investigates the ability of individuals who have suffered from a stroke to walk at high aerobic intensities while intentionally trying to change their movement pattern, such as by receiving visual gait biofeedback. The second focus is understanding how cognitive impairment resulting from a stroke may impact a person's ability to learn via different motor learning mechanisms. For example, there is a motor learning mechanism related to the frontal lobe that is more cognitively demanding and a mechanism related to the cerebellum that is more automatic. As different motor learning mechanisms are known to occur simultaneously, experimental design relies on creating tasks that are known to engage only specific mechanisms. To engage the more cognitively demanding mechanism, the participant receives gait biofeedback that they must be able to process and understand, then adjust their movement in response to an error. To engage the automatic mechanism, participants are instructed to walk on a split belt treadmill programmed to move at a different speed for each leg. Everyone begins to walk with an asymmetric gait but eventually, both those who have never experienced a stroke as well as those who have will automatically learn to use symmetric steps in this environment. Dr. Leech hypothesizes that someone with post-stroke cognitive impairment may not be able to learn through a cognitively demanding mechanism but may still be able to take advantage of an automatic mechanism.

Ever since the COVID-19 pandemic, Dr. Leech has noted a few significant changes in the patient population. COVID-19 is known to cause blood clotting issues, which can lead to COVID infection-related strokes. Moreover, patients who are deconditioned, especially from physical inactivity, and later contract COVID may develop strokes due to their already deteriorating health. It is important for physical therapists to take note of these developments, due to how the treatment for post-stroke patients who have contracted COVID differs from that of post-stroke patients without any respiratory illness. Though the patient pool itself remains mostly the same, the priority of treatment changes. Aside from COVID, some of the more challenging cases involve damage or disease to the central nervous system, since the CNS is partially "plastic," but not as plastic as the peripheral nervous system or other parts of the body. Treatment of such patients who undergo a catastrophic life event or life-changing diagnosis may end up being more emotionally challenging than intellectually challenging at times, as patients may plateau and more clinical troubleshooting may be needed, which can be more frustrating overall for the practitioner.

In terms of ongoing technological advancements, Dr. Leech's lab monitors motor learning with a three-dimensional motion capture system that involves reflective markers and infrared cameras to monitor a patient's movements and step lengths while measuring their heart rate using a Bluetooth heart rate tracker. Dr. Leech believes the future landscape of physical therapy will emphasize implementation science and knowledge translation. She states that future technologies that could lead to further development in her field are those that involve translating technologies used in research labs to clinical and at-home settings and improving the scope of data collected for clinical practice and research. Dr. Leech is enthusiastic about a "markerless" motion capture system, which does not require the use of markers to be placed on a subject's joint centers (which have to be thoroughly calculated), and this only indicates that research with motion capture systems that do involve markers is time-consuming and harder to translate to a clinical setting.

In theory, this would allow similar data to be collected in the clinic, and with a laboratory set up within a hospital, these findings could then contribute directly to the existing literature. She is also interested in technological developments that allow researchers to track the activity of research participants outside of the lab, as the capacity for change tested in the lab and at-home performance are not always indicative of each other. New methods of at-home data collection will allow for better assessment of how greatly performance in the clinic impacts an individual's at-home performance and will elucidate how effective treatments really are. For post-stroke rehabilitation and stroke therapy, she believes that there will be a greater emphasis on precision medicine, which involves tailoring interventions to the individuals themselves, rather than providing treatments based on the diagnosis.

Dr. Leech expresses a strong passion for physical therapy and love for the patients that she treats. She is especially enthusiastic about physical therapists' overarching message and service in promoting mobility, longevity, and participation within the community. Were she to start again, she would wholeheartedly devote herself to the field of physical therapy. When asked about her difficulties within the field and the challenges that she must respond to on a daily basis, she replied, "That's why I'm in research… to try and figure out what we don't know yet to further maximize peoples' potential."

Insights from Oral Maxillofacial Surgery Faculty: A Fresh Perspective

By Antranig Mesrobian & Steffi Chen

Dr. Daniel S. Miller is the newest addition to the Oral and Maxillofacial Surgery faculty at the Herman Ostrow School of Dentistry: the new Director of the Pre-doctoral Oral Surgery Clinic. Under his tutelage, the clinic will serve as his arena to shape the hands and minds of future dental practitioners and future oral surgeons alike. "My job is to help students improve their clinical skills while broadening their diagnostic acumen and improve their ability to make sound clinical decisions. This will help them understand their limitations and hopefully avoid complications. Every extraction does not need to be referred out; our pre-doctoral clinic is where each student can learn to better understand their level of comfort."

The Beginning

Born in Southern California, Dr. Miller spent time alternating between the East Coast and the West Coast for a reasonable portion of his childhood. His early influence in life was his father; although he wasn't a dentist, he sparked Dr. Miller's interest in dentistry. Dr. Miller's initial foray into the dental world was as a member of the inaugural class of ten students accepted into the ADAPT Dual Degree BS/DDS at the University of Southern California. Entering dental school, Dr. Miller was sure he would fulfill his childhood dream of becoming an orthodontist, yet, his first fateful procedure in oral surgery would set him on the path of oral surgery. The decision to change career trajectories was simple: "Oral surgery piqued my curiosity, and my interest in orthodontics waned. As a dental student, the minor oral surgery procedures made me feel like I was in my element."

Dr. Miller graduated from the USC School of Dentistry in 1989; however, he did not match into a residency program. With his dental degree and license in hand, Dr. Miller entered the United States Air Force and worked for three years as a general dentist. When reflecting upon his work in the Air Force, Dr. Miller expressed gratitude for the experience. In 1992, Dr. Miller again applied to the Oral Maxillofacial surgery residency and was ultimately accepted at the University of Miami/ Jackson Memorial Hospital.

Unparalleled Training

Dr. Miller's residency was a time of unparalleled learning. During his time at the University of Miami, Dr. Miller was mentored by Dr. Charles Kates, a dual-trained Oral Surgeon and Anesthesiologist. Throughout his residency, Dr. Miller encountered a wide array of anesthetic procedures alongside the many surgeries he did. Upon completing his training program, this California boy returned home, where he established himself in the vibrant community of Huntington Beach.

An Oral Surgeon in Private Practice

In August of 1996, Dr. Miller entered the private practice of Dr. John Forte, an oral surgeon who was planning his retirement. Coincidentally, the owner's son was a former college friend of Dr. Miller's. Dr. Miller made the life-altering decision to purchase the practice, and the rest is history. Dr. Forte even served as a mentor during Dr. Miller's initial years in private practice and continued to work with Dr. Miller in a part-time capacity for several years.

Dr. Miller had found a wonderful community in which to practice, one filled with superb doctors and patients alike. The scope of Dr. Miller's practice included intravenous and inhalation anesthesia, third molar surgery, and implants. Given his background and extensive training in anesthesiology, Dr. Miller effectively performed procedures requiring general anesthesia and intubation, later transitioning to the propofol infusion pump. So integral was anesthesiology to Dr. Miller's practice that he states, "In another life, anesthesiology would be calling my name."

A Fresh Perspective

After 24 years in private practice, Dr. Miller's day-to-day work life was changed due to physical difficulties. Yet this man driven by a passion for his profession still wanted to contribute, thus he turned to academia. A chance advertisement for a faculty position in an AAOMS publication once again took Dr. Miller to the East Coast, where he joined the Oral and Maxillofacial surgery faculty at the Henry Goldman School of Dental Medicine at Boston University. Here, Dr. Miller was exposed to oral surgery in an academic environment. He brought a private practice mentality to the dental students and residents. This complemented the pre-existing staff and was a welcome perspective to a wonderful program. "Functioning in an academic environment is different than private practice. In private practice, you are in charge of your time and can call all the shots. In academia there is more responsibility to others, because the team's synergy dictates the success and effectiveness of the program as a whole. Understanding how to work as a part of a greater whole is important. Still, as residents, it is equally important to understand the scope of practice and responsibility that awaits upon completing residency."

"Boston was a great place to work, but we missed the West Coast and Winter was a great reminder of what we left." Upon hearing about an open faculty position at the Herman Ostrow School of Dentistry's oral surgery program, Dr. Miller decided it was time to escape the cold and return to his Trojan roots.

In October of 2022, Dr. Miller started his tenure as director of the pre-doctoral oral surgery clinic. Bringing a unique perspective that he has developed over the course of his career, Dr. Miller will provide the students of Ostrow with a clinician who is eager and willing to help and teach the next generation of dental professionals.

Dr. Daniel Miller, The Man

Adding to his roles as a doctor, professor, and director, Dr. Miller is also a family man. He consistently and adoringly prioritizes his family, passing down to his children the same appreciation of education and thirst for knowledge emphasized during his childhood. In his own poignant words, "Family is important because, in the end, when you look beside you, it's your family that will be standing [there]."

Dr. Miller has a plethora of skills, interests, and hobbies that extend far beyond oral surgery. For instance, Dr. Miller is an avid traveler. He has experienced a wide variety of destinations, cuisines, and cultures, having traveled to China, Europe, New Zealand, and Australia—just to name a few. In addition, Dr. Miller first began skiing during his college years. Then, during his time in the United States Air Force, Dr. Miller found himself stationed in Denver, Colorado. Given the abundant snow and natural beauty that the Rockies had to offer, it is no surprise that this is where Dr. Miller truly fell in love with the sport. Now, skiing has become a family activity for Dr. Miller; it is a cherished activity that he and his wife enjoy doing together. When he is not skiing the slopes or traveling the world, Dr. Miller can be found in the kitchen. Dr. Miller has a great passion for baking—cookies, bread, and every delicious confection in between.

Happy is the One Who Teaches and Transfers What They Know

See one, do one, teach one. This aphorism is a common rule in medicine and the foundational bedrock for those involved in surgical specialties. For some, it may seem like an oversimplification of an intricate practice; yet, it is the perfect expression to describe the life of a surgeon. If we are to use Dr. Miller's career as the standard to which we measure, then it is a saying that supersedes that status quo, thus serving as the template one should follow to contribute to the betterment of their respective fields.

ADVOCATING FOR
DENTAL ANESTHESIOLOGY AWARENESS

By Catherine Frusetta & Eun Bi Jung

Anesthesia describes a state of insensitivity to pain induced by the administration of various pharmacological substances. There are different levels of anesthesia that may be utilized depending on the situation - minimal sedation, moderate sedation, deep sedation, and general anesthesia. A dental anesthesiologist (DA) is an individual who is trained to safely monitor dental patients who are under general anesthesia.

Dental anesthesiology is currently recognized as an official dental specialty, though it went through a tumultuous path to gain recognition. Prior to 2019, dental anesthesiology was an advanced degree one could earn through a two- to three-year residency after graduating dental school. However, since 2019, the National Commission on Recognition of Dental Specialties and Recognizing Boards declared dental anesthesiology to be the 10th dental specialty. However, it is important to note that dental anesthesia has a rich history dating back centuries. For example, in the 19th century both ether and nitrous oxide were utilized to provide sedation in dental cases. Today, the modern DA has a more complex arsenal of medications and techniques in their toolbelt to safely provide care even in emergency situations.

Since dental anesthesiology is a relatively new specialty, many dentists are still learning about how DAs operate and when their services are indicated. A dental anesthesiologist is a dentist who can administer general anesthesia during dental cases. It is a safe technique that can be done in an in-patient office setting with proper monitoring systems in place. Dental anesthesia

allows patients to comfortably tolerate difficult procedures. Certain populations such as children, those with complex medical needs, and those with dental anxiety are more likely to require anesthesia for dental work. Likewise, long, complex, and invasive procedures also may call for a DA to provide general anesthesia.

Dental anesthesiology differs from medical anesthesiology in several ways. DAs and medical anesthesiologists both start with four years at their dental or medical school prior to anesthesia residency. During residency, both dental and medical anesthesiologists-in-training learn together in a hospital setting. Residents in both medical and dental anesthesiology take on similar yet complex cases. There may be a culture shock for a dental anesthesia resident as they experience the transition from dental school to a medical-based program. Though, after some hard work, DA residents are fully prepared to safely provide care in an out-patient setting. The biggest difference is after graduation. DAs are restricted from providing anesthesia in medical cases and can only offer sedation during dental care.

As a dental anesthesiologist, providing care to a patient can mean life or death. Therefore, it is crucial that an anesthesiologist is fully prepared for every case and to have quick thinking skills and a strong medical knowledge to be prepared for any emergencies that can and will occur. In addition, communication is a key value in anesthesiology. Dental anesthesiologists typically work independently; therefore, as the sole communicator with the patient, it is crucial to be able to relay information clearly and succinctly to discover and identify any issues with providing anesthesia. Examples of red flags for administering anesthesia include a history of family members having bad reactions to anesthesia, recent illness, allergies to certain medications, and a myriad of other issues that would put a patient under higher risk.

Thus, in order to be successful as a dental anesthesiologist, an individual must be knowledgeable, meticulous, and compassionate. Dr. Michael Alanes is one such individual. Dr. Alanes is a board-certified dental anesthesiologist who has spent years perfecting the craft of maintaining general anesthesia in a variety of patients. He was born in Brooklyn, New York, but was raised in Los Angeles. Dr. Alanes earned a BS in biology from UC Irvine, a BS in dental hygiene from USC, and then a DDS degree at USC. As a dental student, Dr. Alanes was a part of the Dr. Stat team. The Stat team is an anesthesia selective composed of USC dental students who get more exposure to dental anesthesiology and act as first responders to any medical emergency on the dental campus. He cited this experience as being his introduction to dental anesthesiology and when he began to consider specializing in this subset of dentistry.

After graduating dental school, Dr. Alanes completed a general practice residency at Stony Brook School of Dental Medicine and then specialized in dental anesthesiology at Stony Brook University Hospital. Graduating from Stony Brook and passing a written and oral board exam after residency earned Dr. Alanes the title of a board-certified diplomate in 2015. Today, Dr. Alanes offers his services full time as a part of an anesthesia group that administers anesthesia for general dentists as they provide patients with dental care. Additionally, Dr. Alanes is an adjunct faculty member at USC. As an adjunct faculty member, Dr. Alanes provides anesthesia for all graduate specialties at USC, gives clinical instruction for students and residents, prepares continuing education lectures for doctors and staff, and is a contributing faculty member for Dr. Stat.

Working as a DA, Dr. Alanes finds himself looking forward to the future of dental anesthesiology and what it could mean for the patients he treats. Dr. Alanes believes that dental anesthesiology may be the gateway to providing dental treatment for certain populations, such as children and patients with complex healthcare needs. He sees the recent official recognition of dental anesthesiology as an opportunity to bring awareness to the availability and advantages of general anesthesia in dentistry. As dental communities learn more about the roles of a DA, more dentists will be able to make use of it to assist a greater array of patients who may struggle during procedures. In addition, a greater recognition for DAs would also improve access to care through an increase in funding options for dental anesthesia. Dr. Alanes hopes that insurance companies will be compelled to see the importance and necessity of dental anesthesiology and provide coverage for more patients to qualify for general anesthesia who may otherwise not be able to get the dental care they need.

Dental anesthesia can provide an opportunity for a patient to change their life through their dental health, whether it be from removing their pain, restoring function, or giving them a more beautiful smile. Dr. Alanes describes the joy that providing these patients with dental care gives him. Pediatric patients who have never had a dental home before due to fear can get consistent care with the help of DAs. A patient with extreme dental fear can be put under for an “all-on-four” implant supported denture case and have their life changed with the help of anesthesiology. Dr. Alanes states that the gratefulness that these patients exude is better than any monetary award. However, it is not only the lack of DA providers that is stopping many patients from getting the care they need. An increase in general dentists referring to and collaborating with dental anesthesiologists can increase the quality of care for many patients. In the end, a greater awareness of dental anesthesiology and the care it can provide only serves to make dentistry safer and more accessible for patients.

Dr. Michael Alanes can be found in the Auto Patterson operating room most Tuesday mornings. This is located on the first floor just past the special patients clinic and graduate oral surgery and is adjacent to the oral medicine and dental radiology clinics. He recommends that all dental students of any year stop by the operating room to ask questions and get more exposure to anesthesia. He hopes that the next generation of dentists will be more knowledgeable about dental anesthesia and how it can interact with general dentistry. The more collaboration between general dentists and dental anesthesiologists, the better, safer, and more effective the care that can be provided to a larger patient pool.

Mitigating on-the-job stress:

Stress Mapping with Artificial Intelligence

By Mike McNulty

Stress Test

USC Chan's Shawn Roll leading interdisciplinary team on $1.1M National Science Foundation grant for managing, mitigating on-the-job stress.

The World Health Organization has called stress the "health epidemic of the 21st century" – and that was before the Covid-19 pandemic.

While a highly personalized phenomenon, job-related stress is consistently cited as the primary source of stress in adults' lives. According to Gallup's State of the Global Workplace: 2022 Report, 50 percent of workers in the United States and Canada reported experiencing "a lot" of stress during their previous workday.

For many, work-related stress is painfully obvious. Musculoskeletal tension, headaches and gastrointestinal symptoms are common physical symptoms of stress, while irritability, distractibility, fatigue and decreased motivation are frequent mental health symptoms. According to the American Institute of Stress, an estimated one million workers are absent from work every day due to stress, and its estimated annual costs total more than $300 billion in lost time, decreased productivity and accidents.

But because so few employees have actionable insights into the ways that on-the-job activities and the physical and social environments contribute to stress and other health outcomes, workplace stress experiences can form vicious cycles that are difficult to break.

USC Chan Associate Professor Shawn Roll looks to disrupt, if not break them, with his new four-year, $1.1 million grant from the National Science Foundation.

By gathering a variety of data from workers, the workplace and the environment, Roll and colleagues will develop multi-factor models that illustrate how stress manifests in the workplace and in workers' lives. Those models will then help build personalized solutions for enabling workers to improve their self-awareness, better manage workplace stressors and, ultimately, improve their own work-related health and well-being.

"My career to this point has focused on addressing worker health and well-being using a broad lens to identify applications across the general workforce," Roll says. "But for this project, we'll be using technologies to help individual workers understand their own stress on their own terms. It's analogous to precision medicine – identifying what works best for each individual."

Better Worker Health Through Data

The project will capture different types of data from the person, the built environment and the socioemotional environment at work. Interviews, focus groups, real-time assessments, mobile devices, wearable technologies and embedded sensors in the environment will all

help researchers understand the ebb and flow of stress experiences as workers engage in different tasks across different workspaces and sites. Those include not only formal work environments, per se, but everywhere else that modern-day work is conducted, from the kitchen table to the corner coffee shop.

Although the term "stress" typically carries negative connotations, the researchers recognize that there is such a thing as positive stress, also known as eustress, which can feel energizing and be essential to productivity. Differentiating between types of stress experiences will be a key component of the study.

"We know eustress can lead to the experience of flow states when you're challenged, in the moment and you view things as opportunities," Roll says. "But in a lot of environments, workers don't always have full control. So our goal isn't necessarily to achieve a stress-free environment, but to understand what is causing stress and how to balance bad and good stress, the negative stress-inducing pressures with positive opportunities and challenges."

Once data are integrated, the researchers hope to identify patterns to inform personalized solutions for better self-awareness and management of work-related health and well-being.

"Who are you, how do you perform, and when you engage in an activity or step into a space, how are you engaging in that activity and space?" Roll asks. "What's causing, for example, your neck pain? We want to help you stop, step back and figure out what you can do to better manage it."

Interdisciplinary Experts Teaming Up Again

To do that, Roll will look to his co-principal investigators: Gale Lucas, Shrikanth Narayanan and Burcin Becerik-Gerber, scientists at the USC Institute for Creative Technologies and the USC Viterbi School of Engineering. Their expertise in human-technology interfaces, remote sensing and machine learning discovery systems will help identify the most valuable combinations of data for personalized, automated and/or technology-supported intervention approaches for stress management.

"Not only can we map people's physiological and personal responses to let them know how they're doing at work, but my colleagues are looking at automating the process of stress mapping with artificial intelligence to meaningfully account for a wide range of variables that include additional data from the physical and social environments," Roll says.

It's not the first time Roll has joined Viterbi faculty members on studies funded by the NSF, which is the independent federal governmental agency for science and engineering research, akin to the National Institutes of Health.

Roll, Lucas and Becerik-Gerber previously worked together on a $667,000 NSF grant to design a workstation that uses artificial intelligence to learn about and adjust to worker preferences and patterns, with the goal of improving overall well-being.

The new study, he says, is a natural follow-up to their intelligent workstation project.

"Most of my previous research has identified what's good en masse," Roll says. "But we are all very different individuals, and whenever a principle is applied en masse there are still people who fall through the cracks. So this new project is trying to understand individual stress factors, use technologies for ongoing monitoring and then make recommendations that are far more customized and useful to individuals."

The grant is administered by the Smart and Connected Health initiative, a NSF-NIH interagency program exploring how next-generation computer and information science and engineering approaches can transform health and medicine.

Roll and Lucas are also co-principal investigators on a recently funded $1.8 million NSF grant led by Becerik-Gerber to develop and test a sensory-enhanced workstation for remotely operating demolition machines in the construction industry. While this so-called teleoperation can increase workplace safety (because you can't get crushed by a wrecking ball if you're not actually standing on the jobsite), there is limited understanding at the moment on how to conduct remote operation effectively and safely within dynamic construction sites.

Roll acknowledges that working on two large-scale grants totaling nearly $3 million is a rare achievement, in NSF terms. In 2022, USC was awarded only ten NSF grants that received individual funding greater than $1 million.

"I am so grateful for the continued support of the USC Chan Division in my research efforts, and I cannot be happier with the collaborative efforts of our transdisciplinary team."

Schedule of Events

08:00 AM
Registration (Presenters & Judges)

09:00 AM – 12:00 PM
Poster Presentation Judging

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

12:30 PM – 12:45 PM
Opening Remarks

Ishwar Puri, PhD
Senior Vice President
USC Office of Research & Innovation

Avishai Sadan, DMD, MBA
Dean
Herman Ostrow School of Dentistry of USC

Yang Chai, DDS, PhD
University Professor
Associate Dean of Research
Herman Ostrow School of Dentistry of USC

12:45 PM – 01:30 PM
Keynote Speaker

Rena D'Souza, DDS, MS, PhD
Director
National Institute of Dental & Craniofacial Research

01:35 PM – 02:10 PM
Keynote Speaker

Michael Pazzani, PhD
Principal Scientist
USC Information Sciences Institute

02:15 PM – 02:55 PM
Keynote Speaker

Lori Michener, PhD, PT, ATC, SCS, FAPTA
Professor Clinical Scholar
USC Division of Biokinesiology & Physical Therapy
Herman Ostrow School of Dentistry

03:00 PM – 04:30 PM
Student Presentations

04:30 PM – 05:30 PM
Poster Viewing

05:30 PM – 06:00 PM
Award Presentations

06:00 PM – 06:30 PM
Reception

Keynote Speakers

Rena
D'SOUZA
DDS, MS, PhD

Director
National Institute of Dental & Craniofacial Research

12:45 PM – 01:30 PM Virtual Presentation

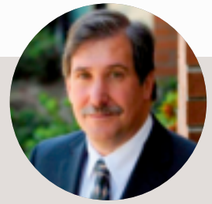
Dr. Rena D'Souza is the Director of the National Institute of Dental and Craniofacial Research, National Institutes of Health. She is deeply committed to the organization's mission — advance fundamental knowledge about dental, oral, and craniofacial health and disease and translate these findings into prevention, early detection, and treatment strategies that improve overall health for all individuals and communities across the lifespan.

As the director of NIDCR, Dr. D'Souza oversees the institute's annual budget of over $520 million, supporting basic, translational, and clinical research in areas of oral cancer, orofacial pain, tooth decay, periodontal disease, salivary gland dysfunction, and the craniofacial development and the oral complications of systemic diseases.

Prior to becoming NIDCR's director, Dr. D'Souza served at the University of Utah as Assistant Vice President for Academic Affairs and Education for the Health Sciences. She held the Ole and Marty Jensen endowed chair in the School of Dentistry that she led as inaugural dean. As a clinician-scientist, D'Souza has been strongly committed to discovery and mentoring throughout her academic career. She is past president of the American Association for Dental and Oral Craniofacial Research (AADOCR) and the International Association for Dental Research (IADR).

Dr. D'Souza is an internationally recognized researcher and has authored over 150 publications and book chapters in the areas of craniofacial development, matrix biology and tissue regeneration for over 30 years. She is a Fellow of AAAS and also of AADOCR. She was inducted into the German National Academy of Sciences in 2012 and the Columbia University College of Dental Medicine's awarded Dr. D'Souza the Birnberg Research Medal in 2016. She received the Irwin D. Mandel Distinguished National Mentoring Award in 2017, the Shils Fund Innovation Award in 2022 and was the inaugural recipient of the Alumni Lifetime Achievement Award from UTHealth Houston School of Dentistry in 2022.

Dr. D'Souza is active on several trans-NIH committees and maintains an active research laboratory in the National Institute of Child Health and Human Development (NICHD), NIH.



Michael
PAZZANI
PhD

Principal Scientist
USC Information Sciences Institute

01:35 PM – 02:10 PM

Michael Pazzani, PhD, is a Principal Scientist at the USC Information Sciences Institute at the University of Southern California and Director of the Artificial Intelligence Research for Health Center. Dr. Pazzani was the Vice Chancellor for Research and Economic Development at the University of California, Riverside where he was also a professor of computer science with additional appointments in statistics and psychology. From 2006-2012 he was the Vice President for Research and Economic Development at Rutgers, the State University of New Jersey, where he was also a Distinguished Professor of Computer Science. Prior to his appointment at Rutgers, Dr. Pazzani was the Director of the Information and Intelligent Systems Division at the National Science Foundation. He also served as a member of the Board of Regents of the National Library of Medicine at the National Institutes of Health from 2003- 2005. Dr. Pazzani has published over 150 papers on machine learning, explainable artificial intelligence, knowledge discovery from databases, personalization, internet search, and recommendation systems. He serves on the Editorial Board of Machine Learning. He is a Fellow of the Association for the Advancement of Artificial Intelligence.

Lori
MICHENER
PhD, PT, ATC, SCS, FAPTA

Professor Clinical Scholar
USC Division of Biokinesiology & Physical Therapy
Herman Ostrow School of Dentistry

02:15 PM – 02:55 PM

The central theme of Dr. Lori Michener's funded research is to define optimal treatment pathways for patients with musculoskeletal shoulder disorders by focusing on characterizing mechanisms, defining classification and management approaches, and determining optimal outcomes of care. Specifically, her main research aims are: 1) to elucidate the biomechanical and neurophysiological mechanisms related to the presence of pain and poor recovery, in order to 2) develop classification and management strategies to optimize functional outcomes and simultaneously 3) determine the optimal set of patient outcome measures that comprehensively capture activity limitations and participation restrictions to judge treatment outcomes. She is director of the Clinical Biomechanics and Orthopedic Outcomes Research Laboratory, and directs the development, collection and analysis of patient-rated outcomes and process of care in the USC Physical Therapy clinics, and serves as a resource for clinical research.

RESEARCH DAY
POSTER ABSTRACTS

ADVANCED SPECIALTY PROGRAM RESIDENTS

Poster #1

Title: COVID Lockdown Spiked Interest in Dental Specialty Educational Blogs

Authors: Joan C. Wang, Jack Botros, & Mariela Padilla

Faculty Advisor: Mariela Padilla

Background: COVID lockdown protocols resulted in an increase in online communication. Educational blogs are an effective method for sharing information online. Purpose: To determine if educational blog viewership was affected by the increased use of online resources due to COVID lockdown. **Methods:** Data about page views, reading time (in minutes), and publication dates was collected from the Ostrow online blog analytics website. The percentage of returning visitors and the duration of publication were calculated. Word counts were determined using Microsoft Word. Blogs were categorized by content and discipline. Analytics were collected for the top-viewed blogs published until July 2022 based on chronology: before 3/2/2020 (pre-COVID), 3/2/2020 to 5/10/2020 (during the 1st wave), and after 5/10/2020 (after the 1st wave). Multivariate linear regression models were employed. **Results:** On average, blog views were higher during (n=36, ß=2531.5, P=0.03) and after (n=24, ß=4669.2, P=0.001) the 1st wave versus those before (n=18) regardless of publication date. The mean time spent on a blog was 45 seconds longer during (ß=0.76, P=0.001) and one minute longer after the 1st wave (ß=0.99, P<0.001) compared to pre-COVID adjusting for word count. The percentage of blog re-visitors decreased during (ß=-1.96, P<0.001) and after (ß=-3.59, P<0.001) the 1st wave. All analyses were adjusted for discipline and content. **Conclusion:** This study indicated that COVID lockdown increased the demand for dental specialty educational blogs at USC even beyond the 1st wave. Research should be conducted to determine if this spike in reader interest occurred across all disciplines.

Poster #2

Title: Orofacial Pain Wiki

Authors: Reem Salman, Mariela Padilla, Glenn Clark, & Luciano Nocera

Faculty advisor: Mariela Padilla

Background: The possibility of making academic information readily available in a format that is searchable, which can be continuously updated has been shown to be well accepted by health sciences students. 1,2 This model has been tested in dental education. 3,4 **Purpose:** To assess a scalable and easily editable wiki used as part of the Orofacial Pain academic resources. **Methods:** A Wiki solution (Wiki.js) with orofacial pain terms was deployed in February 2021. The initial implementation is limited to registered students and faculty and included tags per category in each created page. Google analytics are used to assess the scalability, connectivity of the pages, and behavior of the users. **Results:** From 105 users, 90% are students, and the average time on the page is 3 mins and 23 secs. Most of the users come from US (234) and Canada (20). Six editors have created a total of 297 pages under seven different categories (tags). Although the first content was uploaded in January 2021, analytics started in May 2022. Reingold-Tilford tree of all the pages show that there are only 5 back links. There was an increase of access related with the dates of the diplomate exam for Orofacial Pain both in 2021 and 2022. As the Orofacial Pain wiki matures, the goal is to open it to the public and find other use cases, for example using the wiki content to build study flash cards.

Poster #3

Title: Relationship between age and OSA, a retrospective study

Authors: Jaqueline D. Venturin, George Sheppard III, Mohammad Masoudian Khouzani, Reyes Enciso, & Mariela Padilla

Faculty Advisor: Mariela Padilla

Background: Obstructive sleep apnea (OSA) occurs when there are recurrent episodes of upper airway collapse with oxygen desaturation during sleep; prevalence studies have shown that this condition increases with age. **Purpose:** To examine the relationship between age and oxygen saturation (SPO_2) during sleep in patients with diagnosed OSA referred to the Orofacial Pain and Oral Medicine (OFPM) center of the University of Southern California. **Methods**: This is a retrospective study conducted at OFPM (IRB# UP-07-00416), with clinical data collected from September 2015 to July 2021. A single researcher reviewed all the charts of patients with an ICD code corresponding to OSA and from 118 records the first 49 consecutive patients that met the inclusion criteria were selected for further investigation. All data was analyzed using SPSS software. **Results:** This sample showed that as age increases so does apnea hypopnea index (AHI - events/hour) (rho = 0.174; p = 0.233), though this result was not statistically significant. More importantly, as age increases, SPO_2 average and nadir decreased significantly (rho = -0.287; p = 0.045 and rho = -0.488; p ≤0.001, respectively). **Conclusion:** Our data found a statistically significant relationship between age and decreased SPO_2 average and nadir in this sample of OSA patients.

Poster #4

Title: Clinical characteristics and initial treatment outcome of patients with BMS

Authors: Suma Nambiar, Marshall Freilich, Amrita Kundu, & Jouliana Davoudi Chegani

Faculty Advisor: Mariela Padilla

Background: Burning mouth syndrome (BMS) is a condition that produces pain in the tongue and lips. The average duration is 3-4 years, with two-thirds of patients recovering within 6-7 years. The first-line treatment is clonazepam. **Purpose**: The objective of this retrospective study was to analyze the characteristics of patients with burning mouth syndrome. (IRB #UP-20-00436) **Methods**: Retrospective study of BMS at the OFPM Clinic of Herman Ostrow School of Dentistry (IRB #UP-20-00436). From 141 identified cases, a convenience sample of 47 was selected for a preliminary descriptive analysis. **Results**: Most of the patients were female (76.6%) over 60 years of age (51.1%). The chief complaints are pain (66%) and dysgeusia (23.4%) for over a year (55%). 31.9% of the cases reported dry mouth, confirmed in 21.3% of the cases. 21% of the patients had candidiasis. Initial treatment was clonazepam (89%) with 28% of the cases improving after the first appointment. 53% of the patients did not return after the third appointment. **Conclusion**: After the first three visits, most of the patients did not return, whether because they understand better their condition or because did not get the expected results. Since this is a long-lasting condition, a long-term protocol is needed to provide sustained relief.

Poster #5

Title: External Apical Root Resorption (EARR) in Patients with Short Root Anomaly (SRA)

Authors: Sohee Moon, Rebecca Lim, & Glenn Sameshima

Faculty Advisor: Glenn Sameshima

Background: By understanding association between SRA and EARR, orthodontists can anticipate the long-term prognosis of short-rooted teeth and better adapt their treatment plans when considering anchorage control, force load, and biomechanics. SRA is a condition not to be overlooked as it has a genetic component and has many implications on orthodontic treatment. **Purpose:** To investigate the response of dental roots to orthodontic treatment in Hispanic patients with SRA, and to determine if there is a significant correlation between EARR and gender, root shape, and extraction pattern. **Methods:** A retrospective analysis of panoramic radiographs was evaluated for SRA and EARR, specifically affecting maxillary central and lateral incisors. Quantitative EARR was measured using R/C ratio pre and post treatment, and qualitative EARR was assessed with Lavender's EARR classification. **Results:** The SRA group had a significantly higher decrease in relative root lengths after treatment in the upper central incisors (10.47% on the upper right central and 11.15% on the upper left central). They also had significantly more Grade 3 (severe) and 4 (extreme) EARR in the upper centrals. Overall, male patients with pipette/bottle shaped or dilacerated roots and extraction therapy had a greater predilection for EARR. **Conclusion:** Hispanic patients with SRA exhibit significantly more resorption in the upper centrals than non-SRA patients. This is the first study to compare EARR in SRA and non-SRA population. Its findings further validate that SRA could be a risk factor for EARR, suggesting clinicians to be aware and anticipate any treatment complications of orthodontic treatment.

Poster #6

Title: Influence of the Initial Material Thickness on the Final Thickness of Clear Retainers

Authors: Elliott Schwartz, Andre Weissheimer, Glenn Sameshima

Faculty Advisor: Glenn Sameshima

Background: VFRs have advantages primarily in ease of fabrication and patient acceptance. VFRs depend on precise adaptation of the material to each tooth to prevent unwanted relapse in three planes of space. The material may become distorted during the vacuum forming process resulting in poor adaptation and durability in the anterior teeth. **Purpose:** The purpose of this study is to evaluate the relationship between the preprocessing thickness of thermoforming plastic sheets and the final thickness in select clinically relevant areas on maxillary anterior dentition where adaptation is paramount. **Methods:** The dependent variable for all analyses is material thickness in millimeters (0.75, 1.0, and 1.5mm). The independent variables are a type of tooth (maxillary incisors), location measured along the long axis of the tooth at three locations, and thickness of material. A three-factor nested ANOVA is used to test for significance (α = o.o5). **Results:** Fabricating clear splints with the vacuum form technique creates thinning in the plastic on the most gingival aspect. For each Biocryl thickness: 0.75mm decreased by 43%; 1mm decreased by 55%; 1.5mm decreased by 52%. Total average decrease thickness across all splints was 50%. All trails tested significant (α = o.o5). **Conclusion:** This is the first study evaluating splint thickness in this fashion. This could impact the amount of force given by the clear splint materials around the apical aspect of the clinical crown. Plastic thinning can also lead to breakage. Future considerations for 3D printed aligners with uniform thickness which eliminated the need for 3D printed model.

Poster #7

Title: Influence of the Model for Thickness of Clear Retainer

Authors: Emin Hartunian

Faculty Advisor: Glenn T. Sameshima

Background: Retention is the final and one of the significant stages of any orthodontic treatment. The thickness of the Clear retainer could jeopardize the retention of the treated teeth leading to post-treatment relapse. Vacuum formed retainers (VRF) are a popular alternative to conventional orthodontic retention with removable appliances. Clinicians have reported that VRFs do not have consistent thickness, especially for teeth that have different angulation. **Purpose:** The purpose of this study is to evaluate the influence of model position variation to the thickness of Clear Retainer and whether a significant difference in VFR thickness exists at specific locations on the maxillary incisors with different angulations of the teeth. **Methods:** A virtual model will be created and copies will be made virtually to vary the angulation of the model. The STL files generated by this process will be 3D printed and the measurement locations identified and marked. A 1.0 mm thick Essix material designed for orthodontic retainers will be fabricated on each model and replicated ten times. Transverse angulation will also be tested. **Results:** It is found that there is significant difference in VFR thickness at specific locations on the maxillary incisors for different angulations of the teeth. The thickness of the material decreases from incisal to gingival. **Conclusion:** The thermal plastic devices are much thinner than expected. Clinically, if the retainer material has insufficient thickness, it will result in breakage, jeopardizing retention.

Poster #8

Title: The orthodontic periodontic symbiosis: a clinical guide to interdisciplinary topics

Authors: Amanda Israel

Faculty Advisor: Glenn Sameshima

Background: A healthy periodontium is the foundation to any successful orthodontic treatment outcome. The understanding of the complex periodontic-orthodontic interrelationship is not only necessary in maintaining a patient's oral health but can also help in achieving ideal smile esthetics. **Purpose:** The purpose of this research project was to create a summary of the most common orthodontic periodontic problems encountered in practice - a contemporary guide for the clinician illustrated with well documented clinical cases and supported by the best current evidence from the literature. **Methods:** 1) When is it appropriate to consider extrusion instead of crown lengthening? 2) Is periodontically accelerated osteogenic orthodontics justified in reduced treatment time

and efficiency? 3) How do the orthodontist and periodontist work to ensure a successful outcome for difficult impacted teeth cases? 4) Should periodontal maintenance protocols be changed during active orthodontic treatment? 5) How should orthodontic treatment be approached for a patient with pre-existing attachment loss? 6) What esthetic considerations of the periodontium must be taken into consideration when diagnosing and treatment planning the orthodontic patient? 7) What can the periodontist and orthodontist do for a thin alveolar ridge? **Conclusion:** The consideration and integration of periodontal treatment in every orthodontic treatment plan will help to achieve a functional and beautifully esthetic smile, on top of a sound and healthy periodontium. This presentation will summarize three or four of these topics in the limited time allotted. This will be of interest to residents, academics, and clinical orthodontists and periodontists.

Poster #9

Title: Retrospective study on sedation outcomes in overweight and obese children

Authors: Sonya Lin, Alexander Alcaraz, Catherine Pham

Faculty Advisor: Catherine Pham

Purpose: This retrospective cohort study aims to determine if reducing the dose of morphine affected sedation success in overweight/obese children and measure incidence of adverse events in overweight/obese children during dental treatment under oral conscious sedation (OCS). **Methods:** Data was collected from electronic health records of patients seen for OCS at the USC Pediatric Dental Clinic from January 2012 to September 2022. Inclusion criteria consisted of children 3-18 years old who were overweight (BMI from the 85th to less than the 95th percentile) or ASA II due to obesity (BMI at or above the 95th percentile). OCS was done with a triple drug regimen of either morphine, midazolam, hydroxyzine or morphine, diazepam, hydroxyzine. Adverse events, sedation level, and sedation effectiveness were recorded. **Results:** Of 1,079 charts, 137 were included (60 overweight, 76 obese). In overweight patients, success rate was 75.0% when morphine dose was less than or equal to 0.3 mg/kg, 88.9% at 0.31-0.49 mg/kg, 80.0% at 0.5-0.65 mg/kg, and 78.8% greater than or equal to 0.66 mg/kg. In obese patients, success rate was 73.3% when morphine dose was less than or equal to 0.3 mg/kg, 81.8% at 0.31-0.49 mg/kg, 85.7% at 0.5-0.65 mg/kg, and 90.9% at or greater than or equal to 0.66 mg/kg. Incidence of adverse events in overweight patients was 5.0% versus 5.2% in obese patients. Statistical significance pending analyses. **Conclusion:** Sedation success was similar among the four groups in obese and overweight patients. Incidence of adverse events was low in overweight and obese patients.

Poster #10

Title: Oral Health Status in Children with Pediatric Feeding Disorders

Authors: Ami Gadhia, Jose Polido, Alexander Alcaraz

Faculty Advisor: Alexander Alcaraz

Background: Pediatric feeding disorders (PFD) are defined as any impairment in oral intake that is not age-appropriate and may be associated with medical, nutritional, feeding skill, and/or psychosocial dysfunction. The diet of pediatric patients is very intimately intertwined with their oral health status. Previous studies have demonstrated that earlier age of G-tube placement and younger age of first dental visit have been associated with decreased DMFT and fewer OR events. However, further analysis is required to fully elucidate the interaction of these risk factors with general anesthesia utilization. **Purpose:** The purpose of this study is to review the oral health status of children with pediatric feeding disorders at Children's Hospital Los Angeles (CHLA) feeding and dental clinics. Furthermore, the aim is to evaluate the correlation of known risk factors for this population and frequency of operating room events. **Methods:** A retrospective chart review of subjects with diagnosis of pediatric feeding disorders ages 0-18 with SNOMED CT codes was conducted. Multivariate analysis of risk factors was completed to analyze association with number of general anesthesia events and caries experience (dmft/DMFT). Risk factors assessed included prematurity, age at G-tube placement, oral intake, medical diagnoses, age of first dental visit, developmental delay, and pulmonary complications. **Results:** Out of 145 charts, 130 were included. Fifty patients (38.5%) had dental treatment completed under general anesthesia, and of these, 18 patients returned to the operating room multiple times for dental treatment under general anesthesia. Statistical significance and multivariate analyses of results pending. **Conclusion:** Conclusions pending.

Poster #11

Title: Soft Tissue Norms for Individuals of Vietnamese Ancestry

Authors: Judy Nguyen & Glenn Sameshima

Faculty Advisor: Glenn Sameshima

Background: Dental and skeletal cephalometric norms are still widely used for orthodontic diagnosis and treatment planning. Norms have been determined for many, many populations throughout the world. However, cephalometric norms for Vietnamese populations are not well established. **Purpose:** The purpose of this retrospective pilot study is to determine cephalometric measurements in a Vietnamese population focusing especially on soft tissue measurements. **Methods:** The study sample will include twenty five patients who are generally first or second generation Vietnamese in California. Diagnostic records include lateral cephalograms and extraoral photos from a sample of consecutively treated patients from a private practice. The subjects are over the age of 12 with complete dentitions and without pathology or dysmorphology, not be limited by type of malocclusion. Data analysis consists of descriptive statistics and graphs, tests for normality and equality of variances, and t-tests comparing group means and variances with known Caucasian and Japanese norms from the literature. Method error will be evaluated with Bland-Altman plots or intraclass correlation coefficients. The study has been approved by the IRB at USC. **Results:** Vietnamese subjects had more protrusive soft tissue structures as compared to other ethnicities. Vietnamese females had thicker lips than Caucasians but thinner than Japanese. **Conclusion:** We found minor but clinically significant differences in certain soft tissue measurements that will be helpful in the diagnosis and treatment planning of Vietnamese individuals.

Poster #12

Title: Parent and Child Preference of Dentist Appearance Pre- and Post-COVID-19

Authors: Jesslyn White & Alexander Alcaraz

Faculty Advisor: Alexander Alcaraz

Background: Physical appearance plays a critical role in the dentist-child-parent relationship. Since the COVID-19 pandemic, provider attire and personal protective equipment (PPE) has increased in global attention and demand, especially in dental settings. **Purpose:** This research study aims to evaluate parent and child preferences of their pediatric dentist with regards to the provider's attire and personal protective equipment. **Methods:** This is a cross-sectional descriptive study using survey methodology with patients aged 7-17 years old and their parents that attended the Children's Dental Health Clinic of Miller Children's Hospital and the USC Pediatric Dental Clinic. Parents and their children completed separate questionnaires that included photos of two male and female dentists wearing various combinations of attire (white coat, scrubs, business casual, surgical gown) and PPE (surgical mask, eyewear, hair protection, face shield, N95 respirator, loupes). **Results:** Preliminary data shows the majority of children and their parents prefer dentists wearing surgical gowns and minimal PPE. Business casual attire and no PPE was least preferred. A trend demonstrates that children prefer dentists of the same gender as themselves. **Conclusion:** Final conclusions are pending complete data collection and statistical analysis.

Poster #13

Title: Analysis of the new disease classification system of periodontitis

Authors: Mohammed Al Qranei & Casey Chen

Faculty Advisor: Casey Chen

Background: Periodontal diagnosis is a critical step toward comprehensive treatment planning in dental care. Advances in the etiology and pathogenesis of periodontitis led to the development of a new disease classification system by the American Academy of Periodontology in 2017 (i.e., the 2017 system). However, it is unclear whether the 2017 system is user-friendly, error-free, and provides diagnoses comparable to those derived from the older system (i.e., the 1999 system). The information will be critical for improving the diagnostic system and for training and calibration of the users. **Purpose:** This study aims to evaluate the implementation of the 2017 system at the Ostrow School of Dentistry to identify (1) the frequencies and types of user errors and (2) the accuracy in periodontal diagnosis. **Methods:** This retrospective observational study analyzed data from 5,755 patients of the school between 7/28/19 to 4/30/21. A dataset of the old 1999 system from 9,527 patients between 06/17/2017 and 08/11/2017 was included for comparison. **Results:** 47% and 53% of the diagnoses were non-periodontitis and periodontitis, respectively. Generalized stage III grade B was the most common diagnosis of the latter category. The diagnoses of non-periodontitis and periodontitis using the 1999 system were 34% and 66%, respectively. Multiple errors were noted, including incomplete clinical records and failures to include diagnosis and risk assessment. Variations in diagnoses and risk assessment were also noted. **Conclusion:** Numerous challenges in the application of the 2017 system point to the drawbacks of the system and the need for calibration in periodontal diagnosis.

Poster #14

Title: Parental Perception and Motivation for the Use of Therapy Dogs

Authors: Annie Tsuchiyama, Rachel Anderson, & Alexander Alcaraz

Faculty Advisor: Alexander Alcaraz

Background: Dental anxiety in children is common and can pose a barrier to receiving care. Nonpharmacological therapies like the use of therapy dogs in the dental setting are promising areas of research. The use of therapy dogs in the dental setting has been studied less extensively than in medicine but preliminary studies show results of reducing dental anxiety and helping introduce patients to the dental environment. **Purpose:** The purpose of the present study is to understand parental motivations for using therapy dogs at their child's dental visit and what concerns deter them from the use of therapy dogs. The study aims are to determine the parental acceptability and demand of therapy dogs in the dental setting, determine parental motivating factors for choosing the use of a therapy dog and determine concerns deterring parents from the use of therapy dogs. **Methods:** This study is a survey-based cross-sectional study, where a convenience sample of parents with children at USC Pediatric Dental Clinic and Healthy Smiles for Kids of Orange County were assessed on their opinions of therapy dogs in the dental office. The survey consisted of questions using ordinal and quantitative scales to assess parental opinion of therapy dogs in the dental setting. **Results:** The preliminary data shows the majority of parents would like to have a therapy dog present for their child's dental procedure and were more likely to choose a pediatric dental office that provided therapy dog services. **Conclusion:** Pending final data collection and statistical results.

Poster #15

Title: Orofacial Trigeminal Autonomic Cephalalgias: A Review of Case Reports

Authors: Jack Botros, Glenn Thomas Clark, & Mariela Padilla

Faculty Advisor: Mariela Padilla

Background: About 10% of trigeminal autonomic cephalalgias (TAC) present in the face; however, evidence about these presentations is lacking. **Purpose**: To describe and analyze the orofacial presentations of TAC. **Methods:** A PubMed search was performed for the last 5 years until November 2022. The keywords used were TAC, cluster headache (CH), paroxysmal hemicrania (PH), hemicrania continua (HC), short-lasting headaches, SUNCT, and SUNA. Another focused search was done without time limitation. Cases were included if they (i) were published as case reports or case series; (ii) presented TACs in V2 and/or V3 of the trigeminal nerve distribution. Linear regression analyses adjusted for age and sex were employed. **Results:** Forty-nine cases (CH:16, HC:11, PH:11, SUNCT:11) were included. Females represented 49% (n=24) and the mean age was 50.9 years (standard deviation (SD)=12.2). About 43% (n=21) had intraoral/tooth pain and 30.6% (n=15) presented exclusively in V2 and/or V3 distributions. The same percentage (n=15, 30.6%) had painful TMD. Cases had an average of 2.1 autonomic symptoms (SD=1.3), 9.5/10 worst pain (SD=3.8), 3.7 years since onset (SD=5.1), and 1.6 previous providers (SD=1.7) at the time of the report. Non-indomethacin-responsive TAC (i.e., CH and SUNCT) had on average 5 years longer onset than indomethacin-responsive TAC (β= 5.2, P=0.009). TAC with shorter episodes (i.e., PH and SUNCT) were seen by fewer clinicians (β= -1.54, P=0.012). **Conclusion:** Indomethacin diagnostic trial could be associated with less diagnostic delay. Due to the resemblance to other orofacial conditions, orofacial TAC with longer episodes might go mis- or undiagnosed.

Poster #16

Title: Transnasal Dental Implants: Indication and the Report of Cases

Authors: Nathan Eshoiee, Alexandre Aalam, & Neema Bakshalian

Faculty Advisor: Neema Bakshalian

The rehabilitation of the atrophic maxillae with dental implants represents a challenge that can be addressed with zygomatic dental implants and traditional axial implants. In the event of a severely atrophic pre-maxilla, a quad-zygoma approach may be necessary to provide anchorage for the fixed restoration. The proximity of anatomical features can increase the possible morbidity of the quad-zygoma approach and instead, transnasal implants may serve as a viable alternative in the atrophic

pre-maxilla region. This retrospective analysis utilizing CBCT imaging, seeks to evaluate the radiographic marginal bone changes adjacent to the transnasal implant following one year after placement. The results of this study will aim to provide quantitative data in regards to the viability of placing a transnasal implant to provide the anterior anchorage needed for the reconstruction combined with a pair of single posterior zygomatic implants.

Poster #17

Title: Bone Remodeling and Cover-Screw Depth Associated with Two-stage Implant Placement

Authors: Mylea Hunter, Neema Bakhshalian, & Kian Kar

Faculty Advisor: Neema Bakhshalian

The annual rate of marginal bone loss (MBL) was considered as a predictor of implant failure. The process of MBL can be described in two phases: ''early MBL'' which occurs around the first year of service; and ''late MBL'' which may occur over time with the function of the implant in the mouth in the years after its prosthetic loading. Animal studies have suggested that loading of occlusal forces can lead to MBL in the early stage, which may be related to the vertical position of the implant to the level of the bone crest. To the best of our knowledge, this is the first investigation to evaluate the effect of vertical position of the cover screw on the early MBL. Data from 50 patients of the Herman Ostrow School of Dentistry of USC were analyzed between 9/13/17 to 11/2/22 who underwent dental implant placement under a two-stage protocol and were prescribed interim removable prostheses. The implant systems analyzed were all internal connection systems consisting of: Straumann BL, Astra Tech EV and Biomet 3i Certain. Crestal bone level changes around dental implants were analyzed in two-dimensional radiographs, at implant placement and at time of implant uncovery. The aim of retrospective observational study is to determine if there is a difference in crestal bone remodeling around dental implants when placed subcrestal or non-subcrestal when using removable prostheses

Poster #18

Title: Effects of air polishing for the treatment of peri-implant diseases

Authors: Jiarui Bi, Vahid Khoshkam, Christopher Cho, Mylea Hunter, Kian Kar

Faculty Advisor: Kian Kar

Peri-implant diseases have become one of the notable oral issues nowadays. The effectiveness of decontamination of infected implant surface is critical for the clinical success of implant treatment. The air polishing is considered one of the recommended clinical methods of treatment of peri-implant diseases. Few systemic reviews about clinical effectiveness of air polishing have been published over the past 5 years, therefore, an update is necessary. In this study, four electronic databases from January 1990 to December 2022 were explored to identify the relevant studies. Studies included were human clinical trials published in English that employed air polishing for treating peri-implant mucositis and peri-implantitis. Parameters evaluated included probing depth (PD), bleeding on probing (BOP), and radiographic bone level at baseline and follow-up evaluations. The weighted mean differences (WMD) with a 95% confidence interval of the studied parameters were estimated using the random effect model. The aim of this systemic review is to evaluate the clinical evidence and assess the efficacy of using air polishing for the management of peri-implant diseases, including peri-implant mucositis and peri-implantitis

CBY/PIBBS GRADUATE STUDENTS

Poster #19

Title: Ameloblastin Promotes Polarization of Ameloblast Cell Lines in a 3D Culture System

Authors: Gayathri Visakan, Jingtan Su, & Janet Moradian-Oldak

Faculty Advisor: Janet Moradian-Oldak

Background: Ameloblastin is the second most abundant enamel matrix protein. Here, we demonstrate the differential response of immortalized ameloblast like cells in 3D culture to ameloblastin compared to controls. **Purpose:** Can ameloblastin induce overt morphological changes and polarization of ameloblast cells in 3D culture? **Methods:** ALC, LS-8 and HAT-7 cells were cultured using 3D on top type culture was carried with growth factor reduced Geltrex following standard protocols. Test (AMBN, AMEL, AMBNΔ5 and AMBNΔ6) and control (heat denatured AMBN, BSA) proteins were pre-coated on the plates. Cells were added atop the set gel and following attachment were coated with 10% gel. Cells were labeled using DiD, DAPI, Anti-E-cadherin, Anti-Actin, Anti-Par3 and Anti-Claudin-1 antibodies and imaged using Keyence BZX810 and Leica SP8 confocal microscope. **Results:** 3D culture of ALC, LS-8 and HAT-7 cells in the presence of enamel matrix proteins resulted in the formation of cell clusters with selective elongation along the Z plane when viewed on 3D reconstructions. Heat denaturing AMBN results in a reversal of these effects with the cells appearing discrete and planar. The clusters formed with AMBN display an asymmetrical distribution of E-cadherin, Par-3 and Claudin-1 proteins. The bioactive region within AMBN was identified largely to be the exon 5 encoded region. **Conclusion:** Culturing ALC in the presence of Ambn leads to cytoskeletal changes as evidenced by the change in cell morphology and polarization in 3D. This suggests a functional significance of ameloblastin in establishing ameloblast morphology and hints at a potential role in Tomes' process formation.

Poster #20

Title: Investigating Mechanisms of Craniosynostosis in Bent Bone Dysplasia Syndrome

Authors: Audrey Nickle & Amy Merrill

Faculty Advisor: Amy Merrill

Background: Bent Bone Dysplasia Syndrome (BBDS) is the most recently identifed 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. There are two unique BBDS mutations (M391R and Y381D) to the transmembrane domain of FGFR2 that relocalize the receptor from the plasma membrane to the nucleus where it performs a non-canonical function. 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 progressive pan-suture fusion throughout 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. In particular, we have investigated the role of non-osteogenic connective tissue which is poorly understood in comparison to bone. **Conclusion:** Furthering our understanding of this disease mechanism can not only improve BBDS therapeutics and patient outcomes, but also expand on our understanding of calvarial development.

Poster #21

Title: The skull bone injury repair and suture regeneration at single-cell resolution

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

Faculty Advisor: Jianfu Chen

Background: Calvarial sutures joint flat bones of the skull and serve as the growth center of the skull. The development and homeostasis of calvaria are under tight regulations, which are crucial for understanding the etiologies and developing treatments of craniofacial disorders. However, a comprehensive mechanistic understanding of skull injury repair and suture regeneration is lacking. **Purpose:** To uncover the cell dynamics and potential signaling interactions within the injured skull and regenerating suture. **Methods:** Here we performed single cell RNA-sequencing of regenerating tissues of mouse coronal sutures after suturectomy followed by RNAScope imaging analysis. **Results:** Mesenchymal stem cells (MSCs) have limited presences in regenerating tissues, whereas injury induced a drastic increase in three sub-populations of macrophages with distinct localization. We identified injury-induced four sub-clusters of fibrotic or regenerative fibroblasts at the wound site as potential progenitor cells for the potential replenishment of loss sutures. Transcriptomic analysis suggested that these induced fibroblasts may originate from local ectocranial layers above the coronal suture as well as the meninges below the suture, through a cell state transition process resembling suture development. CellChat analysis suggest a potential macrophage-fibroblast interaction via Igf1 signaling after injury. **Conclusion:** Thus, our study provides a systematic view of cell dynamics during skull injury repair and suture regeneration.

Poster #22

Title: Glutamine amidotransferases regulate MHV68 lytic replication via deamidating RTA

Authors: Rui Wang, Qizhi Liu, & Pinghui Feng

Faculty Advisor: Pinghui Feng

Background: RTA is an essential activator of gamma-herpesviruses (γHV) lytic replication. Our previous report showed that PFAS, a member of the glutamine amidotransferase (GATs) family, deamidates γHV RTA and inhibits KSHV transcriptional activation. However, in other γHV strains, GATs family deamidases may differentially regulate virus lytic replication, which is the subject of this study. **Purpose:** Explore the role of MHV RTA deamidation in its lytic replication. **Methods:** Murine gamma-herpesvirus 68 (MHV68) is a model to explore the catalytic function of deamidases in γHV lytic replication. The interaction between deamidases and RTA is detected in 293T cells. Two-dimensional gel electrophoresis and mass spectrometry analyze RTA deamidation. Luciferase reporter assay and real-time qPCR shows virus genes expression. **Results:** The mass spectrum shows the deamidation of 4 RTA amino acids was increased, while that of other 4 was decreased after PFAS depletion. The luciferase reporter assay shows enhanced RTA-activated promoter expression in three of GATs-overexpressing cells. While on the GMPS, one of GATs, knocking-down cells, RTA-activated promoter activity is inhibited, and virus gene expression was inhibited after MHV68 infection. **Conclusion:** Based on these results, GMPS could be a potential deamidase that deamidates RTA to promote MHV68 lytic replication. Together with PFAS, these findings point to the potential to target protein deamidation to ameliorate γHV infectious diseases.

Poster #23

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

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

Faculty Advisor: Pinghui Feng

Background: CAD (Carbamoyl-phosphate synthetase, Aspartate transcarbamoylase and Dihydroorotase) 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. Given that CAD-mediated RelA deamidation is usurped by tumor cells to underpin metabolic reprogramming, TBK1 and IKKβ can impair colon cancer cell proliferation by suppressing aerobic glycolysis and pyrimidine synthesis. **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 #24

Title: Viral glutamine amidotransferase activate phosphoribosyl-formylglycinamidine synthetase (PFAS) to enhance tumorigenesis

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

Faculty Advisor: Pinghui Feng

Background: Tumor cells are generally highly proliferative. Cellular glutamine amidotransferases (GATs) catalyze the synthesis of nucleotides, amino acids, glycoproteins and enzyme cofactors which are cell building blocks. PFAS belongs to the GAT family and is essential for the *de novo* purine synthesis. We previously found that Kaposi's sarcoma-associated herpesvirus (KSHV) vGAT (encoded by ORF75) interacts with PFAS and induces tumor formation in nude mice. Though sharing homology with PFAS, vGAT lacks intrinsic enzyme activity in purine synthesis. We hypothesize that vGAT interacts with PFAS to activate *de novo* purine synthesis and fuel cell proliferation, thus contributing to KSHV-associated angiogenesis. **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:** The metabolic activity of PFAS in purine synthesis and protein deamidation will be analyzed by mass spectrometry examining the metabolites of nucleotide synthesis and

protein post-translational modification of the purinosome, a cytosolic "organelle" for purine synthesis. **Results:** Metabolite analysis by mass spectrometry shows that vGAT expression increases purine and pyrimidine synthesis in diverse cell types, including endothelial cells and keratinocytes. vGAT enhances the *de novo* purine synthesis was further confirm by the tracing analysis using stable-isotope labeled precursors. Interestingly, vGAT expression in NIH3T3 cells promoted tumor formation in nude mice. **Conclusion:** vGAT induces PFAS activation in purine synthesis and protein deamidation, which collectively increases cell proliferation underpinning the KSHV-associated angiogenesis. Further work on this topic may reveal potential molecules to target for antiviral and antitumor therapy.

Poster #25

Title: Skull-meningeal lymphatics-brain communication impairment and rejuvenation in craniosynostosis

Authors: Qing Chang, Li Ma, Can Wang, Mengmeng Liu, Young-Kwon Hong, Yang Chai, and Jianfu Chen

Faculty Advisor: Jianfu Chen

Meninges is well-positioned for skull and brain crosstalk, which remains poorly understood. Craniosynostosis is a major congenital disorder characterized by the premature fusion of cranial sutures with the loss of skull suture mesenchymal stem cells (MSCs). Craniosynostosis infants have both skull and brain defects with neurological complications. Here we identified a skull suture MSC-meningeal lymphatics-brain communication pathway, whose loss leads to while its rejuvenation rescues neurological defects in craniosynostosis. We found meningeal lymphatic morphology and drainage functional defects coupled with impaired brain perfusion and waste clearance in *Twist1*$^{+/-}$ mouse, a craniosynostosis model recapitulating human Saethre-Chotzen syndrome. *Twist1*$^{+/-}$ mice exhibited premature loss of suture MSCs, whereas adding MSC back rejuvenated meningeal lymphatic morphology and functions. Meningeal lymphatic defects were mechanistically caused by suture MSC loss leading to its reduced secretion of vascular endothelial growth factor C (VEGFC). Treating *Twist1*$^{+/-}$ mice with VEGFC promoted meningeal lymphatics and led to the restoration of ICP, brain perfusion, and cognitive behaviors. Thus, we identified an integrated organization of skull-meningeal lymphatics-brain communication axis, whose disruption and rejuvenation causes and rescues neurological defects, respectively.

Poster #26

Title: Characterizing a Peptide-Based Hydrogel for Treatment of White Spot Lesions

Authors: Erika Bauza Nowotny & Janet Moradian-Oldak

Faculty Advisor: Janet Moradian-Oldak

Background: White spot lesions (WSLs) have high prevalence (68%) and incidence (45%) in fixed orthodontic patients. **Purpose:** The aim of this study was to characterize the stability and degradation of an amelogenin peptide-based chitosan hydrogel (P26-CS) and to evaluate its remineralization potential on WSLs. **Methods:** To investigate whether chitosan (CS) has any effect on the stability of peptides P26/P32, we compared the in vitro stability of peptides in aqueous solutions with that in CS by HPLC analysis. Degradation of P26 and P32 solutions was characterized by mass spectrometry (LC/MS). To better mimic in vivo conditions, the stability of P26 and P26-CS was assessed following incubation with salivary enzymes MMP1, MMP8, salivary amylase, and lysozyme. Artificial WSLs were treated with water (control), P26-CS, or fluoride varnish (positive control) followed by remineralization in artificial saliva (pH 7.1) for 21 days. Remineralization was assessed using quantitative light-induced fluorescence (QLF). **Results:** P26 and P32 in CS exhibited significantly increased stability than in aqueous solution ($p < 0.0001$). Minimally degraded products of P26 and P32 were identified after 7 days at 37 °C by LC/MS. Additionally, P26-CS showed slightly increased stability than in aqueous solution after incubation with selected salivary enzymes. Preliminary remineralization data indicates that P26-CS is superior to fluoride varnish in restoring mineral density. **Conclusion:** These results showed that CS confers additional stability to P26/P32, which suggests prolonged shelf life of the hydrogel. The peptides were largely resistant to degradation in vitro. Our results suggest that P26-CS can be an effective treatment for WSLs.

Poster #27

Title: Bacteria Fuel Gamma Herpesvirus Lytic Replication via Inducing ISGylation

Authors: Shutong Li, Yongzhen Liu, Chao Qin, & Pinghui Feng

Faculty Advisor: Pinghui Feng

Background: Herpesviruses are common residents of the oral cavity and implicated in periodontitis. However, how herpesvirus and bacteria interact and their association with periodontitis remain poorly understood. Interferon-induced gene 15 (ISG15) can be added to target proteins via ISGylation. The effect of ISGylation on microbial infection may be target-specific and biological functions of ISGylation are not well-defined in viral infection. **Purpose:** Our preliminary results suggest that murine gammaherpesvirus 68 (MHV68), a model herpesvirus of Kaposi's sarcoma-associated herpesvirus, hijacks ISGylation to promote its lytic replication and oral bacteria stimulate MHV68 replication via ISGylation. We will investigate roles of ISGylation in MHV68 replication that underpins the bacteria-stimulated effect. **Methods:** Mouse embryonic fibroblasts (MEFs) were infected with MHV68, followed by the infection with *Aggregatibacter actinomycetemcomitans (A.a)*. Affinity purification and LC-MS technology were employed to characterize MHV68 viral proteins ISGylation. Biochemistry experiments were applied to validate the viral protein ISGylation. The recombinant MHV68 that contains ISGylation-resistant mutations will be engineered to examine functions of ISGylation in *A.a*-MHV68 interaction. **Results:** *A.a* promoted MHV68 replication. Moreover, MHV68 and *A.a* synergized to induce ISG15 expression. Loss of ISG15 impaired MHV68 replication in MEFs. Key viral structural proteins were identified, including capsid, portal and tegument proteins that are ISGylated. The effect of ISGylation on MHV68 lytic replication will be examined by virological and immunological analyses, combining with the recombinant MHV68 engineered that is resistant to ISGylation. **Conclusion:** Our preliminary findings support the hypothesis that MHV68 hijacks ISGylation to promote its lytic replication, which may underpin the bacteria-virus interaction.

Poster #28

Title: Spatial Transcriptomics Reveals Crucial Roles of ADGRG6 in Cartilage Homeostasis

Authors: Fangzhou Bian, Hong Colleen Feng, & Zhaoyang Liu

Faculty Advisor: Zhaoyang Liu

Background: Osteoarthritis (OA) is the most common form of degenerative joint disease with no disease-modifying therapeutics available. We have recently identified a cartilage-enriched G protein-coupled receptor (GPCR) named ADGRG6, which is highly expressed in healthy cartilage in both humans and mice, but its expression is generally reduced in OA cartilages. Ablation of *Adgrg6* in osteochondral progenitor cells does not affect embryonic limb development but leads to OA-like joint phenotypes when these mice age. **Purpose:** To better understand the functional role of *Adgrg6* in the whole knee joint, we performed spatial transcriptomics with the 10x Genomics Visium platform utilizing a novel workflow on FFPE (Formalin-fixed paraffin-embedded) mineralized tissues. **Methods:** We analyzed two biological replicas of P20 knee joints of wild-type and *Adgrg6* mutant mice and identified a list of differentially expressed genes. Some of these targets have been validated via IHC (Immunohistochemistry) analysis on tissue sections. **Results:** In general, we observed altered expression of ECM components and dysregulated catabolic enzyme expression. Importantly, we found loss of resting zone cells associated with increased apoptosis, decreased cell proliferation, and increased hypertrophic differentiation in the mutant growth plate. **Conclusion:** Taken together, our results suggest that *Adgrg6* is an important regulator that maintains cartilage homeostasis and may serve as a potential target for OA treatment. Future directions will focus on integrating spatial transcriptomics with scRNA-seq data sets to elucidate molecular crosstalk and mechanisms of ADGRG6 in subsets of cell populations of the joint cartilages.

Poster #29

Title: Establish and characterize mouse models of painful temporomandibular disorder (TMD)

Authors: Supawadee Jariyasakulroj, Binbin Li, Jotham Sadan & Jianfu Chen

Faculty Advisor: Jianfu Chen

Background: Temporomandibular disorder (TMD) is one of the main causes of pain in the orofacial region. It involves pain and dysfunction of masticatory muscle and temporomandibular joint (TMJ). In addition to TMD, trigeminal neuropathic pain is a severe painful condition affecting the face. Both TMD and neuropathic pain are deteriorate patients' quality of life. However, treating pain conditions are challenging tasks due to the inability to target underlying mechanisms precisely. Therefore, further studies in mechanisms contributing to orofacial pain is required. **Purpose:** To establish mouse models for mechanistic studies related to orofacial pain. **Methods:** Muscle pain and TMJ osteoarthritis (TMJ-OA) were used as models to study painful TMD. Ligation injury of the masseter muscle was performed in 2-month-old mice. Complete Freund's Adjuvant was injected into the TMJ to generate TMJ-OA. Inferior alveolar nerve transection was also performed to study neuropathic pain. Nociceptive behavioral tests, including bite force measurement and von Frey filament test, were analyzed at different time points. Immunofluorescence staining and RNAscope were performed on TMJ, trigeminal ganglion and spinal trigeminal nucleus caudalis (SpVc). **Results:** Bite force and head-withdrawal threshold were decreased, whereas microglia in SpVc was increased in all models. Additionally, the expression of Netrin-1 in osteoclasts were increased in TMJ-OA. **Conclusion:** All of the orofacial pain mouse models experience mechanical allodynia and reduce biting habit. These painful conditions also activate microglia. Further studies in microglia activation related to pain resolution and the role of Netrin-1 in TMJ-OA will be investigated to provide novel target in pain management.

Poster #30

Title: Probing the Metabolic Roles of IKKe in KSHV-associated Lymphoma

Authors: Ali Savas, Ting-Yu Wang, Chao Chin, Stephanie Rice, & Pinghui Feng

Faculty Advisor: Pinghui Feng

Background: Inhibitor of kB (IkB) kinase (IKK) e is a member of non-canonical IKKs that are crucial for host immune defense against microbial infection and cancers. Interestingly, cancer cells often co-opt IKKe to foster inflammation and promote tumor development; however, the exact function of IKKe in tumorigenesis is not fully characterized. Human Kaposi's sarcoma-associated herpesvirus (KSHV) is the etiological agent of Kaposi's sarcoma (KS), primary effusion lymphoma (PEL) and multicentric Castleman's disease. **Purpose:** In this study, we explored KSHV-positive PEL cells to examine the roles of IKKe in cell metabolism and proliferation. **Methods:** By employing high throughput mass spectrometry to analyze IKKe directed phosphoproteomics and metabolomics. **Results:** We report here that, KSHV deploys vCyclin, Kaposin and vIRF3 to interact with and activate IKKe. Genetic depletion or pharmacological inhibitors of IKKe potently impede the proliferation of KSHV-positive PEL cells. Phosphoproteomics analysis of IKKe-depleted PEL cells identified metabolic pathways, particularly *de novo* nucleotide synthesis, under the control of IKKe. Further biochemical analysis demonstrated that IKKe interacts with and phosphorylates phosphoribosyl-formylglycinamidine synthetase (PFAS), and GMP synthetase (GMPS) to fuel *de novo* nucleotide synthesis. Nucleotide synthesis and proliferation impeded by IKKe depletion can be restored by phosphorylation-mimetic mutants, but not the phosphorylation-resistant mutants, of PFAS and GMPS. **Conclusion:** These findings reveal a signaling cascade in which IKKe is activated by KSHV to power nucleotide synthesis, thus promoting the proliferation of PEL cells. Our work establishes critical roles of an innate immune kinase in tumorigenesis, providing a new target for remediating KSHV-associated lymphoma and diseases.

Poster #31

Title: Probing the role of HSV-1 in Tauopathy and neurodegeneration using a mouse model

Authors: Zhenfeng Shu, Shu Zhang, & Pinghui Feng

Faculty Advisor: Pinghui Feng

Background: Neurodegeneration is a growing unmet problem in the aging world. Alzheimer's disease was found highly associated with HSV-1 brain infection, but the underlying mechanism is unknown. US3 is a protein kinase encoded by HSV-1 and can phosphorylate TAU. Abnormal phosphorylation of TAU is an important hallmark of Alzheimer's disease. We hypothesize that US3 phosphorylates TAU in HSV-1-infected cells, inducing the formation of TAU oligomers and consequently neurodegeneration. **Purpose:** This project is to 1) probe the role of HSV-1 in Tauopathy and 2) elucidate the mechanism of US3-mediated phosphorylation and oligomerization underpinning neurodegeneration. **Methods:** In vitro kinase assay is performed to verify US3 phosphorylates TAU. TAU phosphorylation sites were identified through MS analysis. Point mutations of these sites are being generated to determine the contribution and function of these phosphorylation events. SK-N-BE(2) neuroblastoma cell line was chosen to examine HSV-1 neuronal infection. TAU protein will be purified through fast protein liquid chromatography (FPLC). The size of TAU will be analyzed to determine the change of oligomerization upon HSV-1 infection. Animal experiments will be carried out in aged PS19 mice to further verify TAU oligomerization change upon HSV infection. **Results:** We found that US3 was able to phosphorylate TAU, causing a more soluble form which could be toxic TAU oligomers. **Conclusion:** US3 has shown to be a promising exogenous kinase that can phosphorylate TAU and induce oligomer formation. This finding strengthens the bond between HSV-1 infection and Alzheimer's disease.

Poster #32

Title: Identifying injury-responsive cells in the temporomandibular joint

Authors: Maria Pacheco Vergara, Aaron Huang, & Amy E. Merrill

Faculty Advisor: Amy E. Merrill

Background: Over 10-15% of the adult population are affected by temporomandibular joint disorders (TMD), a group of clinical conditions resulting in chronic jaw dysfunction and persistent orofacial pain. In arthrogenous TMD, where there is derangement of joint connective tissue, is thought to originate from displacement of the articular disc (AD). Yet, very little is known about the transcriptional and cellular changes that occur in the temporomandibular joint (TMJ) following AD displacement. **Purpose:** The aims of this study are to characterize the molecular and cellular response that occur in the TMJ following AD displacement, combining genomics and genetics in a mouse surgical model. **Methods:** To induce AD displacement in the mouse TMJ, the posterior masseter musle is cut between the zygomatic and buccal branches of the facial nerve to expose the TMJ capsule. Next, the joint capsule is opened and the AD's retrodiscal laminae severed. At days 5 and 10 post-surgery, I will use histology to characterize the injury, bulk RNA-seq to identify gene expression changes, and scRNA-seq to detect cell composition differences. I will test how Sox9- and Scx-lineage cells, which are key sources of cells in the condyle and disc, respond to TMJ injury using genetic lineage tracing. **Results:** I expect Sox9- and Scx-lineage cells will respond to AD displacement, and induce adaptive changes that disrupt the condylar cartilage and deform the AD. **Conclusion:** Completion of this study is expected to reveal new insights into the molecular and cellular mechanism that underlie arthrogenous TMD.

Poster #33

Title: The role of LGRs in jaw tendon attachment development

Authors: Arshia Bhojwani, Audrey Nickle, Ryan R. Roberts; J. Gage Crump, Amy E. Merrill

Faculty Advisor: Amy E. Merrill, J. Gage Crump

Background: Function of the vertebrate jaw depends on precise integration of tendon with bone, yet we know little about mechanisms that regulate development of tendons attachments in the head. Previously, we showed that tendon attachment progenitors (APs) in the mouse jaw co-express tenogenic factor Scx and chondrogenic factor Sox9, and have the ability to differentiate into cartilage-like or tendon-like cells. ScRNAseq analysis of the developing mouse jaw indicates that APs selectively express G-protein coupled receptor Lgr5. Activation of Lrg5 enhances Wnt signaling to regulate proliferation and maintenance of stem/progenitor cells in multiple epithelial tissues. However, the role of Lrg5 in mesenchyme-derived tissues such as the skeleton are relatively unknown. **Purpose:** The aim of this project is to determine the role of LGRs in APs during vertebrate jaw development. **Methods:** ScRNAseq analyses are used to characterized Lrg-expressing cell populations in developing mouse and zebrafish jaw. *In situ* hybridization for *Lgr5* in mouse and zebrafish orthologs *lgr4* and *lgr6* will identify the spatial distribution of Lrg cells over development. The necessity of Lrg5 in jaw AP development is examined using the *Lrg5* KO mouse line. **Results:** ScRNAseq analysis of *Scx*+ cells from the zebrafish jaw have identified several clusters expressing *Lgr5* orthologs *lgr4* and *lgr6*, suggesting functional conservation. Through *in situ* analysis and lineage tracing, we determine that Lgr cells contribute to tendon attachment sites in mouse and zebrafish. **Conclusion:** We expect to find that Lgrs are critical in maintaining a progenitor-like state in jaw APs and in proper development of tendon attachment sites through the Wnt/B-catenin pathway.

Poster #34

Title: The Essential Role of Arid1a and Arid1b in Palatogenesis

Authors: Heliya Ziaei, Mingyi Zhang, & Yang Chai

Faculty Advisor: Yang Chai

Background: Cleft palate is one of the most common craniofacial congenital abnormalities, affecting major physiological functions such as swallowing, breathing, and speech. Palatogenesis requires the timely regulation of specific genes and flawless control of cell-fate identity. The roles of particular transcription factors and protein complexes in the regulation of cell fate identity in hard and soft palate development are of paramount importance. ARID1A and ARID1B are two mutually exclusive subunits of SWI/SNF, a chromatin remodeling complex, that plays an important role in repressing tumorigenesis. Mutation of these two genes also implicated in various developmental disorders, suggesting they may play important roles in cell fate determination. **Purpose**: To analyze the role of ARID1A and ARID1B in palatal mesenchymal cells during hard and soft palate development. **Methods:** Histological analyses, RNAScope, immunofluorescence staining, and MicroCT analyses of control and *Osr2-Cre;Arid1a$^{fl/fl}$;Arid1b$^{fl/fl}$* mice. **Results:** Deletion of *Arid1a* and *Arid1b* in palatal mesenchymal cells utilizing *Osr2Cre*, which affects palatal mesenchyme, results in severe defects in the palatal region. *Osr2-Cre;Arid1a $^{fl/fl}$;Arid1b$^{fl/fl}$* mice show complete cleft palate with severe defects in the development of soft palatal muscles such as tensor veli palatini, palatoglossus, levator veli palatini, and palatopharyngeus. These results suggest an essential role for Arid1a and Arid1b in palatogenesis through tissue-tissue interactions. **Conclusion:** This study emphasizes the regulatory potential of Arid1a and Arid1b in mesenchymal cells during palatogenesis. Our results will contribute to understanding the underlying etiology of craniofacial malformations, specifically cleft palate, and suggest the potential role of Arid1a and Arid1b in other developmental processes.

Poster #35

Title: Role of Runx2 arginine methylation in functional interaction with its transcriptional co-factors

Authors: Prerna Sehgal, Nicha Ungvijanpunya, Yongchao Gou, Abhijit Shinde, Stephen Yen, Baruch Frenkel, & Jian Xu

Faculty Advisor: Jian Xu

Background: Runx2 is the master transcription factor for bone formation. Mutations in Runx2 results in cleidocranial dysplasia with patients displaying craniofacial defects including an open metopic suture. Because of its importance, Runx2 is tightly regulated by various post-translational modifications. Our preliminary data showed that PRMT3 and PRMT4 are highly expressed in the osteoblast lineages and catalyze Runx2 methylation at four arginine (R) residues within the transactivation/repression domain. **Purpose:** To investigate the role of Runx2 arginine methylation in osteogenesis and craniofacial development. **Methods:** qRT-PCR, Alp staining and RNA-seq analysis were performed using dox-inducible C2C12 stable cell lines expressing Runx2 WT or methylation-deficient mutants. ChIP-seq will be conducted to compare genomic enrichment of Runx2 WT or mutants at promoter and enhancer regions. **Results:** Runx2 arginine methylation is required for osteogenic differentiation and essential in promoting osteoblast migration in cultured osteoblasts. PRMT4 deficiency inhibits osteoprogenitor migration at the osteogenic fronts in mice with neural crest-specific PRMT4 deletion. These mice exhibit open posterior frontal suture, which corresponds to the metopic suture in human. Genomic and transcriptomic analysis revealed a significant downregulation of ECM-related and cell motility genes, as well as decreased Runx2 enrichment in these gene promoters. **Conclusion:** Arginine methylation of Runx2 is required for osteogenesis and PRMT4-methylated Runx2 at the osteogenic fronts is essential for posterior frontal suture closure via regulating osteoprogenitor migration and matrix maturation.

Poster #36

Title: The Interplay between arginine methylation and citrullination in oral inflammations

Authors: Mehrnaz Zarinfar, Xi Chen, & Jian Xu

Faculty Advisor: Jian Xu

Background: Periodontitis is a multifactorial inflammatory disease formed by a complex interaction between a broad spectrum of pathogens and host immune response. It is characterized by bone destruction, irreversible damage of the periodontal ligaments, and tooth loss. Induction of inflammation critically depends on TLR signaling and NFkB pathway, known to be regulated by TGF-b and BMP signaling. TGF-b and BMP pathways are shown to be controlled by Arginine (Arg) methylation. Arg methylation of SMAD6, a TGF-b signal inhibitor, repressed inflammation and bone loss in experimental mouse periodontitis. Arg can also be modified by PAD enzymes to citrulline, a modification detected in inflammatory diseases such as periodontitis, rheumatoid arthritis and Alzheimer's disease. **Purpose:** To define if the interplay between methylation and citrullination may affect the way oral inflammations occur and progress. **Methods:** Biochemical and signaling analysis using oral gingival epithelial cells will be performed. Furthermore, we will implement translational and transcriptional analysis using an experimental mouse periodontitis model. **Results**: Our preliminary results have shown that citrullination and arginine methylation in the inflamed tissue was significantly higher than in non-inflamed tissue assessed by immunofluorescence. Inhibition of citrullination in the mouse periodontitis limited bone destruction, while inhibition of arginine methylation aggravated inflammation and bone loss. **Conclusion:** Our findings suggest that protein arginine methylation exerts protective functions, while citrullination exhibits detrimental roles in periodontal tissue upon inflammation resulting in bone loss. Future experiments will directly investigate the molecular events that underpin the interaction between methylation and citrullination in oral inflammatory diseases.

DENTISTRY & CCMB POST-DOCTORAL FELLOWS

Poster #37

Title: Investigating The Enamel Phenotype In Novel *Ambn-IRESCre/Smad4$^{fl/fl}$* Mouse Model

Authors: Rucha Arun Bapat, Yanbin Ji, Alexis E. Bauer, Yan Zhou, & Michael L. Paine

Faculty Advisor: Michael L. Paine

Background: We recently developed a novel *Ambn-IRESCre* mouse line to allow ameloblast specific gene silencing. **Purpose**: The aim of this study was to evaluate the efficacy of this line by observing the enamel phenotype in *Ambn-IRESCre/Smad4$^{fl/fl}$* mice. **Methods**: The spatiotemporal expression of Cre-recombinase was observed using LacZ staining in *Ambn-IRESCre^{+}/R26R^{+}* mice. Enamel mineral density and enamel volume in Ambn-*IRESCre^{+}/Smad4$^{fl/fl}$* mice were analyzed by micro-CT. Enamel microstructure was observed using scanning electron microscopy. Ameloblast morphology and amelogenin-ameloblastin expression were observed using H&E staining and immunohistochemistry. **Results**: LacZ staining limited to ameloblasts confirmed that the Cre-recombinase expression was ameloblast specific. *Ambn-IRESCre^{+}/Smad4$^{fl/fl}$* enamel was chipped off on both incisor and molar surfaces, in severe cases exposing the pulp. Hypomineralized enamel was present on the cervical thirds of the molars, but the occlusal surfaces of molars had almost no enamel. Overall, the enamel mineral density and enamel volume in the mutants were significantly lower than that of the wild-type. *Ambn-IRESCre^{+}/Smad4$^{fl/fl}$* incisor enamel lacked characteristic decussating rod-interrod structure. Enamel hydroxyapatite crystals appeared flat and plate like instead of thin and needle like. Backscatter SEM images confirmed the lower mineral density of mutant enamel. *Ambn-IRESCre^{+}/Smad4$^{fl/fl}$* ameloblasts appeared scalloped and multilayered and formed cysts in some cases. Amelogenin and ameloblastin had pooled apical to the ameloblasts suggesting digestion and/or re-uptake of these proteins by ameloblasts was compromised. **Conclusion:** *Ambn-IRESCre^{+}/Smad4$^{fl/fl}$* mutant enamel was significantly hypomineralized compared to wild-type. However, unlike *Krt14-Cre^{+}/Smad4$^{fl/fl}$* animals, these mice were viable and otherwise healthy. We conclude that *Ambn-IRESCre* line is a valuable tool to study amelogenesis.

Poster #38

Title: TGF-β signaling regulates Fgf18 to control soft palatal muscle development

Authors: Jifan Feng, Xia Han, Yuan Yuan, Courtney Kyeong Cho, Eva Janečková, Tingwei Guo, Siddhika Pareek, Md Shaifur Rahman, Banghong Zheng, Bi Jing, Junjun Jing, Mingyi Zhang, Jian Xu, Thach-Vu Ho, & Yang Chai

Faculty Advisor: Yang Chai

Background: Coordinated movements of pharyngeal muscles, particularly soft palate muscles, are crucial for speech, swallowing, breathing, and hearing. Previous studies suggested that cranial neural crest (CNC)-derived cells are in close contact with myogenic cells in multiple craniofacial myogenic sites and that these two populations develop in sync during craniofacial morphogenesis. **Purpose**: The aim of this project is to test whether a distinct CNC-derived cell subpopulation surrounding the myogenic cells, known as perimysial cells, can regulate soft palate myogenesis through tissue-tissue interaction. **Methods**: Using mouse levator veli palatini (LVP) development as a model, we systematically investigated how perimysial fibroblasts communicate with myogenic cells to regulate mouse pharyngeal myogenesis. **Results**: Using single-cell RNAseq data analysis, we identified that TGF-β signaling is a key regulator for the perimysial fibroblasts. Loss of TGF-β signaling in the neural crest-derived palatal mesenchyme leads to defects in perimysial fibroblasts and muscle malformation in the soft palate in *Osr2^{Cre};Tgfbr1$^{fl/fl}$* mice. In particular, Creb5, a transcription factor expressed in the perimysial fibroblasts, cooperates with TGF-β signaling to activate expression of *Fgf18*. Moreover, Fgf18 supports pharyngeal muscle development in vivo and exogenous Fgf18 can partially rescue myogenic cell numbers in *Osr2^{Cre};Tgfbr1$^{fl/fl}$* samples, illustrating that TGF-β-regulated Fgf18 signaling is required for LVP development. **Conclusion**: Collectively, our findings reveal the mechanism by which TGF-β signaling achieves its functional specificity in defining the perimysial-to-myogenic signals for pharyngeal myogenesis.

Poster #39

Title: Joubert syndrome protein Arl13b impacts palatogenesis and craniofacial myogen-

esis

Authors: Eva Janečková, Jifan Feng, Tingwei Guo, Aileen Ghobadi, Angelita Araujo-Villalba, Heliya Ziaei, Thach-Vu Ho, & Yang Chai

Faculty Advisor: Yang Chai

Background: The craniofacial region determines our identity and is essential for our daily activities, communication, and intellect. Craniofacial malformations represent 75% of congenital disorders, with the most common being cleft palate. Furthermore, craniofacial phenotypes are associated with 30% of ciliopathies. However, detailed mechanisms underlying the relationship between cilia and craniofacial development is not known. **Purpose**: To analyze the detailed mechanism by which cilia serve as key mediators of tissue-tissue interactions among cranial neural crest (CNC)-derived mesenchymal and mesoderm-derived muscle cells during palate and muscle development. **Methods**: Histology, RNAScope, immunofluorescence and MicroCT analyses of *Wnt1-Cre;Arl13b*$^{fl/fl}$, and *Arl13b*$^{fl/fl}$ mice. **Results**: Conditional deletion of *Arl13b*, a Joubert syndrome-associated gene, specifically in CNC-derived mesenchymal cells using *Wnt1-Cre* caused severe defects leading to death at birth. Decreased numbers of ciliated cells were observed in *Wnt1-Cre;Arl13b*$^{fl/fl}$ mice. Focusing on the craniofacial region, complete or soft palate cleft was observed, coupled with changes in maxillary, palatine, and mandibular bones. Furthermore, we observed defects in the tongue and soft palatal muscles. Surface area and volume of the tensor veli palatini, palatoglossus, and levator veli palatini were reduced in *Wnt1-Cre;Arl13b*$^{fl/fl}$ mice. These results suggest that cilia in CNC-derived mesenchymal cells mediate signaling to the mesoderm-derived myogenic cells through tissue-tissue interactions. **Conclusion**: This study presents a mouse model of Joubert syndrome and an opportunity to expand knowledge about regulatory inputs of primary cilia, their interactions and complexity. This will contribute to understanding the precise etiology of craniofacial malformations which present with very high incidence in humans.

Poster #40

Title: *Trp53* supports mesenchymal stem cell homeostasis through regulating vascular architecture

Authors: Tingwei Guo, Fei Pei, Mingyi Zhang, Junjun Jing, & Yang Chai

Faculty Advisor: Yang Chai

Background: Mesenchymal stem cells (MSCs) are crucial for tissue homeostasis, repair, and regeneration. The neurovascular bundle is part of the MSC niche environment and provides important cues to regulate the fate of MSCs. Blood vessels, a component of the neurovascular bundle, have long been known for their role in transporting oxygen, nutrients, and small molecules. However, the function of blood vessels themselves in regulating stem cells is largely understudied. **Purpose**: We use adult mouse incisors as a model to reveal the functional significance of *Trp53* in regulating the vascular architecture to maintain tissue homeostasis. **Methods**: Transgenic mouse models, *in situ* RNAscope hybridization, immunostaining, organ culture, whole-mount tissue clearing. **Results**: Our study shows that the loss of *Trp53* in GLI1+ progenies reduces THBS2, which leads to alterations in the vascular architecture including an increase of arteries and a decrease of non-artery vessels. These changes in vessels further result in an increased deposition of artery derived PDGFA and PDGFB to the proximal MSC region, where they interact with PDGFRA and PDGFRB. More importantly, PDGFRA+ and PDGFRB+ cells are subpopulations of MSCs and can contribute to different cell lineages in the adult mouse incisor. **Conclusion**: Collectively, our results highlight the important role of *Trp53* in regulating the vasculature niche in adult mouse incisors and how different vessels can provide unique microenvironmental cues to regulate MSCs. This study not only reveals the complexity of the vasculature in the adult incisor, but also provides mechanistic insight into the crosstalk between blood vessels and stem cells.

Poster #41

Title: Human iPSC suture stem cells for mechanistic and therapeutic studies

Authors: Wei Zhang, Li Ma, Supawadee Jariyasakulroj, & Jianfu Chen

Faculty Advisor: Jianfu Chen

Background: Our human models of craniofacial stem cells and human cell-based therapeutic strategies for craniofacial disorders are limited. 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. It has been reported that mouse Gli1+ MSC implantation can regenerate sutures and mitigate skull and neurocognitive dysfunctions in mouse models of craniosynostosis. **Purpose**: Here we established a robust protocol for differentiating human induced pluripotent stem cells (iPSCs) into highly uniformed and unlimited numbers of GLI1+ MSCs in a defined serum-free culture condition. **Results**: We used human iPSC-MSCs to model ribosomopathy-associated mutations and craniosynostosis-related gene FGFR2 mutations and found that ribosome biogenesis disruption leads to proteotoxic stress due to the disruption of nucleoli liquid-liquid phase separation (LLPS). So we used iPSC-MSC as a cellular model of craniosynostosis and identify disease gene functions that cannot be found in mice. We also attempted to implant iPSC-MSCs in Twist1+/- craniosynostosis mouse models, with the goal of regenerating cranial sutures and correcting skull dysmorphologies in craniosynostosis mice. **Conclusion**: Together, we aim to develop a human iPSC-MSC model for mechanistic and therapeutic studies of craniosynostosis.

Poster #42

Title: Sensory and motor nerve innervation is essential to cleft palate

Authors: Mengmeng Liu, Jifan Feng, Tingwei Guo, Eva Janeckova, Siddhika Pareek, Fei Pei, Mingyi Zhang, Peng Chen, Thach Vu Ho, & Yang Chai

Faculty Advisor: Yang Chai

Background: Innervation of peripheral organs is crucial to maintaining physiological homeostasis and transmitting responses in response to external stimuli. Organ innervation is initiated during development, with stimuli being conducted through several types of neurons including sympathetic, parasympathetic, and sensory. **Purpose**: While the physiological modulation of mature organs by these nerves is well understood, their role in mammalian development is still largely unknown. **Methods**: Interactions with cells in target tissues can affect the development and eventual function of several organs, highlighting their significance. Here, we use the development of the mouse palate as a model to analyze the function of nerve innervation in organogenesis. Results: We show that with loss of sensory innervation, the palatal shelves failed to elevate at the early stage of palate development, leading to a complete cleft palate. Furthermore, we show that after the loss of motor innervation, the palate failed to fuse in the middle leading to a complete cleft palate. **Conclusion**: Our results highlight the important role of innervation in organogenesis.

Poster #43

Title: Ameloblastin interacts with amelogenin and membrane via a multi-targeting domain

Authors: Natalie C. Kegulian, Ralf Langen, & Janet Moradian-Oldak

Faculty Advisor: Janet Moradian-Oldak

Background: Ameloblastin (Ambn) as an enamel matrix protein has critical physiological functions including regulation of mineral formation, cell differentiation, and cell-matrix adhesion. **Purpose**: We sought to investigate localized structural changes in Ambn during its interactions with cell membranes, amelogenin (Amel), and itself. **Methods**: We performed biophysical assays and used liposomes as a cell membrane model, together with a variety of Ambn-derived peptides. The xAB2N and AB2 peptides were rationally designed to encompass regions of Ambn that contained previously identified self-assembly and helix-containing membrane-binding motifs. **Results**: Electron paramagnetic resonance (EPR) on spin-labeled peptides showed localized structural gains in the presence of liposomes, of Amel, and of Ambn. Vesicle clearance and leakage assays indicated that AB2-membrane interactions were independent from peptide-peptide self-association. Tryptophan fluorescence peak shifts showed peptide interactions with liposomes and Amel, and tryptophan fluorescence and EPR showed competition between Ambn-Amel and Ambn-membrane interactions. **Conclusion**: Our data collectively revealed localized structural changes in Ambn upon interaction with different targets via a multi-targeting domain, spanning residues 57 to 90 of mouse Ambn. Structural changes of Ambn following its interaction with different targets have important and relevant implications for the multifunctionality of Ambn, including cooperative function with Amel in controlling mineralization and roles in ameloblast polarization, signaling, and adhesion of ameloblast membranes to the enamel matrix.

Poster #44

Title: CAD programs cellular metabolism to promote cancer cell proliferation

Authors: Chao Qin, Taolin Xie, Yulu Duan, Ali Can Savas, Yongzhen Liu, & Pinghui Feng

Faculty Advisor: Pinghui Feng

Background: Uncontrolled proliferation is a hallmark of cancer cells and requires extraordinary metabolic activity. Understanding how cancer cells rewire cellular metabolism will elucidate molecular events underpinning cancer cell biology, exposing new molecules that can be targeted for antitumor therapy. **Purpose**: Carbamoyl-phosphate synthetase, aspartate transcarbamoylase and dihydroorotase (CAD) is the rate-limiting enzyme of the *de novo* pyrimidine synthesis pathway. Our previous study showed that CAD promotes cancer cell proliferation in a pyrimidine synthesis-dependent and -independent manner. We are interested in the activity of CAD in cancer cell proliferation independent of pyrimidine synthesis. **Methods**: two-dimensional gel electrophoresis, LC-MS. **Results**: In this study, we report that CAD promotes aerobic glycolysis via directly deamidating rate-limiting enzymes of the central carbon metabolism, specifically glucose-6-phosphate dehydrogenase (G6PD) and phosphoglycerate dehydrogenase (PHGDH). CAD depletion blocked the carbon flux from glycolysis to the serine synthesis pathway (SSP) and pentose phosphate pathway (PPP). Mechanistically, CAD deamidates G6PD and PHGDH in cells and *in vitro*. Moreover, CAD deamidated G6PD and PHGDH in S phase and in a cell cycle-dependent manner. Further LC/MS analysis identified Q339, Q446 and N449 of PHGDH, and N153 and Q161 of G6PD that were highly deamidated in S phase. Remarkably, deamidated mutants of PHGDH and G6PD exhibited higher enzymatic activity compared to their wild-type counterparts. Deamidated G6PD and PHGDH promotes PPP and SSP, respectively, while their deamidation-resistant mutants had the opposite effect on these pathways. **Conclusion**: Taken together, CAD deamidates PHGDH and G6PD to upregulate the PPP and SSP that provide metabolites for proliferation of cancer cells.

Poster #45

Title: *Tcf12* mutation can affect cranial suture formation and brain function

Authors: Takahiko Yamada, Jesse Anderson-Ramirez, Md Shaifur Rahman, Jianfu Chen, & Yang Chai

Faculty Advisor: Yang Chai

Background: Craniosynostosis is a craniofacial disorder characterized by the premature fusion of cranial sutures. Patients with severe craniosynostosis often have neurocognitive abnormalities caused by elevated intracranial pressure (ICP). Heterozygous loss-of-function mutations in *TWIST1* or *TCF12*, which can form a heterodimer, cause coronal suture fusion in humans. Craniosynostosis is observed both in *Twist1* mutant mice and *Tcf12* mutant mice. Neurocognitive abnormalities have also been observed in *Twist1* mutant mice, but whether *Tcf12* mutation induces neurocognitive abnormalities in mice is unknown. **Purpose**: The present study was designed to reveal the relationship between *Tcf12* mutation and neurocognitive dysfunction. **Methods**: The incidence rate of coronal suture fusion and the morphology of the skull in 3-month-old mice were studied by μCT imaging of *Tcf12*$^{fl/fl}$ (Control) and *Wnt1-Cre;Mesp1-Cre;Tcf12*$^{fl/fl}$ (Mutant) mice. Behavioral tests, MRI imaging of brains and ICP measurements were performed to evaluate neurocognitive abnormalities in each mouse. **Results**: *Tcf12* mutant mice showed altered coronal suture positions and partial coronal suture fusions which were less severe than those in *Twist1* mutant mice. Also, ICP was elevated in *Tcf12* mutant mice while skull shape was unaffected. In behavioral tests, motor learning ability was reduced in *Tcf12* mutant mice. This result was consistent with the small cerebellum revealed by MRI analysis in *Tcf12* mutant mice. **Conclusion**: Loss of *Tcf12* leads to craniosynostosis and elevated ICP but does not affect skull shape. It can cause decreased volume of the cerebellum and motor learning disabilities independent of craniosynostosis.

Poster #46

Title: Sensory nerve innervation is crucial in regulating tooth root development

Authors: Lin Meng, Siddhika Pareek, Fei Pei, Tingwei Guo, & Yang Chai

Faculty Advisor: Yang Chai

Background: Sensory neurons can regulate mesenchymal stromal cell lineage commitment. Therefore, they may play a role in tooth development. However, it is unclear how sensory nerves affect organogenesis, especially tooth root development. **Purpose**: Using the tooth root as a model, we investigated how loss of the sensory nerve can affect tooth root development. **Methods**: First we conducted staining of advillin and β III tubulin on molars from E18.5, PN0.5, PN3.5, PN5.5, PN7.5 and PN14.5 wild-type mice. We then generated *Avil-Cre*^{ERT2}*;DTA*$^{fl/fl}$ and *DTA*$^{fl/fl}$ mice, which were induced with tamoxifen at PN3.5. Samples were collected at PN7.5 and PN14.5 for micro-CT imaging and HE staining. **Results**: To elucidate sensory nerve innervation during tooth root development, we performed staining of sensory nerve markers on mouse molars from embryonic to postnatal stages. The results showed that nerve marker genes are expressed in the inferior alveolar nerve under apical zone and some odontoblasts. Furthermore, to test whether the inferior alveolar nerve is essential for

tooth root development, we generated *Avil-Cre^{ERT2};DTA$^{fl/fl}$* mice in which Advillin-expressing cells (i.e., sensory nerve cells) were ablated by diphtheria toxin after induction with tamoxifen. We observed that ablation of the sensory nerve had no effect on tooth crown formation, but led to a shortened tooth root in the mouse molars compared to controls, which was confirmed by micro-CT imaging and HE staining. These results demonstrate the indispensability of sensory innervation during rooth root development. **Conclusion**: Sensory innervation is important for regulating of CNC-derived cells during tooth root development.

Poster #47

Title: Sensory nerve niche regulates mesenchymal stem cell homeostasis via FGF/mTOR/autophagy

Authors: Fei Pei, Li Ma, Junjun Jing, Jifan Feng, Tingwei Guo, Mingyi Zhang, Thach-Vu, Ho & Yang Chai

Faculty Advisor: Yang Chai

Background: Mesenchymal stem cells (MSCs) reside in microenvironments, referred to as niches, which provide structural support and molecular signals. Sensory nerves are niche components in the homeostasis of tissues such as skin, bone marrow and hematopoietic system. However, how the sensory nerve affects the behavior of MSCs remains largely unknown. **Purpose**: Here we show that the sensory nerve is vital for mesenchymal tissue homeostasis and maintenance of MSCs in the continuously growing adult mouse incisor. **Results**: Loss of sensory innervation leads to mesenchymal disorder and a decrease in MSCs. Mechanistically, FGF1 from the sensory nerve directly acts on MSCs by binding to FGFR1 and activates the mTOR/autophagy axis to sustain MSCs. Modulation of mTOR/autophagy restores the MSCs and rescues the mesenchymal tissue disorder of *Fgfr1* mutant mice. **Conclusion**: Collectively, our study provides new insights into the role of sensory nerves in the regulation of MSC homeostasis and the mechanism governing it.

Poster #48

Title: Arid1b Epigenetically Regulates TGFβ Signaling Maintaining Mesenchymal Stem Cell Homeostasis

Authors: Mingyi Zhang, Jifan Feng, Junjun Jing, Tingwei Guo, Fei Pei, Jiahui Du, Thach-Vu Ho, & Yang Chai

Faculty Advisor: Yang Chai

Background: Epigenetic regulators play critical roles in regulating mesenchymal stem cell (MSC) quiescence and differentiation according to an organ's needs. Arid1b is a core member of the canonical BRG1/BRM associated factors (cBAF) complex, involved in modulating genome-wide chromatin accessibility. However, the roles and functional mechanism of Arid1b in epigenetic regulation of MSC fate commitment remain unclear. The adult mouse incisor harbors MSCs that support its continuous growth throughout the lifetime, thus offering an excellent model to study MSC fate during tissue homeostasis. **Purpose**: To investigate the role of Arid1b in regulating cell fate commitment of MSCs and their homeostasis using the adult mouse incisor model. **Methods**: *Gli1-Cre^{ERT2};Arid1b$^{fl/fl}$* mice were generated to study the roles of Arid1b in mouse incisor MSCs. **Results**: Arid1b is widely expressed in the mouse incisor and colocalizes with a subset of Gli1+ MSCs. The growth rate of the mouse incisor was impaired and dentin formation was abnormal in the *Gli1-Cre^{ERT2};Arid1b$^{fl/fl}$* mice, which was caused by the reduced MSC population leading to defective transit-amplifying cells and compromised odontoblast differentiation and migration. TGFβ signaling was upregulated after loss of Arid1b, and knockdown of Alk5 could rescue the defect caused by loss of Arid1b. **Conclusion**: Arid1b coordinates TGFβ signaling in regulating MSC fate commitment and tissue homeostasis.

Poster #49

Title: Investigation of calvarial bone development using *Tcf12* mouse model

Authors: Md Shaifur Rahman, Takahiko Yamada, Thach-Vu Ho, & Yang Chai

Faculty Advisor: Yang Chai

Background: Transcription factors encoded by *Tcf12* and *Twist1* play an important role in the development of cranial bones and sutures, and the loss-of-function of these factors in neural crest and mesoderm lineages lead to cranial skeletal malformations. However, the individual function of *Tcf12* is still largely unknown. **Purpose**: The purpose of the study is to unveil the role of *Tcf12* in coronal suture formation and regulation of frontal/parietal bone growth. **Methods**: We generated *Tcf12$^{fl/fl}$*, *Wnt1-Cre;Tcf12$^{fl/fl}$* and *Mesp1-Cre;Tcf12$^{fl/fl}$* mice, and performed detailed anatomical landmark analysis from 3D μCT images at different developmental time points. **Results**: CT image analysis unveiled a displacement of the bregma and a relative change in the frontal/parietal bone sizes in mice with cranial bone-specific loss of *Tcf12*. In comparison to the control mice (*Tcf12$^{fl/fl}$*), the length between the nasion and bregma was shortened in *Wnt1-Cre;Tcf12$^{fl/fl}$* line with *Tcf12* deleted in the cranial neural crest lineage. In *Mesp1-Cre;Tcf12$^{fl/fl}$* mice with *Tcf12* deleted in the mesoderm, the distance between nasion and bregma was elongated. Additionally, the coronal sutures showed a tendency to move anteriorly in *Mesp1-Cre;Tcf12$^{fl/fl}$* and posteriorly in *Wnt1-Cre;Tcf12$^{fl/fl}$* mice. Comprehensive cellular and molecular studies are required to learn how *Tcf12* mechanistically regulates calvarial bone growth and proper coronal suture formation. **Conclusion:** Since mutation in *Tcf12* results in size and shape changes of the frontal and parietal bones, a better understanding of *Tcf12*'s regulatory role might lead to the development of novel treatment strategies for cranial skeletal defects.

Poster #50

Title: Smad7 is indispensable during tooth root development through TGF-β signaling

Authors: Peng Chen, Mengmeng Liu, Jifan Feng, Tingwei Guo, & Yang Chai

Faculty Advisor: Yang Chai

Background: Root provides an excellent model for organogenesis study; however, root development regulatory mechanism is still largely unknown. *Smad7*, an inhibitor of regulatory transforming growth factor b (TGF-β) signaling, is necessary for maintaining homeostasis and normal function in many organs. While TGF-β is widely involved in tooth morphogenesis, identifying the role of Smad7 in root development is of great value. **Purpose**: To figure out the role of *Smad7* in regulating tooth root development and investigate the mechanism of its regulation. **Methods**: *Gli1-Cre^{ERT2}; Smad7$^{flox/flox}$* mice were generated by crossing over *Smad7$^{flox/flox}$* with *Gli1-Cre^{ERT2}* mice. After tamoxifen injection in PN3.5, molar tooth samples were collected in PN4.5, PN7.5, PN14.5, and PN21.5. RNAscope in situ hybridization and immunofluorescence staining were used to rule out the expression of *Smad7* in developing roots. Micro-CT was also used to compare root morphology between mutant mice and control. **Results**: We found that *Smad7* is expressed in *Gli1+* cells in the apical part of the mouse molar at PN4.5, PN7.5, and PN21.5. And we observed shortened roots in *Gli1-Cre^{ERT2}; Smad7$^{flox/flox}$* mice compared to those of controls at PN14.5 and PN21.5. **Conclusion**: We revealed that *Smad7* is expressed in a subpopulation of *Gli1+* root progenitor cells and that loss of *Smad7* in these *Gli1+* progenitor cells leads to a shortened tooth root. This result demonstrates the indispensability of *Smad7* during tooth root development. However, further studies are needed to identify the *Smad7* downstream target genes during root development to investigate how *Smad7* regulates tooth root development.

Poster #51

Title: Generation and profiling of *TP53/CDKN2A* double-knockout gastroesophageal junction organoids

Authors: Hua Zhao, Yulan Cheng, Andrew Kalra, Ke Ma, Yueyuan Zheng, Benjamin Ziman, Boyan Hu, Caitlin Tressler, Kristine Glunde, Eun Ji Shin, Saowanee Ngamruengphong, Mouen Khashab, Vikesh Singh, Robert A. Anders, Simran Jit, Nicolas Wyhs, Wei Chen, Xu Li, Dechen Lin, & Stephen J. Meltzer

Faculty Advisor: Dechen Lin

Background: Gastroesophageal junction (GEJ) adenocarcinoma is aggressive, and inactivation of *TP53/CDKN2A* occurs early during GEJ tumorigenesis. However, because of a paucity of GEJ-specific disease models, cancer-promoting consequences of *TP53/CDKN2A* inactivation at the GEJ have not been characterized. **Purpose**: We aim to address the lack of biologically relevant GEJ-specific disease models and deconstruct crucial molecular changes of early GEJ tumorigenesis and neoplastic progression. **Methods**: We employed organoid culture, CRISPR/Cas9, histology, IF, IHC, WST-1 assay, MALDI-IMS, RNA-seq, MethylationEPIC array, and xenotransplantation to develop and characterize GEJ and *TP53/CDKN2A* double-knockout (DKO) organoids. **Results**: We established the first human normal GEJ-derived organoids and inactivation of *TP53/CDKN2A* induced pro-neoplastic features and tumorigenesis. PTAF and its receptor are responsible for tumorigenesis in GEJ organoids. Abrogation of PTAF/PTAFR using siRNA or WEB2086 reduced proliferation of DKO organoids and inhibited tumor growth. Mechanistically, *TP53/CDKN2A* inactivation disrupted the transcriptome and the DNA methylome, likely mediated by transcription factors FOXM1. FOXM1 activated *PTAFR* transcription by binding to the *PTAFR* promoter, further amplifying the PTAF-PTAFR pathway. **Conclusion**: We established a robust model system for investigating early GEJ neoplastic events, addressed the phenotypic, metabolic, and epigenomic alterations occurring during GEJ model tumorigenesis, revealed a promising new treatment, and provided insights into the mechanistic basis of this aggressive and poorly understood malignancy.

Poster #52

Title: The Dual Function of Amelogenin-Derived Peptide-Chitosan Hydrogel in Dentin Repair

Authors: Jing Cai & Janet Moradian-Oldak

Faculty Advisor: Janet Moradian-Oldak

Background: Amelogenin-derived peptides (P26 and P32) promoted the formation of multilayered aprismatic enamel and the peptides could interact with collagen, promoting its mineralization, and enhanced dentin remineralization. **Purpose**: To facilitate clinical application, peptides were incorporated into chitosan (CS) hydrogel and their efficacy in dentin remineralization was investigated. **Methods**: Dentin discs were demineralized using two methods and subjected to a remineralization process in artificial saliva (AS). The morphology, elemental composition, crystal orientation and size, crystallinity, and mineral density of dentin after mineralization were examined by scanning electron microscopy - energy-dispersive X-ray spectroscopy, X-ray diffraction, and micro-computed tomography. **Results**: Following mineralization, rod-like particles were observed on dentin surface. Particularly, with peptide-CS, a thicker layer of bundled rod-like particles was formed compared to CS without peptides. While dentinal collagen and dentinal tubules of acid-etched dentin remained exposed following mineralization in AS and were partially covered with CS treatments, dentinal tubules were well occluded with peptide-CS treatments. Moreover, crystallites formed either in the new layer or within dentin with peptide-CS had a preferential orientation along the *c*-axis and exhibited higher crystallinity compared to those formed with CS without peptides. Additionally, average mineral density was increased across the whole demineralized lesion after mineralization with peptide-CS. **Conclusion**: Amelogenin-derived peptide-CS hydrogels promoted dentin remineralization and formation of a mineralized layer on dentin. Peptides in CS hydrogel mediated the formation of oriented crystallites with high crystallinity and enhanced dentin remineralization across the whole demineralized lesion, possibly due to the penetration of peptides and their interaction with dentinal collagen.

Poster #53

Title: Mutation of *KMT2C* attenuates T cell immunity by inhibiting IRF1-CXCL9/10/11

Authors: Chehyun Nam, Megha Sheth, Benjamin Ziman, Yuhao Pan, Casey Collet, Hua Zhao, Uttam Sinha, & Dechen Lin

Faculty Advisor: Dechen Lin

Background: The lysine-specific methyltransferase 2C (KMT2C/MLL3) is a known tumor suppressor gene in various cancer types including oral and esophageal cancer. Several study groups identified that *KMT2C* mutations promote cancer aggressiveness by inducing abnormal epigenetic status and dysregulating the expression of DNA damage response and DNA repair-related genes. In addition, it has been revealed that *KMT2C* is associated with innate immune response. However, the functional roles of *KMT2C* in oral and esophageal cancer still remain unclear. **Purpose**: To identify specific downstream pathways of *KMT2C* in oral and esophageal cancer. **Methods**: We analyzed the public databases and performed *in vitro* experiments, including Western blot, qPCR, ELISA, Luciferase assay, and ChIP assay. In addition, we generated xenograft models using the *KMT2C* knockdown cells and investigated T-cell infiltration in the tumor by FACS analysis. **Results**: We found that the *KMT2C* directly regulated IRF1 expression by binding to the enhancer region and it downregulated the expression levels of CXCL9/10/11 in the oral and esophageal cancer cell lines. Moreover, *in vivo*, we revealed that the levels of infiltrated CD8 and CD4 T cells are reduced in the *KMT2C* knockdown group. Therefore, our results indicated that mutation of *KMT2C* increases tumor growth and blocks the recruitment of T cells into the tumor by inhibiting the IRF1-CXCL9/10/11 axis. **Conclusion**: Our findings suggest that regulation of the *KMT2C* is crucial for retaining T-cell immunity in oral and esophageal cancer.

Poster #54

Title: Trigeminal nerve innervation in palate development at single-cell resolution

Authors: Sa Cha, Eva Janečková, Jifan Feng, & Yang Chai

Faculty Advisor: Yang Chai

Background: The palate is innervated by a branch of the maxillo-mandibular subdivision of the trigeminal nerve, which can be traced to the trigeminal ganglion that connects to the medulla by the trigeminal nerve root. Previous studies suggested that this nerve may play important regulatory roles in craniofacial organogenesis and tissue homeostasis. However, the molecular mechanisms of trigeminal nerve innervation during palate development is not fully understood. **Purpose**: The purpose of this study was to identify multiple neuron subtypes and

cell-cell communicaitons of the trigeminal nerve during palate development. **Methods**: We used *AdvilCre-Ai9* mice as the model to trace trigeminal somatosensory innervation during palate development. We developed a cell atlas of the mouse trigeminal ganglia at three embryonic ages, specifically embryonic day (E)13.5, E15.5 and E18.5, to establish transcriptional profiles at single-cell resolution. **Results**: Our data suggests that the palatine innervation and vascularization pattern proceeds from the lateral region to the midline following palatal fusion. The nerve has a close relationship with myogenic cells. The *Advil*+ sensory nerves are present mainly in the oral side of the palate. **Conclusion**: This transcriptomic landscape analysis of the trigeminal gangila at embryonic stages improves our understanding of the sensory innervation in palate development.

Poster #55

Title: Single-cell transcriptomics reveals immune cells diversity in calvarial injury repair

Authors: Li Ma & Jianfu Chen

Faculty Advisor: Jianfu Chen

Background: Our previous study shows that dura cells can migrate to the suture injury site and contribute to suture regeneration. While among these dura cells, a small proportion belongs to *Gli1*+ mesenchymal stem cells, indicating that other cell types from the dura were also involved in the suture regeneration. **Purpose**: As it is well documented that a full complement of immune cells reside in the dura and subarachnoid layers of the meninges, which function as immune surveillance of central nervous system. We were curious about whether immune cells also play important roles in bone homeostasis as well as cavarial bone injury and suture regeneration. **Methods**: We collected calvarial bone injury samples at three representative time points and performed extensive single-cell RNAseq analysis. **Results**: We performed suture injury surgery to look at the healing process and chose three time points (post-surgery day 3, 14 and 42) to perform scRNA-seq. ScRNA-seq analysis revealed that immune cells including neutrophil, macrophage, monocyte, B cell and T cell dominated the suture injury site and each of these cell types exhibited dramatic changes during different suture injury repair stages. Macrophages increased significantly at 3 dps which highly express C3ar1. We also found that macrophages and monocytes may mediate the calvarial injury repair through TGFb signaling pathway. Breg and regulatory neutrophils may contribute to calvarial injury repair by promoting MSC survival and proliferation. **Conclusion**: Our study confirmed that macrophages, regulatory B and neutrophils mediate calvarial injury repair, which may mainly be through TGFb signaling pathway.

Poster #56

Title: Protein deamidation couples oxidative phosphorylation to de novo nucleotide synthesis

Authors: Yongzhen Liu, Chao Qin, Yulu Duan, Ali Can Savas, Jessica Carriere, & Pinghui Feng

Faculty Advisor: Pinghui Feng

Background: Mitochondria are multifunctional organelles that produce energy and are critical for various signaling pathways. Mitochondrial antiviral signaling (MAVS) is a mitochondrial outer membrane protein essential for the RNA-induced anti-viral immune response. **Purpose**: Though MAVS is well characterized as an antiviral molecule in RNA-induced immune defense, whether MAVS has additional function remains unknown. Our study reveals that MAVS mediates a crosstalk between mitochondrial oxidative phosphorylation and nucleotide synthesis independent of its immune defense function. **Results**: We found that depletion of MAVS greatly reduced the *de novo* purine synthesis in mouse and human cells. Mechanistically, MAVS promotes purinosome formation adjacent to mitochondria via physical interaction with PFAS. Conversely, PFAS interacts with and deamidates DRP1/DNM1L, a GTPase that empowers the mitochondrial fission process. Deamidation deprives DRP1 of the ability to promote mitochondrial fission, although the specific mechanism of action of deamidation on DRP1 is under active investigation. PFAS overexpression increases mitochondrial fusion, while its depletion promotes mitochondrial fission and fragmentation. Elongated or tubular mitochondria demonstrate higher activity in oxidative phosphorylation than fragmented mitochondria, which supplies intermediates (e.g., oxoacetate > aspartate) for *de novo* nucleotide synthesis. Remarkably, loss of MAVS significantly impedes carbon flow through the TCA cycle, thus driving energy dependency on aerobic glycolysis. **Conclusion**: Collectively, our findings uncover a key function of MAVS and protein deamidation in coupling oxidative phosphorylation to *de novo* purine synthesis.

Poster #57

Title: DNA Methylome Sequencing Identifies FOXM1 as an Oncogenic Factor

Authors: Benjamin Ziman, Qian Yang, Megha Sheth, Yueyuan Zheng, Chehyun Nam, Hua Zhao, John D. Carpten, Uttam Sinha, & Dechen Lin

Faculty Advisor: Dechen Lin

Background: According to 2020 global statistic of 185 countries, esophageal cancer is the 8th most frequently diagnosed cancer in the world and is the 6th highest cause of cancer-related deaths. In the US between 1975 and 2004, the incidence of esophageal adenocarcinoma (EAC) has increased more than 400% in white males and more than 300% in white females. **Purpose**: Unfortunately, EAC is typically diagnosed when it has progressed into late stages, leaving few treatment options. This study aims to identify underlying regulators for this disease, and to improving clinical outcomes. **Methods**: We performed computational methods such as DNA Methylation and RNA sequencing to identify potential regulatory transcription factors (TF) of EAC. We selected one of these TFs, FOXM1 to be examined for its role in cellular proliferation and involvement with tumor immunity, using cell lines and murine mouse models. **Results**: We found that FOXM1 is an important regulator of cellular proliferation in EAC and that the loss of FOXM1 led to a reduction in cellular proliferation and the ability to form tumors in mice. We identified ERBB2 as an upstream regulator of FOXM1, and clinically approved ERBB2-targeting drugs inhibited FOXM1's activity. Upon loss of FOXM1 we observed increased gene expression of immune related pathways and heightened CD8+ T cell killing of cancer cells. **Conclusion**: This research reveals the mechanistic foundation for the immune evasion and resistance to immunotherapy of EAC, while simultaneously identifying potential drug targets for immunotherapy against this deadly cancer.

Poster #58

Title: Monitoring in real time the formation and inhibition of biofilms

Authors: Esmat Sodagar & Parish Sedghizadeh

Faculty Advisor: Parish Sedghizadeh

Background: *Aggregatibacter actinomycetemcomitans (Aa)* is a Gram-negative coccobacillus oral pathobiont that is highly associated with a silent but aggressive orphan disease that results in periodontitis and tooth loss. To address issues with current antimicrobial therapeutics in periodontitis treatment, we have designed, synthesized, and tested novel BP-fluoroquinolone antibiotic conjugates for activity against *Aa*. **Purpose**: To study the real-time development and inhibition of *Aa* biofilms with novel bone-targeting antimicrobial conjugates. **Methods**: Monitoring of biofilm formation and inhibition was performed with an impedance based real-time cell analyzer. The following antibiotics were tested: ciprofloxacin (C), moxifloxacin (X), sitafloxacin (S), and nemonoxacin (N). The following novel experimental conjugates were synthesized and tested: bisphosphonate-carbamate-sitafloxacin, bisphosphonate-carbamate-nemonoxacin (BCN), etidronate-carbamate-ciprofloxacin (ECC), and etidronate-carbamate-moxifloxacin (ECX). MIC and biofilm preventative assays were performed, and HPLC was used to assess hydroxyapatite binding affinity of conjugates. **Results**: HPLC results indicate that conjugates have high binding affinity and retention to HA in comparison to unconjugated antibiotics. Parent antibiotics and the tested conjugates were effective in inhibiting biofilm formation in impedance assays. Sitafloxacin and nemonoxacin demonstrated the lowest MIC values. The conjugate with the lowest and most favorable MIC profile was BCN, followed by BCS, with the etidronate conjugates demonstrating the highest MIC profiles. **Conclusion**: Results show that real-time biofilm analysis can be a promising tool to evaluate antibiotic susceptibility and efficacy in biofilm-mediated infections. This class of conjugates using BP drugs as biochemical vectors for the delivery of antibiotic agents to bone could represent an advantageous approach to the treatment of periodontitis because it improves bone pharmacokinetics while minimizing systemic exposure.

Poster #59

Title: Probing the role of cGAS deamidation in Alzheimer's disease

Authors: Yu Zhou, Ali Can Savas, Zhenfeng Shu, Chao Qin, Yongzhen Liu, & Pinghui Feng

Faculty Advisor: Pinghui Feng

Background: Alzheimer's disease (AD) is the most common age-related dementia and neuroinflammation has emerged as an important component of AD pathology. The cyclic GMP-AMP synthase (cGAS) is responsible for initiating the type-I interferon (IFN-I) production, which has been implicated in neurodegeneration. **Purpose**: Our previous research has shown that cellular glutamine amidotransferases (GATs) are capable of deamidating key innate immune signaling molecules. To probe the metabolic regulation, we have conducted several functional screens to identify the potential GAT that targets cGAS. **Results**: The carbamoyl-phosphate synthetase, aspartate transcarbamoylase and dihydroorotase (CAD), the rate-limiting enzyme of *de novo* pyrimidine synthesis, has been identified as a cGAS-deamidating enzyme to promote IFN induction. Analysis of cGAS by two-dimensional gel electrophoresis (2DGE) showed that HT-DNA transfection could induce cGAS deamidation, but CAD knockdown inhibited the deamidation of cGAS mediated by HT-DNA. Also, CAD knockdown decreased the HT-DNA-induced IFN-I response. CAD-mediated cGAS deamidation occurs in both microglia and neurons, key cell types relevant to HSV-1 infection and neurodegeneration. Moreover, higher level of cGAS deamidation has been found in brain tissues from old mice than young mice, indicating the potential role of cGAS deamidation in chroni inflammation associated with aging and neurodegeneration. **Conclusion**: Our study may reveal the molecular link between innate immune activation and neurometabolism underpinning neurodegeneration, thus advancing the understanding in AD pathogenesis.

Poster #60

Title: Deletion of PRMT4 Induced Heart Injury

Authors: Jiang Qian, Siqi Tao, Kailin Liu, Ching-Ling Lien, & Jian Xu

Faculty Advisor: Jian Xu

Background: Protein arginine methyltransferase 4 (PRMT4), a type I protein arginine methyltransferase, is involved in many cellular processes, including proliferation, cell differentiation and survival. It has been reported that overexpression of Prmt4 in infarcted mouse heart resulted in severe ventricular remodeling via promoting apoptosis. Overexpression of PRMT4 also accelerated ferroptosis to aggravate doxorubicin-induced cardiomyopathy. **Purpose**: Here we aim to investigate whether and how cardiac-specific deletion of PRMT4 affect heart injury responses. **Results**: We found that tamoxifen-induced PRMT4 deletion in cardiomyocytes caused left ventricular dilation and dysfunction in 2 weeks. Immunohistostaining revealed accumulation of immune cells, particularly macrophages and neutrophils in these hearts. Picrosirius red staining showed that PRMT4 deletion promoted collagen deposition compared to control group. **Conclusion**: Our work suggested an essential role of PRMT4 in myocardial injury and remodeling.

UNDERGRADUATE & DDS STUDENTS BASIC SCIENCES

Poster #61

Title: Canonical Wnt signaling is essential for soft palate muscle development

Authors: Aileen Ghobadi, Angelita Araujo-Villalba, Eva Janečková, Jifan Feng, Tingwei Guo, Xia Han, Md Shaifur Rahman, Heliya Ziaei, Thach-Vu Ho, Siddhika Pareek, Jasmine Alvarez, & Yang Chai

Faculty Advisor: Yang Chai

Background: Cleft soft palate is less commonly studied than cleft hard palate, but still poses a significant burden on patients and healthcare providers. Major physiological functions such as swallowing, breathing, hearing, and speech are governed by the soft palate, and are disrupted when cleft palate occurs. **Purpose**: To analyze Wnt signaling in regulating interactions between cranial neural crest (CNC)-derived mesenchymal and mesoderm-derived muscle cells during soft palate development. **Methods**: Histological analyses, RNAScope, immunofluorescence staining, and RNA-sequencing were performed on *Osr2-Cre;β-catenin$^{fl/fl}$* and *β-catenin$^{fl/fl}$* mice. **Results**: We have identified canonical Wnt signaling as a key signaling pathway primarily active in CNC-derived mesenchymal cells surrounding soft palatal myogenic cells. Using *Osr2-Cre;β-catenin$^{fl/fl}$* mice, we further discovered that Wnt signaling is indispensable for mesenchymal cell proliferation and subsequently myogenesis through mediating ciliogenesis. Specifically, we identified that Wnt signaling directly regulates expression of the ciliary gene *Ttll3*. Impaired ciliary disassembly leads to differentiation defects of mesenchymal cells and indirectly disrupts myogenesis through decreased expression of *Dlk1*, a mesenchymal cell-derived pro-myogenic factor. Moreover, we found that restoring *Ttll3* expression rescues mesenchymal cell proliferation and myogenesis in *Osr2-Cre;β-catenin$^{fl/fl}$* samples. **Conclusion**: Our study confirms the essential role of Wnt signaling in tissue-tissue interactions during soft palate development. Our results propose a novel mechanism of ciliary assembly/disassembly downstream of Wnt signaling. Expanding knowledge of the unexplored molecular signaling and mechanisms during soft palate development can ultimately lead to new strategies for functional restoration and treatment of cleft soft palate.

Poster #62

Title: Deletion of Runx2 Protects Against Ovariectomy-induced Osteoporosis in Adult Mice

Authors: Connor Buchanan, Grace Carey, Yuan Yuan, Shuo Chen, Sally Anderson, Janet Sanchez, & Yang Chai

Faculty Advisor: Yang Chai

Background: Osteoporosis is a metabolic bone disorder and is the most common cause of fracture. Bone tissue homeostasis is governed by the balance of osteoblast and osteoclast activity. Gli1+ cells have been identified as a mesenchymal stem cell population critical in the maintenance of bone tissue homeostasis that give rise to osteoprogenitors and are expressed at the osteogenic front in long bones in adult mice. *Runx2*, a transcription factor expressed by a subpopulation of Gli1+ osteoprogenitors, is important in osteoblastic differentiation. However, the functional requirement of *Runx2* in osteoblastic differentiation in an osteoporosis disease model remains unclear. **Purpose**: To determine the effects of *Runx2* deletion in Gli1+ osteoprogenitors on adult bone tissue homeostasis in mice under ovariectomy-induced osteoporosis conditions. **Methods**: Ovariectomized *Gli1-Cre^{ERT2};Runx2$^{fl/fl}$*, ovariectomized *Runx2$^{fl/fl}$*, and sham-operated *Runx2$^{fl/fl}$* mice were induced with tamoxifen 1 week after surgery. MicroCT and histological analysis of distal femurs was performed to assess bone tissue homeostasis at 1 and 4 months following surgery. **Results**: Deletion of *Runx2* increased trabecular bone as early as 1 month after induction. **Conclusion**: Deletion of *Runx2* leads to increased trabecular bone in ovariectomized adult mice. Further investigation is needed to understand the functional requirement of *Runx2* in adult bone tissue homeostasis.

Poster #63

Title: PRMT1-depletion Increases Intron Retention Event in BMP-2-treated ST2 Cell Lines

Authors: Greg S. Park & Jian Xu

Faculty Advisor: Jian Xu

Background: Protein arginine methyltransferase 1 (PRMT1) is an enzyme that methylates various RNA-binding proteins to control splicing. We previously demonstrated that PRMT1 conditional knockout (CKO) mice using the neural crest-specific *Wnt1-cre* displayed multiple craniofacial defects, and increased intron retention events, which correlated with decreased extracellular matrix (ECM) transcripts in the developing mandibles. However, in-depth mechanistic analysis of splicing proteins that are regulated by PRMT1 remains challenging due to the small amount of neural crest cells from embryonic mouse models. **Purpose**: We aimed to establish an *in vitro* cell line model to recapitulate the behavior of neural crest cells and to study the function of splicing factors regulated by PRMT1 during craniofacial development. **Methods**: We depleted PRMT1 in ST2 cell lines by siRNA and induced osteogenesis through BMP-2 treatment for 5 days, and then analyzed the transcript levels of osteogenic markers and intron-retaining ECM transcripts. **Results**: We first demonstrated significantly increased *Sp7*, *Osn*, and *Bsp* transcripts in BMP-2-treated ST2 compared to control to validate BMP-2-induced osteogenic differentiation. PRMT-1-depleted and BMP-2-treated ST2 cell lines exhibited significantly higher ECM intronic transcripts, which is consistent with previous findings in the developing mandibles. **Conclusion**: BMP-2-treated ST2 cell line presents as a cell model to study PRMT1-regulated intron retention activity.

Poster #64

Title: Role of Prmt7 in neural crest-derived cells during craniofacial development

Authors: Yidan Zhang, Jiang Qian, Prerna Sehgal, & Jian Xu

Faculty Advisor: Jian Xu

Background: Protein arginine methyltransferase 7 (PRMT7) belongs to a family of enzymes that catalyzes the methylation of arginine residues on various protein substrates. Prmt7 mutations in human are associated with neurodevelopmental disorder characterized by facial deformity, short stature, brachydactyly, intellectual developmental disability, and seizures (SBIDDS). However, the molecular mechanisms by which Prmt7 mutation causes these defects were not comprehensively studied. **Purpose**: To investigate the effects of Prmt7 deletion in craniofacial development. **Methods**: Neural crest cells (NCCs) give rise to the majority of facial and anterior skull. We aim to investigate the role of PRMT7 in NCCs by generating Prmt7 conditional knockout (CKO) mice using Wnt1-Cre. Histological analysis and immunofluorescence were performed on *Wnt1-Cre;PRMT7$^{fl/fl}$*;Td embryos at E13.5 to confirm Prmt7 deletion and compare craniofacial formation between the control and CKO group. Whole-mount skeletal staining was performed at E18.5 to evaluate craniofacial cartilage and bone. Furthermore, 3D-microCT was performed at E18.5 and anatomical landmarks will be analyzed to determine potential abnormalities in the craniofacial bone. **Results**: Preliminary data showed that *Wnt1-Cre;PRMT7$^{fl/fl}$;Td* embryos displayed significantly reduced PRMT7 expression in neural crest-derived cells of the craniofacial region. Prmt7 CKO may exhibit perinatal lethality, since no Prmt7 CKO have been identified after 25 litters were observed. We further evaluated the craniofacial phenotype of Prmt7 CKO and identified defective features in the palates and mandibles compared to the control. **Conclusion**: Prmt7 deletion leads to craniofacial dysmorphism particularly in the palatal and mandibular region. Further investigation is needed to characterize dysmorphological features at different stages of development.

Poster #65

Title: Generation of Tamoxifen-inducible Tfap2b-CreER^{T2} mice using CRISPR-Cas9

Authors: Yuchen Yang, Mingyi Zhang, Jifan Feng, Yue Li, Peter Z Qin, & Yang Chai

Faculty Advisor: Yang Chai

Background: Transcription factor activating protein 2 (*TFAP2B*) encodes the transcription factor AP-2β in neural crest cells. In humans, mutations in *TFAP2B* are associated with Char syndrome, which is characterized by patent duct arteriosus, facial dysmorphism, and abnormal fifth digits. Recent studies have found that TFAP2b+ cells are progenitor cells for palatogenesis and dental development in mouse. A Cre mouse line enabling conditional knockout by *Tfap2b* has not previously been developed, and it would enable further studies of the progeny populations of Tfap2b+ cells and the function of target genes in Tfap2b lineage. **Purpose**: To investigate the role of TFAP2B+ cells and their progeny in the mouse. **Methods**: CRISPR-Cas9-mediated homologous directed repair method was used to generate a *Tfap2b-CreER^{T2}* mouse line. Pregnant dams were injected with tamoxifen on embryonic day (E)8.5, E10.5, or E12.5 and embryos were collected 48 hours later. **Results**: *Tfap2b-CreER^{T2}* mouse line was generated using CRISPR-Cas9 technique with the insertion of CreER^{T2} at exon 7 adjacent to the stop codon. *Tfap2b-CreER^{T2};tdTomato* reporter mice were generated, and tdTomato fluorescence was detected in a similar pattern to the endogenous *Tfap2b* expression. At early embryonic stages, the tdTomato fluorescence is displayed in the neural tube and branchial arches, and later can be detected in the limb bud, facial mesenchyme, cerebellum, and spinal cord. The earlier Cre activity is activated, the more progeny are detectable during mouse embryonic development. **Conclusion**: *Tfap2b-CreER^{T2}* mice can be readily used for lineage tracing and temporally/spatially controlled *in vivo* genetic modification.

Poster #66

Title: Epigenetic regulation of tooth root development and regeneration

Authors: Natalie Black, Junjun Jing, and Yang Chai

Faculty Advisor: Yang Chai

Background: The tooth root is an essential component of the human dentition. Understanding tooth root development and its regulation through evolution and epigenetics can provide dental clinicians with valuable insight and a foundation for better understanding future perspectives involving the treatment of missing teeth through root regeneration and tissue engineering. This review poster provides an outlook on tooth root development, morphology, and function. In addition, the poster explores how the evolution of root development is regulated by epigenetics. The review will then discuss how researchers are presently working to restore missing teeth through tissue engineering and root regeneration. **Methods**: A search of PubMed was performed to conduct a literature review. **Results**: Epigenetic regulation plays a key role in dental root patterning and development. Recent research highlights how there are specific cellular domains that regulate cranial neural crest cell differentiation into molar mesenchymal tissues. Additionally, within the dental mesenchyme, Foxp4 has been identified as a key regulatory gene responsible for differentiating the periodontal ligament (PDL). Ultimately, the loss of Foxp4 will lead to altered PDL development. Researchers are utilizing information about root development and stem cells to find alternative treatments in replacing missing teeth through a stem cell-mediated bioengineered tooth root (bio-root). **Conclusions:** Tooth root development and morphology is regulated by evolution and epigenetics. Dentistry values preserving the natural tooth morphology for maximized function. Presently, implants are the treatment of choice for replacing missing teeth, but the standard of care might require tissue engineering and bio-root formation in the future.

Poster #67

Title: *Piezo-1* is indispensable for dental mesenchymal progenitor cell fate

Authors: Aaron Harouni, Mengmeng Liu, Junjun Jing, Tingwei Guo, Fei Pei, Mingyi Zhang, Jifan Feng, Peng Chen, Thach Vu Ho, & Yang Chai

Faculty Advisor: Yang Chai

Background: Piezo1 is a large mechanosensitive ion channel protein that is activated by mechanical stimuli, triggering intracellular chemical signals. The conversion of mechanical stimuli to biochemical signals and the resultant activation of downstream signaling pathways have been shown to play a crucial role in the regulation of cellular functions and behaviors. **Purpose**: Although mechanosensitive signals play an essential role in sensing and responding to environmental cues during embryological development, the regulation of these signals remains poorly understood. **Methods**: This study explores these mechanisms and uses mouse tooth roots as a model to analyze the role of Piezo1 in dental mesenchymal progenitor fate determination during tooth root development. **Results**: During tooth root development, Piezo1 is expressed in the mesenchyme and mediates mechanical responses that are required for dental mesenchymal progenitor fate. The results of this study show that loss of Piezo1 in Glil+ root progenitor cells can lead to shortened roots, defective dentin, and defective periodontal tissue development. Loss of Piezo1 in the epithelium leads to delayed root furcation development, delayed tooth eruption, and supernumerary teeth. **Conclusion**: These results illustrate the importance of these mechanosensitive ion channel proteins for dental mesenchymal progenitor fate, making Piezo1 indispensable in tooth root development.

UNDERGRADUATE & DDS STUDENTS CLINICAL SCIENCES

Poster #68

Title: Herpetic Gingivostomatitis with Herpes-Associated Erythema Multiforme and Candidiasis post-COVID infection

Authors: Haeseong Lee, Jouliana Davoudi, Anette Vistoso, Mohammad Khalifeh, & Parish Sedghizadeh

Faculty Advisor: Parish Sedghizadeh

Background: Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that presents with a multitude of clinical presentations in various body systems. In addition to hematological, radiological, and biochemical findings, oral manifestations of COVID-19, including but not limited to xerostomia, loss of taste, and oral lesions have been reported. **Purpose**: This study aims to present a case of compounded immunological involvements of COVID-19 and frame it as a possible predisposing factor to the development of oral lesions and symptoms due to COVID-19's profound role in immune dysregulation. **Methods**: A 40-year-old male healthy patient presented with several painful labial and intraoral lesions, accompanied by bilateral ulcers and vesicles in the buccal mucosa, palate, throat, attached gingiva, and inner and outer lips. Subsequently, erythematous ulcerous lesions in the anterior vestibule and floor of the mouth along with blood-crusted lips and hyperkeratotic bleeding indicated herpes-associated erythema multiforme. After two years, the patient presented to the clinic with the same oral lesions and severe candidiasis, following a recent COVID-19 infection. **Results**: To our knowledge, this is the first case to report on a series of multifactorial and concurrent viral, autoimmune, and fungal oral lesions following a COVID-19 infection, namely the reactivation of herpetic gingivostomatitis, herpes-associated erythema multiforme, and concomitant oral candidiasis. **Conclusion**: Further studies are needed to investigate the etiopathogenesis and pathophysiology of the recurrence of oral lesions following COVID-19 infections.

Poster #69

Title: Pleomorphic Adenoma Misdiagnosed as Chondroid Syringoma Proximal to Oral Commissure

Authors: Haeseong Lee, Navid Senehi, & Parish Sedghizadeh

Faculty Advisor: Parish Sedghizadeh

Background: Pleomorphic adenomas are the most common salivary gland tumors of epithelial and myoepithelial tissue origin that clinically present as mobile, firm, gradual, and asymptomatic swellings. These benign neoplasms share similar histomorphologic features to cutaneous mixed tumors, e.g., chondroid syringoma of the skin, which also consist of epithelial, myoepithelial, and stromal components but derived from apocrine or eccrine glandular tissue. As homologs of cutaneous mixed tumors with nearly identical morphologic and clinical characteristics, dermatologists and pathologists may misdiagnose mixed tumors of salivary gland origin, pleomorphic adenomas, as their unencapsulated dermal neoplastic counterparts, chondroid syringoma. **Purpose**: To our knowledge, this is the first case to report on a misdiagnosis of a cutaneous mixed tumor of the face, which

was ultimately found to be a benign submucosal salivary gland mixed tumor. **Methods**: A 25-year-old female healthy patient developed a firm, painless, slowly growing connective tissue mass proximal to the left oral commissure, which was biopsied by dermatology and histologically diagnosed as a chondroid syringoma. **Results**: However, the lesion continued to grow to a very large mass, which was ultimately excised and found to represent a pleomorphic adenoma histologically. **Conclusion**: As salivary gland neoplasms may develop from head and neck regions with salivary tissue, physicians should consider salivary mixed tumors in the differential diagnosis for suspected subcutaneous tumors, e.g., when histologically diagnosed as chondroid syringoma, and perform intraoral examinations to ascertain the etiopathology of mixed tumors that lie in the head and neck area.

Poster #70

Title: Clinical Applications of Electromyography in Orofacial Pain

Authors: Haeseong Lee, Jack Botros, Glenn T. Clark, & Mariela Padilla

Faculty Advisor: Mariela Padilla & Glenn Clark

Background: Electromyography (EMG) is an advanced technique used to record and evaluate muscle activity and orofacial behaviors. Despite its wide use in research, its clinical benefit has not been assessed. **Purpose**: The study aims were to review the current literature to determine and describe the potential clinical applications of EMG in orofacial pain. **Methods**: A web search was conducted on Medline, Embase, and Web of Science for articles published between July 2006 until October 2022. The following search keywords and medical subject headings were utilized: electromyography, temporomandibular disorders (TMD), facial pain, and bruxism. Studies that utilized EMG in a clinical context of orofacial pain were eligible. Descriptive analyses were employed to assess the study aims. **Results**: Thirty studies and four applications of EMG were identified. EMG was most used for TMD treatment assessment, i.e., splint therapy and stretching exercises (n=13), an adjunctive diagnostic tool (n=9), biofeedback and patient education (n=4), and injection guidance (n=4). Surface EMG was the most frequently used type, whereas needle EMG was only used for injection guidance (n=2). Masseter and/or temporalis muscles were assessed in a majority of the studies. The inter-electrode distance ranged from 10 to 30 mm and the threshold used for a clenching event ranged from 10 to 20% of the maximum voluntary contraction (MVC). **Conclusion**: EMG may serve as an important biometric tool that guides clinicians to make evidence-based decisions when assessing or treating muscle pain. Future studies should test the validity and reliability of EMG use for orofacial conditions.

Poster #71

Title: Indirect Vision and Prevalence of Musculoskeletal Disorders among Dental Students

Authors: Parinaz Esteghamat Tehrani & Kenneth Kim

Faculty Advisor: Kenneth Kim

Background: According to American Dental Association study in 2015, two thirds of participating dentists reported musculoskeletal disorders (MSDs) in neck and lower back with half of them experiencing moderate to severe pain. The prevalence of MSDs in dentistry seemed to be multifactorial ranging from poor postural awareness to proper use of loupes. **Purpose**: This research assessed the prevalence of MSD within the USC dentistry program, current knowledge of proper ergonomics, and comfort level with indirect vision. **Methods**: Separate surveys were administered to the first three years dental students (n=87) at Herman Ostrow School of Dentistry. It included questions about the presentation of MSD symptoms, the effectiveness of loupes in ergonomic adjustment, and the comfort level with indirect vision. **Results**: 18.82% of the students surveyed rated their comfort level with using indirect vision to < 5 on scale 1-10. 63.95% of students use dental loupes to their advantage. Cervical and lumbar spine seem most prevalent areas afflicted. 81.18% of students reported the need for further education on ergonomics. **Conclusion**: There seems to be an inverse correlation between musculoskeletal disorders and comfort level with indirect vision. Ongoing ergonomic training should be integrated into the dental curriculum including principles of ergonomics, stimulation lab architecture in respect to motion efficiency, field of view, and access to the instruments for the first two years of didactic and practical courses. For last two years, principles of operator-environmental harmony, clinical chair adjustable features, and the role of dental team in four-handed dentistry should be established.

Poster #72

Title: Histopathological classification system correlating oral Lichen Planus clinical severity

Authors: Aravindhan Karunakaran

Faculty Advisor: Parish Sedghizadeh

Background: Oral Lichen Planus is a relatively common cell mediated auto-immune disorder that occurs in varying severity. There are various treatment modalities for the condition but nothing can cure the disease permanently. Almost all the therapies are aimed at reducing the severity of the symptoms and improving the quality of life. Our aim is to develop a novel Histopathological classification system to correlate the severity of oral Lichen Planus. **Purpose**: The clinical symptoms of oral lichen planus may range from no symptoms to severe burning mouth syndrome limiting the food intake that can completely disrupt the quality of life. A Clinically correlated histopathological classification system with a sound scientific basis will aid the oral medicine specialists to deliver appropriate medical therapy based on the severity of the patient's condition. **Methods**: The classification system grades the histopathological features seen in 230 patients based on the severity of the destruction of the oral epithelium, level of lymphocytic infiltration, severity of hyperkeratosis, and other histopathological features and grades the cases in the increasing order of severity from Grade I to Grade VI. The histopathological classification is correlated with the clinical severity. **Results**: It has been observed that the histopathological severity correlates 100% with the subjective and objective clinical findings. We were able to classify all the 230 patients among one of the grading categories from Grade I to Grade VI. **Conclusion**: This novel classification system can be used as the guidelines while determining the medical therapy for oral lichen planus based on grading.

Poster #73

Title: Future of Orthodontics and Dental Education: Immersive 3D Virtual Reality

Authors: Stephanie Chai, Danika Banh, & Glenn Sameshima

Faculty Advisor: Glenn Sameshima

Background: Orthodontists often use plaster models for initial diagnosis, progress review, and analysis of a completed case. However, creating these models is labor-intensive, time-consuming, and uncomfortable for patients. Intraoral scanning has become a popular method to view models on a computer, but there is no standard way to view the models. **Methods**: In this pilot study, immersive 3D virtual reality (VR) technology was used to create a virtual classroom where users could view and interact with scanned 3D models of different cases. A commercially available 3D project platform was selected to build the custom VR environment. Users utilized an Oculus Riff headset and controllers to interact with the models and navigate the classroom. **Results**: Users were able to view, walk around, and pick up and put down a model freely with both virtual hands. The maxillary and mandibular scan of the models could be held simultaneously in both hands apart and placed together, similar to traditional stone models. The image of the models was extremely clear due to the detail of the scan and the processing capabilities of the headset and laptop. **Conclusion**: Intraoral scans can be incorporated into a virtual environment and users can independently interact with the virtual models similarly to how they would physical models. VR can facilitate the education, collaboration, and discussion of multiple cases and will save dentists and patients from uncomfortable and time-intensive procedures. The possibilities of integrating VR into dental education are endless and continue to grow as the field of VR advances.

Poster #74

Title: COVID-19 vaccines and Bell's palsy onset: A review of literature

Authors: Greg Park, Haeseong Lee, & Azadeh Ahmadieh

Faculty Advisor: Azadeh Ahmadieh

Background: Bell's palsy (BP), an idiopathic transient facial paralysis has been reported as a rare side effect of COVID-19 vaccines. Limited information is available in the literature regarding the onset of BP symptoms after COVID-19 vaccination, in patients with or without pre-existing medical conditions. **Purpose**: The study was done to identify the onset of Bell's palsy symptoms following COVID-19 vaccination. **Methods**: A PubMed search was conducted between March 2020 and June 2022, using the following key words: "COVID-19 OR COVID-19 vaccine, AND Bell's palsy." Studies entered the review, only if the patients' medical history was clearly discussed and the exact onset of BP symptoms was specified. Publications reporting cases with a previous BP history excluded. **Results**: Initial search, resulted in finding 110 papers; a total of 12 case report studies met the inclusion criteria. The 20 subjects were between 17 and 86 years old, with a mean age of 53.2 years. Out of 24 BP symptoms, 17 were on the left side. The onset of BP, in patients without pre-existing medical conditions (mean = 4.55±3.5 days, CI=95%, 1.08-8.02) was significantly shorter than patients with pre-existing medical conditions (mean = 18±7.8 days, CI=95%, 10.23-25.77, p=0.002). **Conclusion**: This study showed a later onset of BP symptoms in patients with pre-existing medical conditions. Future studies with higher level of evidence and greater sample sizes are needed to consolidate the relationship between COVID-19 vaccines and an onset of Bell's palsy in adult patients.

DENTISTRY & CCMB FACULTY

Poster #75

Title: Influence of Particle-Abrasion & Aging on Biaxial-Flexural-Strength of Zirconia Materials

Authors: Nazanin Forghani, Jin-Ho Phark, & Sillas Duarte Jr

Faculty Advisor: Jin-Ho Phark & Sillas Duarte Jr

Background: Zirconia is widely used in dentistry due to excellent mechanical, physical, and chemical properties, and biocompatibility. Many factors such as yttria content, surface treatment, and artificial aging can affect its strength. **Purpose**: Examine the influence of yttria content, surface treatment, and artificial aging on the biaxial flexural strength (BFS) of zirconia. **Methods**: Three zirconia materials [Bio ZX^2 (3Y-TZP), DD cube One (4Y-TZP), and DD cubeX^2 (5Y-TZP)] (12 mm diameter, 1.2 mm thickness) were divided into aged and non-aged groups, and subclassified based on surface treatments: none, wet and dry abrasion (n=15). For disk fabrication, cylinders (ø 15 mm, length 14 mm) were milled from round blocks using a milling machine. The cylinders were attached to CAD/CAM block metal sprues and sliced into 1.4 mm thickness using a low-speed precision saw. Disks were polished to 1.5 mm thickness and sintered according to the manufacturer's recommendations. Accelerated aging test was performed using steam at 134±2°C under a pressure of 0.2 MPa for 5 h. Wet and dry particle abrasion was performed by 50 μm Al_2O_3 particles. A universal testing machine was used to evaluate BFS using the piston-on-three-balls technique. Data were analyzed by Three-way ANOVA and Weibull analysis. **Results**: Yttria content significantly impacted BFS, with the highest and lowest for 3Y and 5Y, respectively. Particle abrasion increased BFS of all materials. Aging had an insignificant effect on BFS of 3Y and 4Y, but it decreased BFS of 5Y. **Conclusion**: Particle abrasion and decreasing the yttria content can increase BFS of zirconia materials.

Poster #76

Title: DDS students' perspective regarding the "Flipped Classroom OFP Case-Based" pedagogy

Authors: Azadeh Ahmadieh & Mahvash Navazesh

Background: At Herman Ostrow School of Dentistry, the foundational knowledge related to Orofacial Pain (OFP) is delivered via Problem Based Learning (PBL) pedagogy. A new OFP case was developed and delivered utilizing Flipped Classroom Case-Based (FCCB) pedagogy in an attempt to enhance the application of biomedical sciences in OFP in the clinical setting. The learning opportunity was presented to the DDS students in advanced of the one-week clinical Orofacial Pain rotation. **Purpose**: To examine the DDS students' perspective regarding FCCB. **Methods**: An anonymous electronic survey was given to the DDS students regarding the FCCB at the conclusion of the learning opportunity. During the flipped classroom format, the content of the case along with related learning objectives and suggested references were released to the students through Blackboard, before starting the case. In the introductory session, the format and objectives of the module was explained. Students had two weeks to review the case material. During the closing session, the case content was reviewed, and a quiz was given. Students expressed their perspectives by choosing a range of answers from strongly agree to strongly disagree to the items of the survey. **Results**: 196 DDS students participated in the survey. 92% reported satisfaction on remote learning via zoom and 71.45% preferred FCCB approach to PBL. **Conclusion**: Flipped Classroom Case-Based pedagogy for application of biomedical sciences in the clinical setting merits further consideration in DDS students' curriculum in OFP.

Poster #77

Title: ASPID students' perspective regarding the "Flipped Classroom OFP Case-Based" pedagogy

Authors: Azadeh Ahmadieh & Mahvash Navazesh

Background: At Herman Ostrow School of Dentistry, the foundational knowledge related to Orofacial Pain (OFP) is delivered via Problem Based Learning (PBL) pedagogy. A new OFP case was developed and delivered utilizing Flipped

Classroom Case-Based (FCCB) pedagogy to enhance the application of biomedical sciences in OFP in the clinical setting. The learning opportunity was presented to the ASPID (Advanced Sanding Program for International Dentists) students in advanced of the one- week clinical Orofacial Pain rotation. **Purpose**: To examine the ASPID students' perspective regarding FCCB. **Methods**: An anonymous electronic survey was given to the ASPID students regarding the FCCB at the conclusion of the learning opportunity. During the flipped classroom format, the content of the case along with related learning objectives and suggested references were released to the students through Blackboard, before starting the case. In the introductory session, the format and objectives of the module were explained. Students had two weeks to review the case material. During the closing session, the case content was reviewed, and a quiz was given. Students expressed their perspectives by choosing a range of answers from strongly agree to strongly disagree to the items of the survey. **Results**: 51 ASPID students participated in the survey. 79.3% reported satisfaction on remote learning via zoom and FCCB approach to PBL. **Conclusion**: Flipped Classroom Case-Based pedagogy for application of biomedical sciences in the clinical setting merits further consideration in ASPID students' curriculum in OFP.

Poster #78

Title: Influence of Firings and Thickness on Biaxial-Flexural-Strength of Lithium-Disilicate Ceramics

Authors: Sarah Alsaleh

Faculty Advisor: Jin-Ho Phark

Background: CAD/CAM lithium disilicate reinforced glass-ceramic materials (LDS) have been affected in their esthetic properties by multiple firings. Effects on the mechanical properties have yet to be investigated. **Purpose**: Evaluate the effect of different thicknesses and repeated firings on the biaxial flexural strength (BFS) of four CAD/CAM LDS: IPS e.max CAD (EX) and Amber Mill (AM) as "lab-side"; Initial LiSi Block (LS) and n!ce (NC) as "chair-side". **Methods**: Discs (n=120 per material, ∅ 12.00 mm) were fabricated with two different thicknesses (0.5/1.00 mm) and were subdivided according to the number of firings: baseline (BL)/one firing (1F)/three firings (3F)/ and five firings (5F). Firing cycles were performed according to the manufacturers' instructions. BFS test was performed according to ISO 6872-2015 and data were analyzed using ANOVA and Weibull analysis. **Results**: BFS differed between materials (EX=AM>NC>LS). A significant difference was found between firings (3F>5F>1F>BL), regardless of thickness. Higher thickness (1.00 mm) resulted in higher BFS. Higher Weibull modulus and characteristic strength values were observed with lab-side vs. chair-side materials. **Conclusion**: Repeated firings significantly affected the BFS of EX, AM, LS, and NC CAD/CAM lithium disilicate materials and increased with increased thickness. Lab-side materials (EX and AM) have a lower probability of failure than chair-side materials (LS and NC).

Poster #79

Title: Lipophilicity of Peptide Amphiphile Nanofibers Optimizes Caveolae-mediated Wnt signaling

Authors: Yan Zhou & Malcolm L Snead

Background: Peptide amphiphile (PA) nanofiber designed to include bioactive domains that are instructional to cells undergo self-assembly in aqueous fluids into nanoscale filaments to mimic natural extracellular matrices. These PA molecules create supramolecular nanofibers with a core-shell morphology built by collapsed hydrophobic segments and beta-sheets. Membrane-partitioning PA potentiates canonical Wnt signaling, which is initiated by the interaction of Wnt ligands with the Frizzled receptor and Lrp5/6 co-receptor. Phosphorylation of Lrp5/6 leads to cytosolic accumulation and nuclear translocation of beta-catenin to activate target gene expression. Lrp6 phosphorylation occurs in raft membrane domains with subsequent internalization into signaling-competent vesicles (caveolae) that are essential for Wnt pathway activation. **Purpose**: The requirement of caveolae was characterized in PA-mediated potentiation of canonical Wnt signaling. PA lipophilicity was tuned to optimize their membrane-partitioning phenomenon for maximal enhancement of Wnt signaling on bone marrow mesenchymal stem cell differentiation. The ability to modulate Wnt activated osteogenesis has significant potential for therapeutic application. **Methods**: The caveolin-mediated endocytosis was inhibited to block the formation of caveolae with two different approaches, metabolic inhibitor or siRNA specific for caveolin-1. Four PAs with different lipophilic tails were synthesized and their potential to enhance Wnt signaling was characterized. **Results**: PA-mediated potentiation of canonical Wnt signaling was abolished by the inhibition of caveolae formation. The four PAs with different lipophilic tails have distinctive effects on caveolae formation. **Conclusion**: Caveolae formation is required for the potentiation of canonical Wnt signaling by PA nanofibers. Lipophilicity and conformation determine the effect of PA-mediated signaling potentiation.

DENTISTRY & CCMB AFFILIATES

Poster #80

Title: Using of Martensitic One Curve File in Re-Treatment of Severe Curved Root Canals

Authors: Abdal Aziz Alfarra

Faculty Advisor: Research conducted outside of USC

Background: Rotary nickel titanium instrument are an essential part of endodontic treatment; it is important to evaluate the ability for martensite NiTi Alloy with One wave endo file on the Re-root canal cleaning ability of the previous treated tooth. **Purpose:** The aim of this case report was to use a one curve file in root canal re-treatment of severe and rare curved root. Periapical radiograph was to evaluate obturation before and after treatment. **Methods:** The Re root canal was done by using the one curve endo file system, starting from removing the old restoration using round bur at high speed, also to dissolve the Gutta Percha using Chloroform solution though 30 Gauge needle. The roots were instrumented according to the manufacturer's instructions of each file, the root canals were irrigated with sodium hypochlorite (NaOCl), Ethylene-diaminete-traacetic acid (EDTA) and Normal saline with each file use, obturation by using warm vertical compaction technique and Bio ceramic sealer. The cavity was closed by using Cavet Temporary Restoration. **Results:** Using of Martensitic One Curve File in Re-Treatment of Severe Curved Root Canals was successful during the Retreatment Case. **Conclusion:** Pseudoplastic behavior is assigned to situations when the plastic deformation remains recoverable without entering the plastic stage. The amount of plastic deformation that occurs in Ni-Ti alloys is recoverable within certain limits. An irreversible process can be established after excessive stress is maintained, inducing increase of dislocation density which restricts growth of martensite phase and development of stress-induced reoriented martensite resulting in increased transformation hardening.

Poster #81

Title: Determination of protein half-lives in HEK293 cells

Authors: Yanbin Ji, Yan Zhou, & Michael L. Paine

Faculty Advisor: Michael L. Paine

Background: The stability and normality of cellular functions depend on the maintenance of the dynamic balances of various protein turnover, namely continued protein synthesis and degradation. Increasing evidence regarding protein half-lives arouses close attention. **Purpose:** Among versatile assessment approaches, pulse-chase analysis and cycloheximide (CHX) blocking become two significant methods for the current determination of protein half-lives. In general, each method has both advantages and disadvantages, considering multiple factors such as accuracy, precision, reproduction, stability, applicability, cost, simplicity, and availability of equipment or devices. Developing a simple and reliable approach will be valuable for all laboratories. **Methods:** CHX chase assessment plus Western blot. **Results & Conclusion:** In this study, we developed a simple, applicable for most laboratories, low-cost, repeatable, and stable method by a combination of both CHX chase assessment and Western blot to determine protein half-lives.

Poster #82

Title: Swine Calvarial Bone Regeneration Using an Irregular-Sized 3D-printed Scaffold

Authors: Janet Sanchez, Jesse Anderson-Ramirez, Zoe Johnson, & 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 an irregular-shaped calvarial CSD. **Methods:** BMA was collected from the swine tibial crest. A 4.3cm^2 irregular sized defect was made in the calvaria. The MSCs were combined with a 3D-printed osteoconductive scaffold of hydroxyapatite and tricalcium phosphate (HA/TCP) and placed into the defect site. **Results:** We have defined a critical size irregular defect model in the swine calvaria as 4.3cm^2 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 swine 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.

Poster #83

Title: The survival of dormant *A. actinomycetemcomitans* in nutrient-restricted conditions

Authors: Ashley Wu, Jason J. Chang, Natalia Tjokro, & Casey Chen

Faculty Advisor: Casey Chen

Background: Gram-negative *Aggregatibacter actinomycetemcomitans (Aa)* is a periodontal pathogen known for its persistent oral infection. The mechanism underpins the organism's long-term survival in vivo remains unclear. We hypothesize that *Aa* can enter a dormant but viable state in nutrient-restricted conditions for survival in vivo. **Purpose:** This study aims to establish an in vitro model of *Aa* dormancy using nutrient-restricted chemically defined media (CDM) to support bacterial growth. Our long-term goal is to use the model to identify essential genes for in vivo survival of *Aa*. **Methods:** RPMI-1640, a tissue culture medium, and amended RPMI-1640s were used to test the growth of *Aa* strain D7SS. The ability of RPMI and amended RPMI to support the growth of *Aa* was predicted based on genome analysis of *Aa* and published studies of phylogenetically close species *Haemophilus influenzae*. The growth was assessed through BioScreen, which monitored the cultures' absorbance, and also determined the colony-forming unit of the cultures over time. **Results:** As expected, RPMI-1640 could not fully support *Aa*'s growth. Several amended RPMI-1640s, for example, those with bases for the nucleotide salvage pathway, showed promises to initiate *Aa* to enter a dormant but viable state. **Conclusion:** Our preliminary data suggest the potential use of an in vitro model to mimic the nutrient-restricted growth conditions in vivo where *Aa* may enter a dormancy state. The model will be useful to probe *Aa*'s survival mechanism in vivo.

Poster #84

Title: Effect of NOTCH inhibition on head and neck cancer organoids

Authors: Casey Collet, Hua Zhao, Boyan Hu, Uttam K. Sinha, & Dechen Lin

Faculty Advisor: Dechen Lin

Background: Head and neck squamous cell carcinoma (HNSCC) accounts for 4% of all cancers in the United States, and is associated with significant patient morbidity and mortality. Inactivation of tumor suppressor genes *TP53, CDKN2A,* and *NOTCH* are among the top genomic alterations in HNSCC and its contribution to tumorigenesis warrants further elucidation. Organoid technology offers an *in vitro* model that preserves the physiology and pathology of this malignancy. **Purpose:** To explore the impact of *NOTCH* inhibition on genetic, epigenetic, and transcriptomic changes during the early neoplastic transformation of HNSCC in engineered organoid mouse models. **Methods:** Mouse oral tongue and oropharynx tissues were processed to establish organoid lines. *Trp53/Cdkn2a* double knockout (DKO) was established for each tissue using CRISPR-Cas9 genome editing via electroporation. DKO organoids were then exposed to 100 μM DAPT, a notch signaling inhibitor, or vehicle control for 2 weeks. Average organoid size and cell viability was determined by phase-contrast imaging and WST-1 assays at various time points after organoid seeding. **Results:** DKO organoids exhibited increased cell size and viability compared with controls. DAPT treatment significantly increased cell viability of mouse oral tongue DKO organoids compared with controls on days 4, 7, and 10 ($p<0.0001$). Similarly, mouse oropharynx DKO organoids cultured with DAPT exhibited significantly increased cell viability compared with controls on days 4, 7, and 10 ($p<0.0001$). **Conclusion:** These results suggest that notch inhibition contributes to cell proliferation and cell viability in our HNSCC organoid model.

Poster #85

Title: Facebase: A storehouse of comprehensive data from Craniofacial Experiments

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

Faculty Advisor: Yang Chai

Background: The significant objective of FaceBase is to further research into craniofacial development and deformities by creating a storehouse of comprehensive datasets accessible to researchers. **Purpose:** The purpose of Facebase hub is to serve as a tool for researchers to discover

the leading cause of craniosynostosis responsible for half of all birth defects. To improve the impact of Facebase, we need to overcome some obstacles such as; interpreting the substantial datasets, integrating data from experiments conducted by craniofacial researchers, and converting our understanding of animal model studies to progress craniofacial health in humans. **Methods:** FaceBase serves as a tool for identifying, displaying and analyzing data on human and animal models of craniofacial development and disease. **Results:** Facebase contains over 1000 datasets from researchers' and scientific technicians' experiments on mice, zebrafish, chicks, and chimpanzees. This comprehensive database serves as a tool for researchers to analyze data from an organism starting from the embryonic stage to the post-natal stage. **Conclusion:** The comprehensive datasets submitted by the craniofacial research community from experiments, mutations, genotypes, and more from organisms can advance research, and further improve our comprehension of craniosynostosis, craniofacial development, and dysmorphologies. It is a significant resource for inspired researchers due to its accessibility to datasets, experiments, microtomography, and mutations of organisms that are exchangeable and reusable.

Poster #86

Title: Larynx Carcinoma Outcomes Disparities and Impact of Affordable Care Act

Authors: Megha Sheth, Margaret Nurimba, Tamara Chambers, Mark Swanson, Dechen Lin, & Uttam Sinha

Faculty Advisor: Dechen Lin

Background: Certain patient groups are at risk for being diagnosed with more advanced disease and receiving suboptimal treatment for head and neck cancers. **Purpose:** To assess the impact of race and socioeconomic status on diagnosis-to-treatment interval (DTI) and surgical outcomes for patients with larynx carcinoma. **Methods:** Cross-sectional study of patients with laryngeal carcinoma who underwent surgical management (n=36,046) between 2004-2018 in the National Cancer Database (NCDB). Mean differences were assessed with descriptive statistics and one-way analysis of variance. **Results:** There were significant disparities in treatment timing and surgical outcomes: DTI was significantly shorter for non-Hispanic White patients compared to their Black ($p<0.001$) and Hispanic ($p=0.004$) counterparts. The same was true for Asian/Pacific Islander (API) patients compared to Black ($p<0.001$) and Hispanic ($p=0.021$) patients. Similar trends were seen for time from diagnosis to first surgical and definitive surgical procedure. Surgical inpatient stay was significantly shorter for non-Hispanic White patients compared to Black ($p<0.001$) and Hispanic ($p<0.001$) patients, and significantly shorter for API patients compared to Black patients ($p<0.001$). Readmission to the same hospital within 30 days of discharge was significantly higher for Black patients compared to non-Hispanic White patients ($p=0.043$). Thirty-day mortality was significantly higher for Hispanic patients compared to non-Hispanic White patients ($p=0.029$). Ninety-day mortality was significantly higher for Hispanic patients compared to their non-Hispanic White ($p<0.001$) and Black ($p=0.012$) counterparts. **Conclusion:** Race and socioeconomic factors have significant impacts on time to treatment and surgical outcomes in larynx carcinoma, possibly reflecting differences in resources, access to care, and health literacy.

Poster #87

Title: 3D analysis of craniofacial development of the Dlx5 mouse model

Authors: Nayoon Bae & Yang Chai

Faculty Advisor: Yang Chai

Background: The soft palate muscles elevate or depress the palate and synergize with the pharyngeal muscles to close and open the oral and nasal cavities. These movements play important roles in speech, swallowing, breathing, and hearing. However, complete functional restoration in patients with cleft soft palate remains a challenging task. **Methods:** In this project, we aim to study the soft palate muscles of the *Dlx5*$^{+/-}$ mouse model using a 3D microCT (Scanco V1.28) with a resolution of 20 µm and reconstructed in 3D using Avizo 7.0 software. **Results:** Morphometric results showed that the cranial structure and the soft palate muscles of *Dlx5*$^{+/-}$ are smaller than controls. There was not a significant difference in volume of the soft palate muscles between *Dlx5*$^{+/-}$ mutants and controls. **Conclusion:** These data suggest that *Dlx5*$^{+/-}$ play an important role in the cranial structure and the soft palate muscles development. There was not a significant difference between the *Dlx5*$^{+/-}$ mutants and controls, suggesting that Dlx5 may not be a key player in the development of the cranial bones. Further studies are needed to fully understand the development of the cranial bones and soft palate in these mouse models.

Poster #88

Title: Osteomyelitis Associated with Peri-implantitis: A case report

Authors: Aml Abukraa, Jeff CW. Wang, & Hom-Lay Wang

Faculty Advisor: Research conducted outside of USC

Background: Osteomyelitis is a long-standing chronic inflammation in the jaws, which may extend to the bone cortex and marrow spaces causing a devastating destruction to the bone. In this case report, a case of peri-implantitis that has evolved to osteomyelitis was reported. **Purpose:** To report on a case of osteomyelitis as a biological complication of peri-implantitis. **Methods:** A 69-year-old systematically healthy Caucasian female who had 2 implants placed on the lower right posterior areas with guided bone augmentation. Healing was uneventful and the case was restored with splinted prosthesis. Peri-implantitis and bone loss was noted due to poor oral hygiene. Peri-implant abscess subsided following non-surgical treatment; however, refractory peri-implantitis still occurs and eventually the infection extended to the underlying bone that causes osteomyelitis. **Results:** The case was confirmed via biopsy that illustrated typical pattern of osteomyelitis - multiple non-vital bone fragments that were surrounded by the acute and chronic inflammatory cells. Case was successfully managed through removing necrotic bone and associated implants and tooth (#32). **Conclusion:** Peri-implantitis defects should be diagnosis early and treated accordingly with intensive maintenance care. If left untreated, the case may eventually become an osteomyelitis which requires more aggressive treatment.

BIOKINESIOLOGY & PHYSICAL THERAPY

PHD CANDIDATES & POST-DOCTORAL FELLOWS

Poster #89

Title: Does Fitness Impact Gut or Motor Symptoms in Parkinson's disease?

Authors: Kaylie Zapanta, E. Todd Schroeder, & Beth E. Fisher

Faculty Advisor: Beth E. Fisher

Background: While Parkinson's disease (PD) has traditionally been considered a brain disorder, research indicates that gut microbiota alterations influence PD symptomology. Thus, strategies that improve gut health in PD are warranted, like exercise. In non-PD populations, fitness is linked to gut health, and exercise improves the gut. Exercise improves motor symptoms in PD, but the gut may moderate these improvements. However, no study has first linked fitness with PD symptoms or determined whether fitness norms indicate symptom severity differences in PwPD. **Purpose**: Therefore, we aimed to 1) associate fitness, motor symptoms, and constipation and 2) determine the influence of fitness norms on motor symptoms and constipation in 19 PwPD. **Methods**: Constipation was measured via the ROME-IV survey. Fitness was measured via 6-minute walk test (VO_2). Normative classifications identified whether participants met (HI) or did not meet fitness norms (LO). Motor symptoms were assessed via the Unified Parkinson's Disease Rating Scale III (UPDRS-III). A linear regression was used to associate VO_2, UPDRS-III, and constipation. A MANOVA compared symptoms between HI and LO groups. **Results**: VO_2 was associated with constipation ($t = -2.67$, $p = .018$, effect size = -.48, 95% CI= -.86 to -.10) and UPDRS-III ($t = -2.35$, $p = .033$, effect size = -.48, 95% CI = -.92 to -.04). The HI group had lower constipation ($p = .018$) and UPDRS-III ($p = .03$) scores than the LO group. **Conclusion**: Not only is there a link between fitness, motor function, and constipation in PwPD, but there are benchmarks that clinicians can use to increase the fitness of PwPD, thereby improving motor and gut symptoms..

Poster #90

Title: Protein Intake Influence on Muscle Soreness Following High-Intensity Interval Training

Authors: Jared Moore & George Salem

Faculty Advisor: George Salem

Background: It is not well understood how individuals respond to acute bouts of novel HIIT exercise paradigms and whether protein intake influences subsequent soreness. **Purpose**: The purpose of this pilot study was to characterize the lower extremity loading during a HIIT running protocol in healthy participants and explore the relationship of this loading with subsequent muscle soreness and how protein intake following exercise may affect these responses. **Methods**: Five young, healthy participants completed a heart rate maximum test to build individual 4x4 HIIT protocols. Moticon shoe insoles were used to calculate vertical reaction forces (vRF) during the HIIT protocol and were normalized to body weight. The peak vRFs during the middle minute of each active period were averaged for the HIIT protocol. Muscle soreness was measured before and 24 hours after the exercise bout using a 10-point Visual Analog Scale (VAS). Protein intake following the exercise bout was measured using the ASA24 food recall system when the 24-hour VAS was obtained. Data are presented as mean ± SD and Pearson's r correlations were calculated. **Results**: Peak vRFs (2.25 ± 0.27 [BW]) were positively correlated with 24-hour muscle soreness ($r = 0.98$). Total protein intake (112.99 ± 45.24 g) was negatively correlated with 24-hour muscle soreness ($r = -0.91$). **Conclusion**: The results of this pilot study demonstrate a relationship between muscle soreness 24 hours following an acute bout of treadmill running HIIT that may be attenuated with proper protein intake following the exercise protocol.

Poster #91

Title: Patellofemoral Joint Stress in Persons Who Have Undergone ACL Reconstruction

Authors: Thomas A. Demirjian & Christopher M. Powers

Faculty Advisor: Christopher M. Powers

Background: Persons who have undergone an ACL reconstruction (ACLR) have been reported to exhibit early-onset patellofemoral joint (PFJ) osteoarthritis. Elevated PFJ stress (force per unit area) may play a role in the heighted risk of PFJ osteoarthritis in this population. **Purpose**: To compare patellofemoral joint stress during dynamic activities between females who have undergone ACLR and healthy controls. **Methods**: Ten female soccer athletes (5 control, 5 ACLR) between the ages of 18-35 years have participated in this ongoing study. Each completed two phases of data collection: 1) sagittal and axial magnetic resonance imaging (MRI) assessment to determine subject specific PFJ contact area and extensor mechanism parameters, and 2) biomechanical analysis (knee kinematics and kinetics) during walking, running and single leg drop landing. Data obtained from both collection sessions were used as input variables for a biomechanical model to quantify PFJ stress. **Results**: On average, peak PFJ stress during walking was 6.5% lower in the ACLR participants compared to the control group. In contrast, PFJ stress was 10.8% and 9.8% higher than the control group during running and single leg drop landing, respectively. The increase in PFJ stress in the ACLR participants was attributed to a reduction in PFJ contact area, as peak PFJ reaction forces were lower across all tasks. **Conclusion**: Females who have undergone ACLR exhibit higher magnitudes of PFJ stress compared to healthy persons. However, this finding appears to be task dependent with elevated stress values only being observed in the ACLR group with higher demand activities.

Poster #92

Title: Executive function and immediate memory predict post-stroke locomotor performance

Authors: Sarah A. Kettlety, Morgan L. Kelly, Maryana Bonilla Yanez, & Kristan A. Leech

Faculty Advisor: Kristan A. Leech

Background: Visual biofeedback targets post-stroke biomechanical gait impairments, such as reduced paretic propulsion. Using visual biofeedback to alter gait parameters is an explicit, cognitively demanding motor learning approach. Previous work has demonstrated that overall cognitive function is important when using visual biofeedback to improve locomotor performance; however, it is unknown which cognitive domains drove this result. **Purpose**: Understand which cognitive domains predict locomotor performance during a paretic propulsion biofeedback task in individuals post-stroke. **Methods**: Twenty-two participants completed one day of paretic propulsion biofeedback training. Before training, participants completed cognitive testing, which provided scores for executive function, immediate memory, visuospatial, language, attention, and delayed memory. Next, we collected treadmill-walking data for two minutes without biofeedback and twenty minutes with biofeedback. Our primary outcome measure was propulsion error (distance from the propulsion goal, normalized to baseline) averaged over the final thirty strides. We then performed best-subsets selection with terms for lower-extremity Fugl-Meyer (LEFM) and cognitive test scores. Each model in the selection process included a LEFM term to account for motor impairment. The model with the lowest BIC score was chosen as the final model. **Results**: Executive function, immediate memory, and LEFM scores best-predicted propulsion error during the final thirty strides of biofeedback training (adjusted $R^2 = 36\%$, $p = 0.01$). **Conclusion**: When using an explicit motor learning paradigm to improve locomotor performance, executive function and immediate memory are important. This suggests that understanding an individual's cognitive status can aid in developing personalized motor learning approaches.

Poster #93

Title: Examining patterns of explicit and implicit learning in infants

Authors: Marcelo R. Rosales, Jose Carlos Pulido, Nina S. Bradley, Maja J. Matarić, & Beth A. Smith

Faculty Advisor: Beth A. Smith

Background: Contingency learning paradigms (CLP) have defined learning as an increase in the reinforced behavior. While this measure can be useful in describing learning through implicit mechanisms, literature suggests that infants also engage in explicit learning. In this study we examined the visual-motor patterns of infants engaging in a CLP to see if they use an explicit (ELP) and implicit (ILP) motor learning pattern. **Methods**: Thirteen infants with typical development (6-9 months) participated in a 12-minute CLP where a robot provided reinforcement of the infant's right leg movements. The timing and type of visual gazes (i.e. predictive, reactive, or not looking) on the robot activations were identified using a frame-by-frame analysis. Number of each type of gaze and robot activations were plotted in minute blocks. The ELP was defined as displaying predictive gaze during a one-minute block for most reinforcements. The ILP was showing an increase in the number robot activations after the ELP was identified. **Results**: Results showed that all infants exhibited the ELP. Eleven of the thirteen (85%) infants displayed the ELP followed by the ILP. Two infants (15%) did not exhibit the ILP after the ELP was observed. However, these two infants did increase their overall activations throughout the paradigm. **Discussion**: Infants, like adults, may use an ELP followed by an ILP, to learn movements. Therefore, pediatric clinicians should focus on establishing behavioral connections during early learning and then motor practice in later learning.

Poster #94

Title: Control of interaction torques during single-joint arm movements in stroke

Authors: Yannick Darmon, Gerald E. Loeb, Victor Barradas Patino, Zhong S. Zheng, Sook-Lei Liew, Carolee J. Winstein, Emily Rosario, & Nicolas Schweighofer

Faculty Advisor: Nicolas Schweighofer

Background: Sensory-motor strokes abruptly impair motor control of goal-directed movements. Generating fast, smooth and straight trajectories for multi-joint planar reaches requires adequate compensation for the interaction torques that arise at both proximal and distal joints. For single-joint elbow movements, neurotypical individuals learn to compensate for these torques by activating anticipatory shoulder muscles proportionally to the interaction torques (Gribble and Ostry, 1999). **Purpose**: Here, we study to what extent stroke survivors activate shoulder muscles to control for anticipated interaction torques during fast movements restricted to the elbow. We hypothesize that, compared to the less-affected arm, the more-affected arm of stroke survivors will exhibit a diminished scaling between the interaction torques generated at the shoulder and the Electromyographic (EMG) activity of the Posterior deltoid (PD) and Pectoralis major (PEC) during fast single-joint elbow extension. **Methods**: We recruited 26 (13 females), moderately to mildly impaired (UE-FM 42.8 ± 1.9), supra-tentorial chronic stroke survivors and tested their more- and less-affected arms. We studied the relationships between the interaction torques at the shoulder and the PD EMG activity. In addition, we cross-correlated the shoulder EMG activity S_EMG = PEC - PD, to the interaction torque signal at the shoulder. **Results**: S_EMG preceded interaction torque signal more for the less-affected side than for the more-affected side. The PD EMG amplitude was less correlated with interaction torque on the more-affected side than on the less-affected side. **Conclusion**: Our results indicate that stroke survivors have a reduced ability to predictively compensate for interaction torques and to generate adequate anticipatory muscle activities.

Poster #95

Title: Longitudinal brain connectivity changes associated with chronic pelvic pain fluctuations

Authors: Natalie McLain & Jason Kutch

Faculty Advisor: Jason Kutch

Background: Fluctuations in pain intensity for individuals with chronic pain conditions are a common but poorly understood phenomenon. **Purpose**: Identify the changes in brain activity that underlie these fluctuations and assess how hypothesized centralized pain markers (depression, anxiety, painDETECT, pain widespreadness, catastrophizing) modify the relationship. **Methods**: We collected average self-reported pain, clinical questionnaire data, and resting-state functional magnetic resonance imaging (rs-fMRI) data in a population of 492 urologic chronic pelvic pain syndrome (UCPPS) patients. To assess the relationship between pain and functional connectivity, connectivity features were calculated and regressed onto the self-reported pain measures from one baseline and three follow-up visits (6, 18, and 36 months) in each patient. P-values for the fixed effects of pain were FDR corrected ($q<0.05$). Additional regressions were run with an interaction term between pain and the clinical characteristics of interest to determine their impact on the relationship between pain and connectivity. **Results**: We found that the areas of connectivity most likely to vary as a person experienced more or less pelvic pain were medial sensorimotor regions, bilateral insula, cingulate, and ventromedial prefrontal cortex after controlling for site, age, scan type, and sex. Additionally, we found that of the five clinical markers of centralized pain, only widespread pain significantly enhanced the relationship between pain and connectivity. These results suggest that functional connectivity changes in a common set of regions underlie the fluctuations in pain that UCPPS patients experience and that pain widespreadness may modify the relationship between pain fluctuations and functional connectivity.

Poster #96

Title: Decision-Making while Walking in Risky Environments

Authors: Shreya Jain, Nicolas Schweighofer, & James Finley

Faculty Advisor: James Finley

Background: Falls and fall-related injuries can be exacerbated by several fall risk factors. While clinical assessments can be used to identify physiological and psychological risk factors, such assessments are not available for determining how people perceive risk and make decisions when walking in risky environments. These decisions can have devastating consequences, particularly if they lead to unsafe behaviors. **Purpose**: Our goal is to determine factors that influence risk perception and decision-making when walking with balance perturbations. **Methods**: First, we determined if perceived risk is sensitive to the direction of perturbations on a treadmill, which can be either trip-like or slip-like. For different magnitudes of trip-like perturbations, we used a staircase algorithm to determine equally preferred slip-like perturbations. Next, we investigated how the variability of perturbation magnitude influenced risk perception. In each trial, participants chose between two bouts of walking with eight perturbations, either all equal or variable in magnitude. We then compared the predictive ability of three decision-making models, which use distinct properties of the perturbations such as variability and timing. **Results**: In our first experiment, participants preferred trip-like perturbations that were 0.14±0.04m/s larger than slip-like perturbations. In the second experiment, we found that a Mean-Variance model, which accounts for the mean and variability of perturbations, predicted the highest proportion of choices accurately (0.83±0.08). **Conclusion**: This work will provide insight into how people evaluate and decide between risky walking options, allowing us to quantify and potentially mitigate behavioral risk in individuals prone to falls.

Poster #97

Title: Joint Contributions to Mechanical Energy Expenditure in Achilles Tendinosis

Authors: David Ortiz-Weissberg & Kornelia Kulig

Faculty Advisor: Kornelia Kulig

Background: Achilles tendinosis (advanced Achilles tendon degeneration) provides a robust model for studying the body's ability to adapt to pathology. The known adaptations to Achilles tendinosis primarily involve either the tendon or the nervous system. To date, there are few rigorous investigations into joint-level adaptations to Achilles degeneration. Whole-limb analyses, such as joint contributions to mechanical energy expenditure (MEE), can provide insight into ankle function relative to hip/knee function. **Purpose**: The purpose of this study was to test the hypothesis that persons with Achilles tendinosis exhibit reduced ankle contributions to whole-limb MEE. **Methods**: We recruited five persons with Achilles tendinosis and five persons with no history of Achilles symptoms. Participants were tasked with performing single-leg hopping at 2.33 Hz. The mechanical power time series for the ankle, knee, and hip were split into braking and propulsion phases. The data were then rectified and integrated to obtain MEE. The MEE across all joints was summed and the contribution was calculated as the percentage from each joint. We used Cohen's D effect size to compare each joint's contributions across the groups. **Results**: During both phases, the Achilles tendinosis group showed a significant decrease in the ankle contribution compared to the control group. The mean difference in the braking phase was -15.3% (effect size: -1.64) while the mean difference in the propulsion phase was -10.4% (effect size: -1.32). **Conclusion**: These findings indicate that persons with degraded Achilles morphology do not maintain ankle function at the same level as persons with healthy Achilles tendons.

BIOKINESIOLOGY & PHYSICAL THERAPY

PHD & MS STUDENTS

Poster #98

Title: Increasing Paretic Propulsion Modestly Increases Aerobic Intensity of Walking Post-Stroke

Authors: Morgan L. Kelly, Sarah A. Kettlety, Christina K. Holl, & Kristan A. Leech

Faculty Advisor: Kristan A. Leech

Background: Gait biofeedback is an effective way to target walking impairments post-stroke. Clinical practice guidelines recommend high aerobic intensity gait training to reduce walking activity limitations. It is not known if different types of gait biofeedback influence the aerobic intensity of walking. **Purpose**: To understand how changing different gait parameters with visual biofeedback influences the aerobic intensity of walking post-stroke. **Methods**: We tested the effects of biofeedback-driven changes in three different gait parameters: step length, paretic propulsion, and interlimb asymmetry. Participants completed three sessions of baseline walking and walking with biofeedback. The aerobic intensity of walking was measured as the percentage of heart rate reserve (%HRR) reached during walking. We used linear mixed effects models to determine the effects of each biofeedback on the targeted parameters and to understand the impact of each biofeedback type on aerobic intensity. **Results**: Participants used each biofeedback type to change the targeted gait metric relative to walking without biofeedback (all $p<0.05$). Biofeedback driven changes in paretic propulsion led to a significant increase in %HRR (all $p<0.05$; mean increase of 8.43% ± 0.90%) above walking without biofeedback (15.64%). There was no change in %HRR during walking with changes in step length (all $p>0.05$) and interlimb asymmetry (all $p>0.05$). **Conclusion**: Increasing paretic propulsion force with biofeedback increases the aerobic intensity of walking. However, the degree that aerobic intensity elicited (24.07% HRR) did not reach the level of intensity currently recommended (70-80% HRR). Combining biofeedback-based gait training with high-intensity gait training may be beneficial post-stroke.

Poster #99

Title: Promoting Standing and Walking of Infants Born Very Preterm

Authors: Nora Almoadi & Barbara Sargent

Faculty Advisor: Barbara Sargent

Background: Infants born very preterm (VPT) walk later than infants born full-term (FT) and are at increased risk of developing cerebral palsy, characterized by reduced hip-knee selective motor control (SMC). It is unknown if infants born VPT can learn specific tasks to promote hip-knee SMC and walking abilities in a body-weight support system (BWSS). **Purpose**: (1) Determine if infants born VPT and FT can learn specific walking tasks in a BWSS. (2) Compare hip-knee SMC in the BWSS before and after training. **Methods**: Two 6 and 11-month-old infants born FT participated in 2 days of BWSS wearing inertial sensors. Day 1: 10-min independent exploration, then 20-min training in walking tasks. Day 2: 10-min independent exploration. Learning was measured by determining the percentage of time spent in walking tasks and number of steps. Hip-knee SMC was quantified using Z-transformed correlation coefficients (ZCC) of hip and knee joint angle pairs into flexion-extension. **Results**: During independent exploration on Day 2 compared to Day 1, each infant spent more time performing walking tasks in the BWSS (18% increase for infant 1, 43% increase for infant 2), took more steps (53 increase for infant 1, 45 increase for infant 2), and demonstrated more hip-knee SMC (mean hip-knee correlation coefficient reduced by 0.18 for infant 1 and 0.67 for infant 2). **Conclusion**: Preliminary results are encouraging. The training appears feasible and infants born FT are learning the tasks. Next step is to continue to collect data to complete our sample of infants born VPT and FT.

Poster #100

Title: Does the Cerebellum enhance Motor Learning in Parkinson's Disease?

Authors: Pooja Iyer, Gina Shin, Margaret Yamamoto, & Beth E. Fisher

Faculty Advisor: Beth E. Fisher

Background: Research has shown intact *and* deficient motor learning ability in people with Parkinson's disease (PD). Learning may be intact because of increased cerebellar activity in people with PD to compensate for basal ganglia dysfunction. Hence, we assessed learning in a subject with PD (SwPD) and young adults (YA) in a reinforcement task (RT) and measured cerebellar activity using transcranial magnetic stimulation, i.e., cerebellar inhibitory output (CBI) to the motor cortex (M1). **Methods**: A SwPD (65years) and 2YA (29±2years) per-

formed a RT with visual perturbation of 250. Learning is successful if reach angles (RA; the angle between the target and the cursor) differs between the first 15 retention trials and the last 15 baseline trials. CBI was measured at baseline, early, and end of perturbation trials. CBI-measurement: Test Stimulus (TS) to first dorsal interossei representation in M1 to produce a motor evoked potential (MEP) of 1mV. Conditioning Stimulus (CS) to the ipsilateral cerebellum is given 5ms prior to TS to produce an MEP <1mV; CBI-ratio is indexed as the MEP amplitude achieved by: (CS-TS)/(TS_{only}). **Results**: The change in RA for the 2YA was $-12.67^0 \pm 2.13^0$ and for the SwPD was -10^0; demonstrating learning in both YA and the SwPD. CBI-ratio increased only in the SwPD during early perturbation trials (0.89mV) compared to baseline (0.75mV) and the end of perturbation trials (0.55mV). **Conclusion**: We showed that CBI changes in the SwPD might contribute to successful learning, warranting further testing.

Poster #101

Title: Transcranial Magnetic Stimulation of Gluteus Maximus: Comparing EMG Recording Methods

Authors: Maxfield Munk, Christopher M. Powers, & Beth Fisher

Faculty Advisor: Beth Fisher & Christopher M. Powers

Background: Gluteus maximus (GM) weakness is associated with lower extremity pain and injury. Understanding of central processing is increasingly thought to be as important to resolving problems with GM as understanding of peripheral issues. Transcranial magnetic stimulation (TMS) can measure the brain region dedicated to the GM as well as changes related to muscle strength. TMS requires an electromyographic (EMG) signal, however, surface (s) EMG signals can be attenuated by adipose tissue covering the GM. Intramuscular (i)EMG records local motor unit activity within the muscle, eliminating such attenuation. **Purpose**: The purpose of this study was to compare motor evoked potential (MEP) amplitude and short intracortical inhibition (SICI), the influence of inhibitory receptors on motor output, of the GM using sEMG and iEMG. **Methods**: iEMG and sEMG electrodes were placed in and on the GM of two subjects. GM motor hotspot and active motor threshold (aMT) were determined before measuring MEP amplitude at 150% aMT and SICI at 120% aMT. **Results**: iEMG MEP amplitudes were 311% (sd 118%) of sEMG MEP amplitudes. SICI is calculated as inhibited over uninhibited MEP amplitudes. iEMG SICI was 69.4% (sd 2.16%). sEMG SICI was 58.2% (sd 4.05%). **Conclusion**: iEMG MEP amplitudes were greater than sEMG due to the lack of impedance between muscle and iEMG electrodes. Thus, iEMG is preferable to sEMG for measuring MEP amplitude in GM. iEMG and sEMG SICI, expected to be of equal magnitude, differed significantly. iEMG measurement may be too focal to characterize inhibitory mechanisms in the entire GM.

Poster #102

Title: Brain-related Mechanisms of Response to Resistance Exercise in Rotator Cuff

Authors: Matthew Heindel, Jason Kutch, & Lori A. Michener

Faculty Advisor: Lori A. Michener

Background: Rotator cuff tendinopathy(RCtend) is a common cause of shoulder pain. Resistance exercise is the primary treatment, but 40% of patients develop chronic symptoms. Brain dysfunction may play a role. We previously found increased activity within and functional connectivity(FC) between a pain processing region, the anterior insula(Insula), and the sensory cortex(S1) in RCtend. These are known biomarkers for chronic pain. **Purpose**: Determine if Insula, S1 brain biomarkers can differentiate outcomes of resistance exercise. **Methods**: Participants (n=10;age=27±5yrs) with RCtend received 2-weeks of resistance exercise. At baseline and 2-weeks, we collected resting-state functional magnetic resonance imaging and calculated the activity of and FC between Insula and S1. Responders were defined by participant satisfaction with shoulder function via the Patient Acceptable Symptom State. RM-ANOVAs compared total group, and by responder groups over time for regional activities and FC, covarying for baseline scores. **Results**: Total group showed no differences over time in activity within and FC betweeen Insula and S1 ($p>0.05$). At 2-weeks, 7 (70%) participants were classified as reponders. There was an interaction by responder group; higher Insula-S1 FC at 2-weeks ($p=0.046$) in non-responders [1.22(CI:0.43,2.02)] versus responders [0.23(CI:-0.28,0.74)]. Insula-S1 FC increased in non-responders [mean difference=0.29(-CI:-0.21,0.79)] and decreased in responders [mean difference=-0.05(CI:-0.87,0.77)]. **Conclusion**: Insula-S1 FC may be a biomarker of responsiveness to exercise. Higher connectivity (z=1.0) between pain and sensory processing regions was associated with lower symptom satisfaction. In patients with a limited response to exercise a different intervention or exercise dose may improve non-reponder outcomes. Interventions targeting the Insula-S1 FC biomarker are needed.

Poster #103

Title: Feasibility of utilizing a problem-solving measure in preterm infants via

Authors: Arya Salgaonkar, Becky Molinini, Claire Rhee, Ketaki Inamdar, Shaaron Brown, Jennifer Burnsed, Richard Stevenson, Amy Harper, Mary Shall, Karen D. Hendricks-Munoz, & Stacey Dusing

Faculty Advisor: Stacey Dusing

Background: The Assessment of Problem-Solving Skills in Play (APSP) is a play-based assessment of problem-solving, used to monitor progress in children with motor impairments. The COVID-19 pandemic required an adaptation to telehealth. **Purpose**: To evaluate the feasibility of parent-guided completion of APSP via telehealth **Methods**: Standardized toys; popups, cups, and gumballs were used. Families were instructed on camera positioning, supporting the child, and avoiding distractions during the 2 mins interaction between the child and each toy. A trained assessor coached the parent during the session which was recorded via Zoom. Feasibility was evaluated in 2 domains that influenced video scoring. Family measures consisted of 5 items including parents/siblings demonstrating the task a child was supposed to discover independently, or inadequate postural support or positioning of the child to allow free use of the hands. Instrumentation/setup consisted of 4 items such as correct toy placement, video clarity, and good camera angles. A score of ≤ 3 on 4 in any of the domains led to a secondary review and exclusion of all or part of the video from scoring. **Results**: Out of the 17 participants 3 scored ≤ 3 in the family measures requiring all or a portion of their APSP to be removed from the scoring. None of the participants scored ≤ 3 on instrumentation/setup. **Conclusion**: Overall instrumentation/setup was feasible in conducting APSP via telehealth. However, caregivers require more training in providing correct postural support to their child and avoiding any interference in the motor and cognitive exploration abilities.

Poster #104

Title: Stronger or faster muscles: which matters more in shoulder tendinopathy?

Authors: Oscar Vila Dieguez & Lori A. Michener

Faculty Advisor: Lori A. Michener

Background: Resisted exercise is beneficial for rotator cuff tendinopathy (RCtend), but many patients have recurrent symptoms. Neuromuscular performance deficits are a hallmark of RCtend but they are poorly understood. Defining neuromuscular performance metrics associated with positive clinical outcomes is needed. **Purpose**: Characterize neuromuscular changes related to clinical outcomes. **Methods**: Participants (n=10; age=27±5) diagnosed with RCtend underwent a progressive 2-week shoulder resisted exercise protocol. Measures were taken pre and post-intervention. Pain and function outcomes were measured via the Penn Score. Neuromuscular performance of the rotator cuff and deltoid was measured with peak torque, impulse, and muscle onset during resisted external rotation (ER) using a dynamometer and surface EMG. Paired t-tests compared pre to post-intervention measures. Multiple regression using best subset was performed to predict change in clinical outcomes from the change in the neuromuscular variables. **Results**: Post-treatment, the Penn Score [mean difference (MD): 7.7pts (CI:2, 13), $p=0.01$], peak torque (MD: 66 N.m (CI: 40, 91), $p<0.01$) and impulse(MD: 21 N.s (CI: 7, 35), $p<0.01$) improved. The variance in the change in Penn Score outcome was explained by the change in neuromuscular variables ($R^2=0.66$). Infraspinatus muscle onset ($\beta=0.37$,$p=0.03$) was the only significant variable in the regression, followed by deltoid onset ($\beta=0.04$, $p=0.34$) and ER Impulse ($\beta=0.06$, $p=0.38$). **Conclusion**: Faster muscle activation appears to be the neuromuscular factor related to better symptoms at 2 week. Despite having the biggest change, peak torque was not related to improved clinical outcomes. Future research should explore if these neuromuscular performance deficits are normalized after exercise, and determine the dose-response and volume of exercise.

Poster #105

Title: Age-dependent effects of scene complexity on attention during visual search

Authors: Isaiah J. Lachica & James M. Finley

Faculty Advisor: James M. Finley

Background: Allocating visual attention to relevant stimuli is essential when performing everyday tasks. Prior work has shown people become more distractible by irrelevant stimuli as they age, but these studies used simple stimuli not representative of real-world visual complexity. **Purpose**: Determine age-dependent effects of visual scene complexity on visual attention and task performance during visual search in naturalistic virtual environments. **Methods**: Fifteen young and six older adults completed a timed VR-based visual search task based on the Trail Making Test-B in three increasingly complex virtual environments. They searched for randomly placed targets that alternated between letters and objects whose names start with those letters in ascending order. Gaze data from eye trackers were used to calculate time spent fixating task-relevant targets and task-irrelevant distractors. Each pixel's salience was computed for every frame recorded during the task and converted to percentile rank, with 100% indicating the highest salience and 0% the lowest salience. **Results**: As scene complexity increased, all participants took longer to complete the search task ($p < 0.001$), fixated task-relevant targets for less time ($p < 0.001$), and fixated less salient regions more ($p < 0.001$). Compared to younger adults, older adults took longer to complete the search task in all scene complexities (low: $p < 0.001$, mid: $p < 0.01$, high: $p < 0.001$) and fixated less salient regions more in the highest scene complexity ($p < 0.001$). **Conclusion**: More distracting visual scenes and aging make people more vulnerable to distraction by irrelevant stimuli in complex naturalistic environments.

Poster #106

Title: Two-dimensional Estimates Reflect Knee Loading Deficits Post-ACLr

Authors: Jiaqi Wang, Whitney Marsh, & Susan Sigward

Faculty Advisor: Susan Sigward

Background: Individuals post-anterior cruciate ligament reconstruction (ACLr) reduced knee extensor moments (KEM) in their surgical limb during functional tasks. These deficits are difficult to detect clinically because they occur without observable differences in joint angles. Current two-dimensional force plate and video technology may provide more accessible means to identify knee loading deficits. **Purpose**: To determine if the between-limb difference in the two-dimensional moment arm (MA), the distance between GRF vector (GRFv) and knee joint axis of rotation, and GRF magnitude will predict KEM deficits. **Methods**: Twenty-two individuals 110 ± 18 days post-ACLr participated. Kinematic and kinetic data (GRFv: position and magnitude, and KEM: inverse dynamics) were collected during bilateral squats. KEM, GRFv magnitude, and the horizontal distance from a marker placed over knee lateral epicondyle in the anterior-posterior direction (MA) were determined at the instance of peak KEM. Ratios Sx/NSx were computed for all variables to reflect between-limb differences. Multivariate linear regression evaluated the influence of the MA and GRFv magnitude ratio on KEM ratio. **Results**: Together, between-limb ratios of MA and GRF magnitude explained 81.4% of the variance in KEM ratio. MA ratio explained 61% and GRF ratio 20.4% of the variance of KEM ratio. **Conclusion**: KEM estimates using GRF magnitude and two-dimensional MA may be useful for identifying KEM deficits during a squat task post-ACLr. Together they predicted over 80% of the variance in KEM deficits. Further work is needed to determine the clinical validity of these assessments for diagnosing knee loading deficits.

Poster #107

Title: Shoulder Motion Deficits Predict Thinner Supraspinatus Tendons in Baseball Pitchers

Authors: Daniel Awokuse & Lori A. Michener

Faculty Advisor: Lori A. Michener

Background/Purpose: In baseball pitchers, glenohumeral range of motion(ROM) deficits have been linked to the development of a thickened painful tendon, known as rotator cuff tendinopathy. Studies show that decreased shoulder external rotation (ER), internal rotation (IR), and flexion are associated with the development of shoulder pain. Bony morphology of humeral retroversion can impact ROM. Tendinopathy may develop because of increased tendon contact pressure between the humeral head and glenoid-posterior-superior impingement (PSI). In this study, we characterize the relationship between glenohumeral ROM and humeral retroversion with tendon thickness. **Methods**: In the dominant arm of healthy collegiate pitchers (n=76), supraspinatus tendon thickness and humeral retroversion were measured on B-mode ultrasound images. Humeral retroversion was measured with an inclinometer when the bicipital groove was parallel to the horizontal plane. Glenohumeral ER, IR, and flexion passive ROM were measured with an inclinometer. Best-subset regression was used to determine which ROM and retroversion variables predicted tendon thickness. **Results**: Shoulder flexion ($\beta= -0.003$; $p=0.07$) and ER ($\beta= -0.002$; $p=0.09$) best predicted supraspinatus tendon thickness ($R^2=13\%$; $p=0.02$). Models including humeral retroversion and IR didn't significantly improve $R^2(p>0.05)$. **Conclusion**: Decreased shoulder flexion and ER predicted an

increase in supraspinatus thickness. A thickened tendon may represent the development of tendinopathy in these healthy pitchers. Studies have shown that increased ER and flexion could potentially lead to greater risk of PSI and explain why asymptomatic pitchers have a high prevalence(32%) of partial thickness tendon tears. Future studies need to determine if this relationship occurs in pitchers with symptomatic rotator cuff tendinopathy.

Poster #108

Title: Data-driven approaches to identify individuals post-ACL reconstruction needing gait retraining

Authors: Willa Ma & Susan Sigward

Faculty Advisor: Susan Sigward

Background: Analyses of gait kinematics averaged across a sample limits our ability to appreciate individual differences in recovery of gait mechanics following anterior cruciate ligament reconstruction (ACLr). **Purpose**: To use a data-driven clustering analysis to describe knee flexion patterns across stance. **Methods**: Sagittal-plane knee kinematics were calculated for 40 individuals (101±17 days) post-ACLr during stance phase of gait. Data were normalized to 101 data points and averaged across 3 trials for surgical (Sx) and non-surgical (NSx) limbs. K-means clustering created three clusters based on waveform variation across participants. Between-cluster sum of squares (BSS) examined the variation among clusters at each time point. Cluster assignment was compared between limbs. **Results**: Three clusters describe variation in patterns of knee flexion excursion: 1)limited, 2)reduced and 3)full. Clusters were farthest apart during loading response (BSS:80.9) and midstance (BSS:45.9) of gait, indicating the portions of stance that were most limited. When considering the clustering of each limb, Sx and NSx limbs were in the same cluster for 22 individuals; in 18 individuals, limbs fell into different clusters: n=16 (Sx excursion reduced compared to NSx), n=2, (NSx excursion reduced compared to Sx). **Conclusion**: Kinematic data described patterns reflecting reductions in loading response knee flexion and midstance extension. Data-driven analyses revealed differences in knee flexion patterns that highlight the need to focus on restoring knee excursion across stance in the surgical limb. Considering clustering of limbs across patterns allowed for identification of individuals who may need continued and focused gait retraining.

Poster #109

Title: Frontal Plane Knee Demand in Golf Equipment Transportation Tasks

Authors: Guanrong Cai, Jordan Cannon, Yunsheng Zou, & George Salem

Faculty Advisor: George Salem

Background: Golf equipment transportation (GET) is a regular task in the popular sport of golf. Frontal-plane lower extremity demands including knee abductor moment and moment impulse (IMP) during gait may contribute to pain and progression of osteoarthritis (OA). Therefore, the influence of GET on knee mechanics during gait has important implications for performance and injury risks. **Purpose**: To compare the frontal-plane knee moments of two GET methods and unloaded walking. **Methods**: 18 experienced young golfers (10M/8F, 26.4±4.5yrs) participated in 3D motion capture of 3 walking tasks: 1) unloaded walking (UW), 2) unilateral carrying on the right shoulder (SS), and 3) carrying the golf bag across both shoulders (DS); using an 11kg bag. Frontal-plane kinematics and kinetics were calculated in Visual 3D. One-way ANOVA was used to compare across conditions. Hedge's g effect sizes (ES) were calculated. **Results**: The left knee demonstrated higher IMP during SS compared to DS ($p<0.001$, ES = 3.09) and UW ($p<0.001$, ES = 3.19). The right knee demonstrated lower IMP during SS compared to DS ($p<0.001$, ES = 2.86) and UW ($p<0.01$, ES = 1.56). IMP did not differ between DS and UW on the left ($p=0.13$) but did on the right ($p<0.001$, ES=2.51). **Conclusion**: IMP increased on the contralateral knee and decreased on the ipsilateral side during unilateral GET with large effects. Proper GET techniques should be further investigated, especially for persons with knee pathologies.

Poster #110

Title: The Role of TENS for Menstrual Pain Relief: A Feasibility

Authors: Bailey McLagan, Joshua Dexheimer, Nicole Strock, Stephanie Guzman, David Erceg, & E. Todd Schroeder

Faculty Advisor: E. Todd Schroeder

Background: Evidence suggests TENS may provide an alternative to pharmacological interventions in modulating pain associated with menstruation. **Purpose**: This was a feasibility study into the efficacy using a wireless and app based commercial TENS for menstrual pain relief. **Methods**: Eight menstruating individuals (25 ± 4.24 years old, 22.13 ± 2.76 BMI) completed three consecutive menstrual cycles using the Therabody PowerDot in randomized order. The Uno cycle used a single PowerDot pod connected to 2 electrode pads through a set of lead cables. The Duo cycle utilized two PowerDot pods connected to 4 electrode pads through a set of two lead cables. During the Uno and Duo cycles, participants were instructed to place PowerDot over the area of abdominal pain and to increase the unit to a comfortable intensity. Scores were collected through the PowerDot application. During all cycles participants were instructed to record NSAID use along with pre-and post-pain scores. Compliance was assessed based on completion of a daily Whoop survey, reporting pre/post pain scores, and completing all treatments. **Results**: Seven (7/8) participants completed all three months of treatment. All eight (8/8) participants successfully answered the Whoop survey each day of participation in the study. Lastly, all participants (8/8) reported pre/post pain scores in the PowerDot app, and reported NSAID use in the Whoop app. **Conclusion**: To our knowledge, this is the first study that was conducted on menstrual pain and TENS in a setting that is more representative of how participants would use the device outside of the lab.

Poster #111

Title: Effect of Arm Path on Pitch Metrics and Injury Risk

Authors: Travis Craven, Christina Lee, Jason Tabor, Franklin Zhuang, Jonathan Sum, & Lori A. Michener

Faculty Advisor: Jonathan Sum & Lori A. Michener

Background: A pitcher's arm path is a strong predictor of both performance capabilities as well as injury risk. Developing a smooth and efficient arm path can affect elbow torque and may impact pitch performance metrics such as ball velocity, spin rate, and extension at release. These metrics greatly impact movement profiles and aid in the execution, deception, and probable success of specific pitches. **Purpose**: To determine how arm path can influence pitch performance metrics and injury risk factors. To determine the potential mechanical changes from training with the PocketPath device, and the subsequent effect of a shortened arm path on pitch performance metrics and injury risk. **Methods**: Collected pitching and physical measures data on 7 collegiate pitchers before and after a six-week performance training program. Trackman data collected pitch performance metrics. A Driveline Pulse sensor collected elbow torque and arm speed data. 4DMotion collected pitching kinematic data. The PocketPath was used as an intervention to create a short and repeatable arm path. Data was collected during each session under three conditions: throws at 75% intensity, 100%, and 100% with the PocketPath. **Results**: Currently performing statistical tests and visual representations. **Conclusion**: Upon preliminary data analyses, changes in a pitcher's arm path can influence the performance capabilities of specific pitches to generate more success, as well as create mechanics with less variability and result in less stress and torque placed on the elbow. Creating this ideal arm path has the capability to give pitchers more control of their perceived intensity when throwing.

Poster #112

Title: Effects of Bike Fitting or Physical Therapy on Road Cyclist

Authors: Eric Gasmin, Victoria Valdez, Antonio Squillante, Jim Manton, & E. Todd Schroeder

Faculty Advisor: E. Todd Schroeder

Background: Cycling requires specific biomechanical, metabolic, and musculoskeletal elements. While proper body position optimizes these factors, a poor bike fit may cause discomfort, biomechanical constraint, and increased energy expenditure. Attempting to achieve certain positions potentially leads to orthopedic symptoms. Cyclists either seek professional fitting or physical therapy (PT) to improve comfort, performance, and injury prevention. The benefits between bike fitting, PT, or combined modalities remain unknown. **Purpose**: This study observes the differences between proper bike fitting, PT intervention, or combined modalities on a) lower extremity (LE) biomechanics for pedaling, b) metabolic efficiency, c) injury prevention, and d) concurrent symptom reduction. **Methods**: Road cyclists will be assessed for riding history, bike kinematics, muscular and aerobic demand, and prevalence of orthopedic symptoms using current riding position. Subjects will undergo pre and post-intervention testing: 1) *Retul* bike fit, 2) electromyography and aerobic capacity, and 3) PT assessment. Subjects will be randomized into four groups – 1) control, 2) weekly bike fitting, 3) PT for musculoskeletal range of motion and strength, 4) combined interventions – to observe the effects of a 6-week intervention. **Results**: Of 40 subjects, 50% experienced knee, low back, and foot pain using their prior bike fit. While professional bike fitting only improved symptoms, PT improved LE biomechanics and pain. Combined intervention best improved biomechanics, metabolic efficiency, pain, and prevented injury altogether. **Conclusion**: Professional bike fitting or physical therapy separately, improves comfort in those experiencing bike-related symptoms. However, combined intervention best improves biomechanical, metabolic, and musculoskeletal components of cycling.

OCCUPATIONAL SCIENCE & OCCUPATIONAL THERAPY

DOCTORAL STUDENTS

Poster #113

Title: Relationship of External Wrist Ratio to Sonographic Carpal Tunnel Measurements

Authors: Katherine J. Loomis & Shawn C. Roll

Faculty Advisor: Shawn C. Roll

Background: Carpal tunnel syndrome (CTS) is highly prevalent among U.S. workers, resulting in decreased ability to perform daily activities and increased need for costly healthcare services. External wrist ratio (depth/width >.70) has been found to predict development of CTS. Sonography can illuminate how this ratio relates to internal anatomical structure morphology to aid early identification and improve knowledge on variations in etiology. **Purpose**: To explore relationships between external wrist ratio and sonographic carpal tunnel measurements. **Methods**: We used sonographic imaging on a sample of dental hygiene and occupational therapy students (n=226) to measure median nerve cross-sectional area and carpal tunnel cross-sectional area, depth, width, and depth/width ratio. We conducted exploratory correlation and regression analyses to identify relationships of these measures with external wrist ratio. **Results**: External wrist ratio and carpal tunnel ratio were weakly correlated in non-dominant ($r=0.20$, $p=0.002$) wrists and not correlated in dominant ($r=0.12$, $p=0.053$) wrists. Carpal tunnel width variance was 2.8 and 3.7 times that of the height variance for dominant and non-dominant wrists, respectively; more than double that of the corresponding external measures (i.e., 1.4 and 1.3). Stepwise regression modeling using participant factors and carpal tunnel measurements failed to produce a predictive model accounting for >14% of the variability in external wrist ratio. **Conclusion**: The external wrist ratio risk factor for CTS is not adequately explained by these internal carpal tunnel features. Further research into more specific carpal tunnel anthropometric features and their relationship to the development of CTS is warranted.

Poster #114

Title: Women of Color Pursuing PhDs: A New Gaze on Belonging

Authors: Marshae Franklin,* Camille Parchment,* & Amber Angell

(*Marshae and Camille are co-presenting PhD students.)

Faculty Advisor: Amber Angell

Background: Amid calls for justice, equity, diversity, and inclusion (JEDI) in academia, women of color are increasingly invited to pursue higher education. However, there is a dearth of research about their experiences and the extent to which they do or do not feel supported. **Purpose**: The purpose of this theoretical paper is to problematize current occupational science literature on 'belonging' by critically examining the unique and complex challenges facing women of color (i.e., Asian, Black/African American, Latina, American Indian, or Alaska Native) pursuing PhDs. **Methods**: We first explore belonging theory in occupational science scholarship to highlight the paradox between our discipline's conceptualization of belonging. Second, we describe the landscape of PhD programs that contribute to poor mental health outcomes, highlighting the need for survival at a cost. Third, we examine with an intersectional lens the lived experiences of women of color in academia, using case examples from Elevating Marginalized Voices in Academe by Templeton et al. (2021). **Results**: Our analysis of our case examples of the experiences of women of color in academia yielded four themes: Imposter syndrome, survivor's guilt, palpable fatigue, and cultivating a social network. We denote the resiliency among women of color pursuing PhDs, highlighting how they cultivate belonging within an isolated community. **Conclusion**: Given the recent shifts in academia that underscore justice, equity, diversity, and inclusion (JEDI) efforts, our analysis provides implications for occupational science to reflect critically on authentic experiences of belonging on multiple levels, i.e., micro, meso, and macro.

Poster #115

Title: Co-conceptualizing an active seating system's companion app for older adults

Authors: Denisse Mendoza, Gene Lee, Karen Tapper, &

Stacey Schepens Niemiec

Faculty Advisor: Stacey Schepens Niemiec

Background: Sedentary behavior among older adults is linked to chronic conditions and increased mortality risk. Taking a user-centered approach to developing mHealth technology increases the potential to effectively improve older adults' health behaviors. **Purpose**: For older adult users to co-conceptualize a companion app for an active seating system (*FitSitt*). **Methods**: Community-dwelling older adults 65+ years (*N*=15; 10 female; *M* age=71) were enrolled. Participants were assigned to test and log experiences using an mHealth app for 7-14 days. After the trial period, participants attended a virtual co-design workshop (*n*=5 per workshop), which included discussions on experiences with apps trialed, and functions and features of other commercial health apps. Participants ranked function/feature priorities, which guided concretization of an envisioned *FitSitt* app. The workshop concluded with a storyboarding activity depicting how the *FitSitt* and its companion app could be used by older adults in daily life. **Results**: Incorporating video-based, activity-related educational and instructional content was identified as priority for the envisioned *FitSitt* app. Integrating personalized goal setting and progress tracking functionalities that accommodate various fitness levels and existing health conditions were highlighted as key for engaging older adult users. Participants associated understanding physical activity benefits, having access to visual/auditory guidance, and tracking progress towards personalized goals with motivation to reduce sedentariness. Participants advised that the interface should be simple and user-friendly to account for differing digital literacy levels. **Conclusion**: Findings demonstrate key features and functionalities older adults prioritize for inclusion in a desirable and effective companion app for an active seating system.

Poster #116

Title: Comprehensive Guide for Flexor Tendon Protocols in Hand Therapy

Authors: Jessica Jeong & Aimee Aguillon

Faculty Advisor: Aimee Aguillon

Background: Flexor tendon injuries can result in ruptures post-operatively and current evidence remains limited in guiding patients and practitioners in the understanding of flexor tendon protocols as there are several protocols to choose from. There is still no consensus as to the best technique; however, the aim of tendon repairs and rehabilitation to improve function remains the same amongst all practitioners. **Purpose**: In order to improve knowledge and competence for both patients and practitioners, this research aims to provide a comprehensive guide of commonly used flexor tendon protocols. **Methods**: Based on a literature search across Pubmed, ProQuest, and the Journal of Hand Therapy, we were able to synthesize article findings of the needs of patients and practitioners in order to determine a comprehensive guide for rehabilitation of flexor tendon injuries. **Results**: Based on the findings, a flexor tendon protocol guide is produced to safely progress both patients and practitioners throughout the rehabilitation process. **Conclusion**: It is helpful to know our preferences to improve our current practice and outcomes following these common flexor tendon injuries seen in hand therapy.

Poster #117

Title: Scoping Review: Exploring the Evolution and Utility of Neuro-Occupation

Authors: Sofronia M. Ringold*, Bethany A. Gruskin*, Alison Cogan, & Lisa Aziz Zadeh

(*shared first authorship)

Faculty Advisor: Lisa Aziz-Zadeh

Background: Neuro-occupation has the potential to incorporate a holistic, neuroscientific view of occupation; however, the potential utility of this term has been limited by vague definitions, inconsistent theoretical and clinical applications, and minimal recognition across neuroscience, occupational science (OS), and occupational therapy (OT) literature. Pragmatic implications and utilization of neuro-occupation independent of other neuroscience and occupation terms, has not been previously summarized. **Purpose**: We performed a scoping review focused on how neuro-occupation has been defined in the literature, applied in the fields of OT and OS, and how the term has evolved over time. **Methods**: We followed the Arksey and O'Malley five stage framework for scoping review studies with suggestions by Levac et al. **Results**: 25 works published between 1997-2020 were included. In our descriptive analysis, we found that neuro-occupation evolved from primarily a theoretical concept utilized in the United States to a more widespread term applied to many different clinical populations. Through thematic analysis, common threads emerged such as (1) the reciprocal relationship between the nervous system and occupations, (2) the Intention, Meaning, and Perception (IMP) Model of neuro-occupation, and (3) pragmatic implications for OT practice and interventions. **Conclusion**: Neuro-occupation represents the collaboration between neuroscience and OT. Initially explored theoretically, neuro-occupation has more recently been applied as a theoretical model to improve the study of various clinical populations and OT interventions. A majority of the included studies focused on implications for OT, therefore we suggest that future research devoted to neuro-occupation should consider the utility of neuro-occupation in OS.

Poster #118

Title: Parent and infant outcomes related to engagement in NICU co-occupations

Authors: Marinthea Richter, Polly Kellner, Amber Angell, & Bobbi Pineda

Faculty Advisor: Bobbi Pineda

Background: Parent-infant co-occupations in the NICU can include skin-to-skin care, massage, and feeding. However, such parent-infant occupations in the NICU may be altered due to infant prematurity, comorbidities and/or parent mental health. Caregiver-infant co-occupations, which can include holding or cuddling, rocking, or singing may also occur between infants and healthcare professionals/volunteers when parents are not present in the NICU. **Purpose**: To explore differences in parent mental health and infant neurodevelopmental outcomes based on whether parents or others (volunteers/healthcare professionals) engaged in most of the sensory-based co-occupations with infants in the NICU. **Methods**: Thirty-five parent-infant dyads of preterm infants (born <32 weeks gestation) received the Supporting and Enhancing NICU Sensory Experiences (SENSE) program. Parents, volunteers, and healthcare professionals tracked multi-sensory co-occupational engagement on bedside logs throughout the length of hospitalization. At term equivalent age, infants' neurobehavior was assessed using the NICU Network Neurobehavioral Scale (NNNS), and parents completed self-report measures of mental health. **Results**: Eighty percent (n=28) of the infants engaged mostly in parent-infant co-occupations, while 20% (n=7) participated in caregiver-infant co-occupations with volunteers/healthcare professionals. Infants in the parent-infant co-occupations group had lower NNNS lethargy scores (p=0.036). Parents in the parent-infant co-occupations group had lower state anxiety scores (p=0.047), Parental Stress Scale and Parenting Stress Index (PSI) Stress subscale scores (p=0.003, p=0.012), and lower challenges on PSI parent-infant dysfunctional interaction subscale (p=0.021). **Conclusion**: The role of the parents in co-occupational engagement in the NICU appears important in impacting parent and infant outcomes.

Poster #119

Title: Providers' perceptions of providing therapy via Baby Bridge telehealth

Authors: Bethany A. Gruskin, Marinthea Richter, Delaney Smith, & Bobbi Pineda

Faculty Advisor: Bobbi Pineda

Background: Early occupational therapy (OT) is a necessary medical service provided to many preterm infants discharged from the NICU. However, research has demonstrated that infants discharged from the NICU experience a delay in accessing therapy, waiting an average of 4-5 months before OT services commence. To mitigate these delays, the Baby Bridge Program provides weekly therapy services in the home after NICU discharge until other community-based services commence. The in-person Baby Bridge program was shown to be feasible to implement in urban St. Louis, MO. **Purpose**: To understand providers' perspectives on the feasibility of adapting the Baby Bridge program to a telehealth model. **Methods**: 12 healthcare providers were interviewed with probing of their perspectives on telehealth Baby Bridge services. The interviews were transcribed verbatim and independently coded using NVivo 12 into nodes of positive aspects, negative comments, and suggestions. **Results**: Additional themes emerged through deductive thematic analysis and included the delivery model, family demographics, therapist and organizational characteristics, parent engagement, and therapy facilitation. Within these themes, providers concluded that telehealth may improve access to early therapy, but there could be barriers to service delivery depending on technology and other home or organizational factors. Providers also suggested practical strategies for easing challenges that may arise from utilizing telehealth. **Conclusion**: Baby Bridge telehealth was supported as a feasible service delivery model for the transition from NICU to home. Additional research of actual telehealth therapy delivery compared to traditional in-person models of therapy are warranted.

Poster #120

Title: Acceptability and Perceived Efficacy of Weighted Blankets in Pediatric Dentistry

Authors: Jocelyn Hernandez, Riley W. McGuire, & Leah I. Stein Duker

Faculty Advisor: Leah I. Stein Duker

Background: Up to 42% of children struggle with dental fear and anxiety (DFA), which is linked to adverse oral health outcomes including poor oral health, irregular dental attendance, dental behavior management problems, and the need for pharmacological methods. However, few interventions have been developed and rigorously examined to decrease DFA in dental care settings. **Purpose**: To examine the acceptability and perceived efficacy of using weighted blankets to improve dental care for children. **Methods**: Participants included children aged 6-12 years (n=12 children undergoing dental treatment, their caregiver, and dental provider). Following the use of a weighted blanket during care, respondents completed a survey (17 items, 27 items, 25 items, respectively) about the acceptability and perceived efficacy of the intervention. Acceptability and perceived efficacy were assessed using a 5-point Likert scale ranging from (0) "completely disagree" to (5) "completely agree." **Results**: Caregivers, children, and dentists agreed or strongly agreed that the weighted blanket was easy to use (means 4.25-4.83±0.39); comfortable (means 4.17-4.83±0.39); enjoyable (means 4.27-4.67±0.89); and that using a weighted blanket helped the child relax during dental treatment (means 4.00-4.54±0.69). Caregivers and dentists believed using a weighted blanket during dental care would not require significant changes to the child's dental routine (means 4.55-4.75±0.45) and would improve the child's dental experience (means 4.5-4.67±0.49). **Conclusion**: Respondents reported that use of a weighted blanket was acceptable and beneficial during dental care encounters for children. Next steps should include an experimental study examining efficacy for children with DFA during dental treatment.

Poster #121

Title: Measurement and Treatment of IADL in Oncology: A Scoping Review

Authors: Alexandra Feldman, Kathleen Lyons, Caroline Klein, Pamela Roberts, & Alix Sleight

Faculty Advisor: Leah Stein-Duker (Site Preceptor: Alix Sleight)

Background: People with cancer often experience limitations in instrumental activities of daily living (IADL), defined as complex tasks of everyday life such as shopping and household maintenance. A decrease in IADL after cancer often leads to a lower overall level of function, with IADL impairments typically *preceding* impairments in basic activities of daily living (ADL). IADL status may therefore be conceptualized as a proxy for long-term functional potential in cancer survivors. **Purpose**: Despite the importance of IADL in predicting and facilitating overall function after cancer, key gaps exist in occupational therapy practice and research surrounding IADL for this population. **Methods**: A scoping review was conducted to assess the landscape of IADL research in oncology relevant to occupational therapy. A methodical search of PubMed, Scopus, and OTseeker produced 6,730 abstracts. Of these, 14 studies met inclusion criteria. **Results**: Correlates of IADL function in cancer survivors included: physical and functional well-being, fatigue, general satisfaction in functional performance, and global quality of life. Studies indicated that IADL were often impacted more than ADL among cancer survivors, and those with IADL limitations were more likely to have a higher number of hospitalizations/re-admissions than those with ADL limitations alone. **Conclusion**: Interventions focused specifically on IADL are limited, and current tools used to measure IADL are outdated and narrow in scope. Further research is required to develop and test clinical interventions to treat IADL impairments in cancer survivors and to address the impact of IADL function on hospitalization, length of stay, and cost of care.

Poster #122

Title: Exploring Occupational injustice among young adults with Type-1 Diabetes

Authors: Ngozi Nnoli*, Stuti Chakraborty*, Pey-Jiuan Lee, Alison Cogan, & Elizabeth Pyatak *Joint first authors and presenting authors

Faculty Advisor: Elizabeth Pyatak

Background: Type 1 Diabetes (T1D) is a chronic disease that requires ongoing self-management, which is highly influenced by access to resources/external factors (e.g., income, socioeconomic status). Limitations in choice, access to resources, or opportunities to participate in meaningful occupations can disrupt young adults' (YAs) ability to manage their diabetes and render them vulnerable to occupational injustice. **Purpose**: The purpose of this study was to examine whether social needs (SN), race/ethnicity, or socioeconomic status (SES) are associated with mental well-being (SF-12v2 mental component summary), diabetes-related

quality of life (ADDQoL), and diabetes self-management (DSMQ) among YAs with T1D. **Methods**: Young adults (18-30 years old) with T1D from the REAL-T study were recruited. Multiple regression models were used to assess the contribution from the independent variable: social needs (SN), and covariate variables (race/ethnicity and parental education level) to the dependent variables: SF-12v2, ADD-QoL, and DSMQ, while adjusting for age. **Results**: Data from 164 participants (24.4 years old; 54.3% Non-Hispanic White, 31.1% Hispanic, 14.6% Non-Hispanic Minority) were analyzed. Analyses revealed that more social needs predicted poorer mental well-being (r^2 = 0.314, p = < 0.001), diabetes-related QoL (r^2 = 0.146, p = 0.001), and diabetes self-management (r^2 = 0.151, p < .001) while accounting for the covariate and controlling variables. Diabetes self-management was better in Hispanic/Latinx participants than in other groups (β= 0.551, r^2 = 0.151, p < 0.05). **Conclusion**: Overall, social needs predicted decreased diabetes self-management, mental well-being, and diabetes-related QoL, demonstrating the impact of social deprivation and marginalization on YAs with T1D.

Poster #123

Title: Empathy, Affect Recognition and Alexithymia in Children with ASD

Authors: Nandita Raman, Sofronia Ringold, Aditya Jayashankar & Lisa Aziz-Zadeh

Faculty Advisor: Lisa Aziz-Zadeh

Background: Empathy and affect recognition are important components of socialization and communication. Empathy can be divided into cognitive and affective components. In autism, most research indicates difficulties with cognitive empathy, while affective empathy is less understood. Additionally, little understanding exists of the relationship between empathy and affect recognition in autism (ASD). **Purpose**: Explore difference in empathy between ASD and typically developing (TD) groups and the relationship between empathy, affect recognition, and alexithymia. **Methods**: Data collected from 56 TD children and 57 children with ASD between the ages of 8-16 years were analyzed. Cognitive and emotional empathy, affect recognition, and alexithymia was compared between groups, using the Interpersonal Reactivity Index (IRI), Empathy Questionnaire (EmQue), NEPSY-II, and alexithymia (The way I feel). **Results**: Affect recognition, cognitive empathy, and IRI Perspective Taking were significantly higher in the TD group compared to ASD group (p<.0005, p=.04, p=.02, respectively). However, IRI Personal Distress and alexithymia was significantly higher in the ASD compared to the TD group (p=.02, p<0.0005, respectively). In the ASD group, there was a significant negative correlation between IRI Personal Distress and affect recognition (r=-.276, p=.038), and positive correlation between IRI Personal Distress and alexithymia (r=.477, p<.001). **Conclusion**: Results line with previous research which suggests differences in cognitive empathy and affect recognition among children with ASD compared to TD. Interestingly, in ASD, a decrease in affect recognition ability is correlated with increase in personal distress. This indicates that autistic individuals with stronger differences from typical in overwhelming feelings of personal distress over others' experiences also have more difficulties at reading others' emotional expressions.

Poster #124

Title: Short-term impacts of physical activity on mood and well-being

Authors: Loree Pham, Ray Hernandez, Donna Spruijt-Metz, Jeffrey S. Gonzalez, & Elizabeth Pyatak

Faculty Advisor: Elizabeth Pyatak

Background: Few studies have investigated the short-term, momentary relationships between physical activity (PA) and well-being. **Purpose**: This study focuses on investigating the dynamic relationships between PA and affective well-being in adults with T1D. **Methods**: Participants completed daily ecological momentary assessment surveys regarding current activities (activity type and importance) and affective well-being (e.g., happy, stressed, excited, anxious) via mobile phone six times per day over 14 days. Time spent in vigorous PA, moderate PA, light PA, and sedentary was measured using wrist-worn accelerometers. Between and within-person correlations between PA, well-being, and activity type were calculated from the three-hour time period preceding the survey prompt. **Results**: Overall, 8,639 datapoints from 122 adults (41±15 yrs, 56% female, 38% Latinx, 35% White) across 1,812 days were analyzed. Within person, increased sedentary time was associated with less positive affect (r = -0.11, p < 0.001), while more PA was associated with greater positive affect (r = 0.09 to 0.10) and reduced fatigue (r = -0.05 to -0.07), three hours later (p < 0.001). Between-person, however, increased light PA was associated with increased stress (r = 0.21, p = 0.023) and diabetes distress (r = 0.30, p < 0.001). **Conclusion**: This study provides evidence that positive affect, fatigue, stress, and diabetes distress is associated with previous PA. These findings have implications for the timing of short-term interventions, such as just-in-time adaptive intervention approaches.

Poster #125

Title: Prevalence and factors associated with work-related discomfort in sonographers

Authors: Yoko E. Fukumura, Carolyn M. Sommerich, Nicole Stigall-Weikle, Kevin D. Evans, & Shawn C. Roll

Faculty Advisor: Shawn C. Roll

Background: Supporting worker health and well-being requires an understanding of the complex transactions among the worker, work tasks, and various work systems. One occupational group at risk for many work-related ailments is ultrasonography users. The Sonography Work Systems (SWS) model was developed using the Systems Engineering Initiative for Patient Safety as a foundational framework to explore the unique work system factors associated with musculoskeletal discomfort, visual strain, and headaches among ultrasonography users. **Methods**: A collaborative of professional organizations sent an e-mail invitation to approximately 100,000 unique ultrasonography users, combined with recruitment via snowball sampling through social media. Data were collected using Qualtrics from June 8-28, 2021. The questionnaire included questions on personal demographics, constructs within the SWS, and experiences of work-related musculoskeletal discomfort, visual discomfort, and headaches. Regression models were conducted to examine the association of SWS factors with each discomfort outcome. **Results**: 3,659 responses were included for analysis, and 86% of respondents reported regularly experiencing work-related musculoskeletal discomfort. 54.25% of respondents reported participating in sonography-related ergonomics training. Additionally, respondents indicated using adjustable equipment approximately 74% of the time. On average, respondents indicated that employers implemented only 2 out of 7 commonly recommended ergonomic policies and procedures. Higher implementation of ergonomic policies, more frequent use of adjustable equipment, taking work breaks, positive work culture, and minimal workflow interruptions were all associated with reduced risk for work-related discomfort (p<0.01). **Conclusion**: Findings demonstrate a need for holistic support for ultrasonography workers at the organizational level to prevent discomfort and promote well-being.

Poster #126

Title: Transaction Between Primary Care Services and Latinos with Chronic Conditions

Authors: Valerie Tapia, Yujia Mo, Gabby Granados, Elissa Taylor, Daniel Padilla Vega, Elaina Rodriguez Garza, Daniella Flores, Jesus Diaz, & Elizabeth Pyatak

Faculty Advisor: Elizabeth Pyatak

Background: Providing quality care to underserved low-income, non-English-speaking patients with chronic conditions is a pervasive issue in the United States. Occupational therapy (LROT®) doctorate residents were integrated into a LAC+USC primary care since 2017 to provide LROT® for patients with uncontrolled diabetes (HbA1c > 9.0%) and hypertension (BP > 160/100). **Purpose:** This presentation pragmatically examines the impact of an LROT® intervention on HbA1c, and blood pressure. LROT® interventionists provide their overall experiences with patients during their residency. **Methods:** Patients were referred to a 6-month LROT® intervention, screened, consented, and enrolled for free services. Pre and post-surveys related to health management behaviors were administered. Demographic and clinical data were extracted from the electronic health record (EHR) as ordered by the care management team. **Results:** Patients were majority female (n=66, 55%), middle-aged (IQR 46-63 yrs) and identified primarily as Latino (n=100, 83.33%) that speak Spanish (n=88, 73.33%) with a primary diagnosis of Type 2 diabetes (n=108, 90%) and utilized majority MediCal 93 (77.50%). Eighteen patients experienced homelessness (15.00%) and 38 patients experienced food insecurity (31.67%). Wilcoxon Signed Rank's Tests indicated a statistically significant reduction in HbA1c (p<.001) post-intervention, however, there was not enough evidence to support a statistically significant reduction in blood pressure (p>.05). **Conclusion:** LROT® can be beneficial for HbA1c maintenance; however, more investigation is required to determine whether LROT® is beneficial for patients with hypertension. Providing LROT® to this population illustrates that health outcomes transact with service experiences in the cultural context.

Poster #127

Title: Challenges and Opportunities in Work & Industry Occupational Therapy Practice

Authors: Yiyang Fang, Jody Liu, & Shawn C. Roll

Faculty Advisor: Shawn Roll

Background: Work is a primary occupational category in the occupational therapy (OT) practice framework, yet there are minimal resources to support therapists in work and industry (W&I) settings. **Purpose**: Explore the state-of-art of W&I OT practice. **Methods**: This cross-sectional survey consisted of 35 multiple-choice and Likert-scale questions across three domains: training and resources, challenges and barriers, and opportunities. We invited OTs in W&I known to the study team and posted on social media, relying on snowball sampling for recruitment. Descriptive data analysis was completed using SPSS. **Results**: The study yielded 120 complete survey responses. Around 80% of respondents were practitioners with at least 5 years of experience. About 70% of respondents rated continuing education (CE) courses as very to extremely important; nevertheless, only 20% to 30% of respondents considered CE courses very to extremely abundant or accessible. 85.4% of respondents strongly and somewhat agreed that their work relies on research evidence from other professions. Although over 60% of respondents felt prepared to contribute to evidence in W&I OT, only 33% were aware of opportunities to contribute to research. On average, respondents reported 2.4 ± 1.6 workplace issues, of which the top three were workplace stress, cognitive fatigue, and emotional fatigue. The top three opportunities for OT within W&I were workplace injury prevention, psychosocial issues for returning to work, and workplace integration support for marginalized individuals. **Conclusion**: Findings in this study revealed an underrepresented OT voice in research and clinical training resources, warranting calls for action in the W&I OT community.

Poster #128

Title: Improving Healthcare for Latinx Autistic Children: Curriculum Development for Pediatricians

Authors: Alexis Rodriguez & Amber Angell

Faculty Advisor: Amber Angell

Background: Pediatric healthcare providers play an important role in identifying autism and caring for autistic children. However, disparities exist for Latinx autistic children: Pediatricians report difficulty accurately identifying autism in Latinx children, and Latinx parents report a lack of access to high quality healthcare for their children. **Purpose:** The purpose of this work-in-progress is to create an evidence-based, culturally-sensitive curriculum for pediatric practitioners (e.g., pediatricians, primary care physicians) to improve care for Latinx families of autistic children. **Methods:** We conducted a thorough review of the literature and needs assessment. Identifying existing interventions and best practices. We then created curriculum modules based on the literature. Next steps include obtaining input on the modules from Latinx caregivers of autistic children; incorporating this stakeholder feedback; and pilot testing with a small group of practitioners. Results: Currently, this work in progress is in development. Modules that have been developed include topics such as: How to accurately identify signs of autism in Latinx children; how to build respectful rapport with Latinx families; a strengths-based understanding of Latinx culture, and the importance of continuous self-reflexivity and associated practices. **Conclusion:** This work-in-progress focuses on reducing documented disparities experienced by Latinx families of autistic children by educating and training pediatric healthcare providers through an innovative, evidence-based curriculum. The ultimate goal of this curriculum is to equip practitioners to confidently and respectfully engage with Latinx families of autistic children, improving early and accurate identification of autism in this population and improving quality of care.

Poster #129

Title: Establishing a comprehensive definition of parent responsiveness: A systematic review

Authors: Emily Campi, Elizabeth Nye, & Grace Baranek

Faculty Advisor: Grace Baranek

Background: Early intervention occupational therapists (OTs) are uniquely positioned to address parenting and infant development. Parent responsiveness (PR) to infant cues is important for development across domains and can be addressed by OTs. PR has been defined in myriad ways, which may impair understanding of this parenting behavior. **Purpose**: To establish a comprehensive and coherent definition of PR that can be used for future scale development. **Methods**: This study is a systematic review using content analysis. We searched PubMed, CINAHL Complete, and ProQuest Nursing and Allied Health. Search terms for PR were: responsiveness, sensitivity, synchrony, and attunement. We used Covidence software to organize the review. Inclusion criteria

were: studied infants at mean age of 6-18 months, focused primarily on PR, contained a definition of PR, and published in English in a peer-reviewed journal. Two trained study personnel independently reviewed 18,983 article titles and abstracts and 1,629 full texts for inclusion. We extracted and thematically coded the definitions of PR to establish a comprehensive definition. This abstract includes 60 studies that have been thematically coded; we expect approximately 300 will be included in the final results. **Results**: PR is timely, appropriate, predictable, transactional parent behavior that includes: (a) attention to the child, (b) contingent responses, (c) verbal and physical interaction, (d) effective conflict resolution, and (e) following the child's lead. **Conclusion**: PR is a key construct across research and clinical settings. This comprehensive, dimensional definition can be used to inform future studies of the nuances and implications of this important construct.

Poster #130

Title: An Investigation into Office Worker Perceptions of Eustress versus Distress

Authors: Madeline Parga, Gale M. Lucas, Burcin Becerik-Gerber, Shri Narayanan, & Shawn C. Roll

Faculty Advisor: Shawn C. Roll

Background: The conceptual distinction between eustress, stress which motivates progress in activities, and distress, stress which hinders such progress, is well-established. It remains to be understood how people perceive their daily interactions with stress as either eustress or distress, and the further implications of this distinction. **Purpose**: This study will investigate factors associated with trends in workers' perceptions of stressful activities as opportunities for growth or improvement versus overwhelming pressures. **Methods**: Daily data collection will occur with thirty office workers over a 4-month period. Workers will complete four Ecological Momentary Assessment (EMA) surveys each day to obtain information on their current activity, mood, productivity, stress level, and appraisal of the activity and environment as generally positive or negative. This data collection is preceded by one-on-one participant interviews in which we will learn more about their job, preferences for conducting work, and perspectives toward stress. Following the 4-month period, we will conduct a focus group with the cohort to garner reflections on their work-related stress experiences throughout the study. **Results**: First, thematic analysis of interviews will result in themes of stress surrounding the workplace. Next, analyses of repeated survey data will result in stress trends related to activity type, time of day/week, and other daily factors. Finally, survey analysis will contribute to the identification of relationships between stress distinction and productivity, mood, and environmental conditions. **Conclusion**: Understanding individual stress experiences as eustress or distress can be used to make effective suggestions for optimizing workplace stress.

Poster #131

Title: Social Isolation, Third Places, And Precarious Employment: A Scoping Review

Authors: Gorety Nguyen, Sarah Larkin, Kassandra Fernandes, Joana Akrofi, Randee Elias-Moran, Debbie Laliberte Rudman, & Rebecca Aldrich

Faculty Advisor: Rebecca Aldrich

Background: Increasing precarious employment (i.e. gig work, involuntary part-time work, seasonal work, temporary migrant work) and social isolation rates in middle- and high-income countries have generated discussion regarding 'third places' - physical and/or virtual spaces beyond work and home for social interaction, support, and belonging. As unstable workplaces often leave workers lacking resources and social opportunities, the role of third places needs to be reexamined in the context of precarious employment. **Purpose**: This project sought to understand the state of knowledge regarding different types and characteristics of third places and how they facilitate social connectedness and mitigate social isolation among precarious workers. **Methods**: This project implemented a scoping review of articles that were published in full-text English language journals between 2012 and 2022; were peer-reviewed; had primarily studied adults experiencing precarious work conditions; and exhibited findings pertaining to third places, social connection, or social isolation. **Results**: Twenty-four articles depicted how the roles of third places extend beyond that of pure sociability to facilitating a sense of belonging within a group; providing temporary refuge from precarious conditions; asserting visibility to counter social marginalization; and facilitating exchanges of resources and support to manage effects of precarious work circumstances. **Conclusion**: Third places can be leveraged to combat the isolation and exclusion of precarious workers, but access to third places is not always equitable. Precarious workers' diverse uses and creation of third places highlight opportunities for continued research, policy, and practice surrounding place-informed interventions with people experiencing precarious employment circumstances.

Poster #132

Title: Positive Effects of Lockdowns on Families of Autistic Children

Authors: Savannah Gluck, Svitlana Stremousova, Mary Lawlor, & Grace Baranek

Faculty Advisor: Grace Baranek & Mary Lawlor

Background: COVID-19 was a significant event that affected the routines and occupations of autistic children and their families (Tokatly-Latzer et al., 2021). It is unknown what information is available in the literature regarding this topic. **Purpose**: This study aims to contribute to the understanding of the current research about the positive effects of COVID-19 lockdowns on the occupations of autistic children and their families. **Method**: This study used a scoping review methodology to search and analyze current literature systematically (Tricco et al., 2018). We searched PubMed, CINAHL, PsycInfo, and ERIC databases using the keywords "autis*," "coronavirus", "effect", "outcom*," and "impact* and then used criteria related to our research question. After reviewing articles, we identified consistent qualitative themes. **Results**: We found five positive themes: more time spent together as a family, increased engagement in familiar and meaningful occupations, improvement in family and parent-child relationships, parenting skills and abilities, and mental health for an entire family. Identified protective factors include adaptability and self-efficacy of parents of autistic children, effective co-parenting and positive social supports, continuity of education and therapy services, socioeconomic status, presence of other diagnoses, and required support. **Conclusion**: This scoping review provides an overview of the current research on the positive effects of COVID-19 lockdowns on the occupations of families of autistic children. Understanding the impacts of the lockdowns on parents and autistic children is essential for clinicians because it provides insight into the heterogeneity of familial occupations and caregivers' strengths that can inform interventions during such events.

Poster #133

Title: Understanding Stress in Parents of Children with ASD: Cross-Cultural Differences

Authors: Hanjun Xu, Savannah Gluck, Julia Lisle, & Grace T. Baranek

Faculty Advisor: Julia Lisle & Grace T. Baranek

Background: Parents of children with autism commonly present with higher levels of stress. Parental stress can negatively impact a family's quality of life. Currently, there are many types of interventions used in United States of America to alleviate parent stress. However, there are limited interventions for parents in China. In a globalized world, it is meaningful to explore the adaptability of using existing American intervention programs in China with considering the family's cultural context. **Purpose**: This study aims to compare and contrast the stress in parents who have children with autism living in China and America. **Methods**: Three English databases and two Chinese databases were searched for eligible studies using the keywords "autism", "child*", "parent*", "stress*". The eligible studies were published from 2010 - 2022. For each included study, we collected information related to the contributors to parent stress. **Results**: 18 Chinese studies and 15 American studies met the inclusion criteria. We found 4 shared themes: symptom-related stress, financial burden, changes in family interaction, and stigma. Three themes unique to China: geographical barriers, a limited number of professional services, and collectivist culture. Three themes unique to America: lacking self-care, systematic barriers, and individualism culture. **Conclusion**: Our findings demonstrate there were common contributors to parental stress in China and America; however, due to different cultural and societal contexts, researchers and clinicians need to consider and moderate the unique contributors to Chinese parent stress. This may effectively improve the Chinese parents' quality of life when applying existing American interventions.

Poster #134

Title: Literature review: Best practices for screening autism risk in preemies

Authors: Cindy Teow, Allison Q. Phillips, & Grace T. Baranek

Faculty Advisor: Dr. Allison Q. Phillips & Grace T. Baranek

Background: The American Academy of Pediatrics recommends full term infants (FTI) be screened for autism at 18 and 24 months, however, recommendations for preterm infants (PTI; <37 weeks gestational age) are vague. Screening is critical, as PTI are three times more likely than FTI to get an eventual diagnosis of autism. Additionally, given that PTI often present with motor and language delays, practitioners may be challenged in differentiating general developmental delays from autism-specific behaviors, thereby delaying accurate diagnosis. **Purpose**: To describe the current and best practices for autism screening in PTI, and outline possible implications for occupational therapists and health professionals working with PTI. **Methods**: A literature search was conducted using PubMed, PsychInfo, and Google Scholar, with terms "preterm infants, preemie, low birthweight, low gestational age, autism, autism spectrum disorder, and screening". Publications with PTI and autism screening were included. 17 articles were then appraised using checklists from the Critical Appraisal Skills Program. **Results**: 10 studies used parent report (PR) measures; 4 studies used both clinician observation and PR; and 3 solely used clinician observation for PTI. Using both types of measures would 1) increase likelihood of true positive screens, 2) reduce false positives as compared with using PR measure, and 3) reduce parent bias when using an objective measure. **Conclusion**: Combining PR and clinical observation measures increases the accuracy of autism screening in PTI. Practitioners should be aware of the increased prevalence of autism in PTI and be trained in identifying early behavioral markers of autism.

Poster #135

Title: Clinicians' Perspectives: Impact of COVID-19 on the Autism Community

Authors: Mariamme Ibrahim, Svitlana Stremousova, Emily Ochi, Mary Lawlor, & Erna Blanche

Faculty Advisor: Mary Lawlor & Erna Blanche

Background: The COVID-19 pandemic has caused significant disruptions in the lives of the autistic community including autistic individuals, families, and service providers who support this population. **Purpose**: The purpose of this study is to understand the lived experiences of clinicians serving autistic populations to gain insight into the impacts of the COVID-19 pandemic. Narrative strategies are used to highlight the intersectional effects of health and social inequities and racial injustices for this population. **Methods**: The conceptual framework for this study draws on narrative phenomenological and ethnographic studies to help us better understand lived experiences. Narrative interviewing provides insight into the lives of this population through storytelling and helps us understand how individuals and groups make sense of their experiences over the course of the pandemic. This paper in particular will focus on the experiences of practitioners, including occupational therapists (OTs) providing services for this population during the pandemic, however this data is part of a larger study that gathers multiple perspectives of the COVID-19 experience. **Results**: More definitive data themes will be presented, however preliminary themes from a collection of interviews with practitioners reflect new understandings as a result of the pandemic, new opportunities that telehealth services presented, and an understanding of the various clinician-family relationships throughout the pandemic. **Conclusion**: Understanding the lived experiences of clinicians serving the autistic population throughout the COVID-19 pandemic is an important step in addressing ways to move forward to promote health and bridge home, clinic, school, and community life to support autistic individuals.

Poster #136

Title: Temporal stability of the First-Year Inventory (FYI) to identify elevated risk of autism in infants

Authors: Tiffany Cha, Julia Lisle, Allison Q. Phillips, Katherine Hayes, & Grace T. Baranek

Faculty Advisor: Allison Q. Phillips, Julia Lisle, & Grace T. Baranek

Background: Children that go on to receive an autism diagnosis can display risk signs as early as 6-months. Despite these differences, receiving a formal diagnosis is often delayed. The First-Year Inventory (FYI) is a parent-report measure designed to identify risk for autism in infants. Current literature has analyzed the FYI's performance and predictability of a later diagnosis, but there is limited knowledge of the FYI's stability. Temporal stability is an important measure of reliability and is useful in understanding change over time within the constructs assessed. **Purpose**: To investigate the FYI's ability to consistently identify infants at elevated risk for autism over a 3-month period and to explore environmental factors that may have contributed to any variance. **Methods**: Data from a community sample of infants (6-18 months), enrolled in a longitudinal study were obtained. Caregivers completed the FYI 3.1 at three timepoints. FYI scores indicated whether infants were at low or elevated risk for autism. Chi-squared analysis was used to assess the stability of pass/fail rates. **Results**: Less than 2% of participants are projected to be identified for elevated risk due to a small sample size and low prevalence. Scores are predicted to remain relatively stable. Of those at risk, differences are predicted to be due to initiation of services

and/or the implementation of activity suggestions. Data collection is currently underway. **Conclusion**: Examining the psychometrics of the FYI is beneficial for the development of clinically-relevant screening tools. With earlier identification, the initiation of services and intervention can begin for improved functional outcomes.

Poster #137

Title: Lived Experiences of Families with Autistic Children in COVID-19 Pandemic

Authors: Svitlana Stremousova, Mariamme Ibrahim, Brigid M. Connelly, & Mary Lawlor

Faculty Advisor: Mary Lawlor

Background: The recency of the COVID-19 pandemic may limit our understanding of its consequences on autistic children, their families, and communities. While the COVID-19 pandemic has impacted almost everyone, autistic individuals have been disproportionately affected by this unprecedented event (Pfeiffer et al., 2022). The breach in everyday life has endured much longer than initially anticipated and dislocated many families from their narrative and temporal structuring of life. **Purpose**: This paper aims to contribute to the understanding of lived experiences for autistic children and their families by sharing interpretations of multiple narrative perspectives. **Methods**: This paper draws on narrative phenomenological and ethnographic research to explore how autistic children and their families experienced occupational disruptions and encountered emerging needs that affected the collective capacity to move forward and find opportunities to leverage newfound strengths. The paper utilizes a subset of data that is a part of the larger study that gathers multiple narrative perspectives on the COVID-19 experience. **Results**: Data themes from a collection of interviews with participants reflect the significance of the lived experiences in the first twenty months of COVID-19, including newly found capacities and strategies to optimize recovery and build scenarios for the future. **Conclusion**: Health and social inequities and racial injustices had intersectional effects on the lived experiences of the autistic population across the first twenty months of COVID-19. Managing uncertainty and tolerating ambiguity during the current phase of transition relies on the applicability of narrative strategies to enhance scenario-building for the future.

Poster #138

Title: Enhancing the usability and acceptability of a post-stroke biofeedback system

Authors: Miranda Donnelly*, Aisha Abdullah*, Octavio Marin-Pardo, Coralie Phanord, Barrisford Bladon, Kyle Nishimura, & Sook-Lei Liew

Faculty Advisor: Sook-Lei Liew

Background: Electromyography (EMG) biofeedback can lead to improvements in motor control, opening doors for participation in remote post-stroke rehabilitation for individuals with severe disability (Marin-Pardo et al., 2021). However, more work is needed to understand the usability and acceptability of home-based EMG biofeedback. **Purpose**: To examine and enhance the usability and acceptability of an EMG-biofeedback system (Tele-REINVENT) among stroke survivors. **Methods**: Nine stroke survivors used Tele-REINVENT for six weeks, then completed the Post-Study System Usability Questionnaire (PSSUQ) and a Unified Theory of Acceptance and Use of Technology scale (UTAUT), as well as a semi-structured interview. We calculated a mean score for each questionnaire item. Interview data were coded independently by two researchers using UTAUT and PSSUQ constructs (e.g. satisfaction, self-efficacy, behavioral intention, system quality) then discussed to reach consensus and improve intercoder reliability. The coded qualitative data were then matched with PSSUQ and UTAUT items. We analyzed data from the poorest performing items (neutral to dissenting responses) to develop recommendations to improve the usability and acceptability of Tele-REINVENT. **Results**: The poorest performing items on the UTAUT were distributed across four subscales. The lowest scoring PSSUQ items were on the information quality subscale. These results were corroborated by qualitative data and together informed improvements for Tele-REINVENT. **Conclusion**: Our findings suggest that improvements to the user interface may enhance the usability and acceptability of Tele-REINVENT. Interpersonal features of the system also appear to positively influence usability and acceptability, highlighting the value of both the technological and human components of Tele-REINVENT.

Poster #139

Title: Pelvic Floor Rehabilitation through a Biopsychosocial Approach

Authors: Michelle Plevack & Shawn C. Roll

Faculty Advisor: Shawn C. Roll

Background: Pelvic floor dysfunction (PFD) presents across all age groups and genders with increasing prevalence. Pelvic health encompasses sexual wellness, confidence, toileting access, and other senses of identity. While best practice applies a biopsychosocial framework, it is unknown how well the current literature for PFD rehabilitation supports biological, psychological, and social interventions. **Purpose**: Characterize existing PFD rehabilitation literature within a biopsychosocial framework to identify strengths and gaps in current evidence. **Methods**: A systematic search was conducted using MeSH terms and keywords for PFD and biopsychosocial rehabilitation in PubMed, CINAHL, and PsycInfo. Studies describing interventions for PFD within the scope of rehabilitation (e.g., occupational therapy, physical therapy) published in English before Dec-2022 will be included. In addition to extracting descriptive information about the studies and interventions, the studies will be categorized into biological, psychological, and/or social approaches. Descriptive statistics (e.g., frequencies) will be calculated across all data categories to demonstrate what evidence exists across time, by study type, diagnoses, demographics, and other factors relative to the categories of interventions. Various graphical displays will be created to characterize the scope of the literature across the descriptive variables. **Results**: Descriptive mapping of published literature for PFD rehabilitation interventions categorized within a biopsychosocial framework will demonstrate areas of need for further evidence to support the full scope of practice for pelvic floor therapy. **Conclusion**: This review will inform and provide context for providers, patients, and policymakers in the future development of research, health promotion programs, and labor management practices in PFD prevention and rehabilitation.

OCCUPATIONAL SCIENCE & OCCUPATIONAL THERAPY

PROFESSIONAL STUDENTS

Poster #140

Title: Critical Appraisal Paper: Sensory Integrative Therapy

Authors: Liza Abigail Khou & Ashley Halle

Faculty Advisor: Ashley Halle

Background: Sensory Integration Therapy is compared with standard school-based OT on its effectiveness in addressing sensory processing difficulties in this RCT. The study is assessed to have high internal validity because of randomization, blinding, and homogeneity of participants. The study's affirmation of the efficacy of SI in improving occupational performance in the domains of volition, habituation, communication interaction skills, process skills, motor skills and environment can be basis for using SI interventions for children with autism. **Purpose**: The aim of the Critical Appraisal Paper is to assess the effectiveness of Sensory Integration Therapy (SIT) on various determinants of occupational performance in children with ASD compared with standard school-based OT as presented by the study the RCT by Kashefimehr, et. al, 2018. **Methods**: Group 1 (control group) did not receive SIT and only participated in routine school OT. There were 15 participants in the group. Group 2 (intervention group) received 24 sessions of SIT, administered twice a week at 45-minute session lengths. **Results**: Although there were no significant differences in SCOPE domain scores before the intervention was provided, a significant difference in scores was seen between the control and intervention groups in the sensory seeking, sensory sensitivity and behavioral outcomes. **Conclusion**: The results are statistically significant and therefore conclusive within the study that SIT is more effective than standard school OT in improving occupational performance.

Poster #141

Title: Sensory Experiences of Typically Developing Children

Authors: Kayla Brown, Julia Lisle, John Sideris, & Grace Baranek

Faculty Advisor: Grace Baranek & Julia Lisle

Background: Sensory processing challenges can impact a child's ability to respond appropriately to sensory stimuli in their environment, impacting behavior, cognition, and motor functioning. Various studies have already examined sensory processing patterns among children with neurodevelopmental disorders; however, little is known about the sensory features of typically developing children. Given that sensory features can manifest differently across the lifespan, investigations exploring the sensory experiences of typically developing youth are warranted. Such information can assist in establishing measurement norms and aid in identifying atypical sensory responses for children with autism or other neurodevelopmental disorders. **Purpose**: The purpose of this study is to examine the sensory features of typically developing children ages 2-12 and how they vary across age and sex. **Methods**: Parents of typically developing children are being recruited via social media to complete the Sensory Experiences Questionnaire 3.0 (SEQv3.0). The SEQ is a parent report questionnaire, used to sensory processing (hyper-, hypo-responsiveness, sensory interests, repetitions and seeking, and enhanced perception) for children ages 2-12. Upon completion of recruitment, appropriate statistical analysis will be used to measure typical ranges of sensory processing.

Poster #142

Title: The Effectiveness of Play Therapy on Anxiety for Hospitalized Children

Authors: Halla Badawood, Shahad Almohsen, Bhargavi Kalanji, Raghad Alnujayban, Ankit Bhagwane, & Sharon Cermak

Faculty Advisor: Sharon A. Cermak

Background: Hospitalization can be an anxious experience for children which in turn can affect their physical, physiological health and overall wellbeing, thus the medical procedures and recovery. Play is an essential occupation for children. Besides its benefits, play allows children to express themselves, have better relationships with providers, feel relieved and fill their time. **Purpose**: The purpose of this Critically Appraised Topic is to examine the effectiveness of therapeutic play in reducing anxiety in hospitalized children. **Methods**: PICO Question: For hospitalized children, what is the effect of therapeutic play in reducing anxiety? Study Types included were meta-analysis, systematic reviews, randomized control trial (n=7) age birth-18 years (n=5). Titles and abstracts were reviewed to identify inclusion criteria met articles. Full text articles were then reviewed. Excluded (n=3), did not meet the intervention or the outcome component. Included (n=4). **Results**: Therapeutic play interventions are effective in reducing pre- and post-operative anxiety and pain compared to standard care. Moreover, it is effective for hospitalized children as it reduces postoperative pain and anxiety during hospital stay as well as behavior and attitudes improvements compared to children in control groups. There was an exploration of therapeutic play as well as other non-pharmaceutical methods. Children who received the interventions prior to surgery experienced less anxiety than those who received usual treatment. The perioperative puppet show was effective in reducing peri and post-operative pain and anxiety during awake circumcision under local anesthesia compared with controls. **Conclusion**: We can conclude that therapeutic play intervention for hospitalized children is an effective evidence-based intervention for anxiety reduction.

OCCUPATIONAL SCIENCE & OCCUPATIONAL THERAPY AFFILIATES

Poster #143

Title: Job Satisfaction Among Occupational Therapists Working in Riyadh, Saudi Arabia

Authors: Hayouf Alobathani

Faculty Advisor: N/A Research conducted outside of USC

Background: Job satisfaction is a critical factor that must be considered in every profession. It is important for both the employees and the institutions they work for. **Purpose**: The aim of this study was to identify the level of job satisfaction of occupational therapists working in Riyadh, Saudi Arabia. **Methods**: This is a cross sectional descriptive study. A validated job satisfaction questionnaire composed of 44 items was distributed and collected from licensed occupational therapists working in 4 hospitals in Saudi Arabia, with at least one year of experience in direct patient care. The sampling was a non-probability purposive sampling. **Results**: A total of 48 occupational therapists responded to the questionnaire, most of which reported high overall satisfaction level. Occupational therapists showed satisfaction with coworkers, care provided to clients, and autonomy. On the other hand, occupational therapists showed dissatisfaction with salary compared to the work efforts, lack of reimbursement for continuing education, and lack of opportunities for career advancement. The overall level of satisfaction of the occupational therapists was high. **Conclusion**: Efforts must be directed towards maintaining this level of satisfaction. Human resources are encouraged to support areas of satisfaction and find solutions to areas of dissatisfaction.

FROM THE EDITORS

To our fellow students, faculty, and staff:

It is our honor and privilege to present to you the Fifteenth 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 Mrs. T.H. 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 that 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, 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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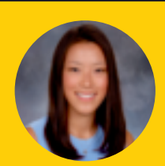
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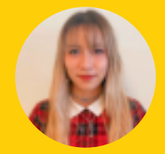
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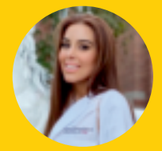
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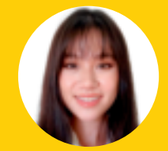
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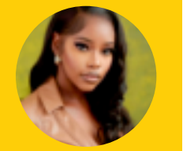
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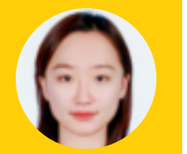
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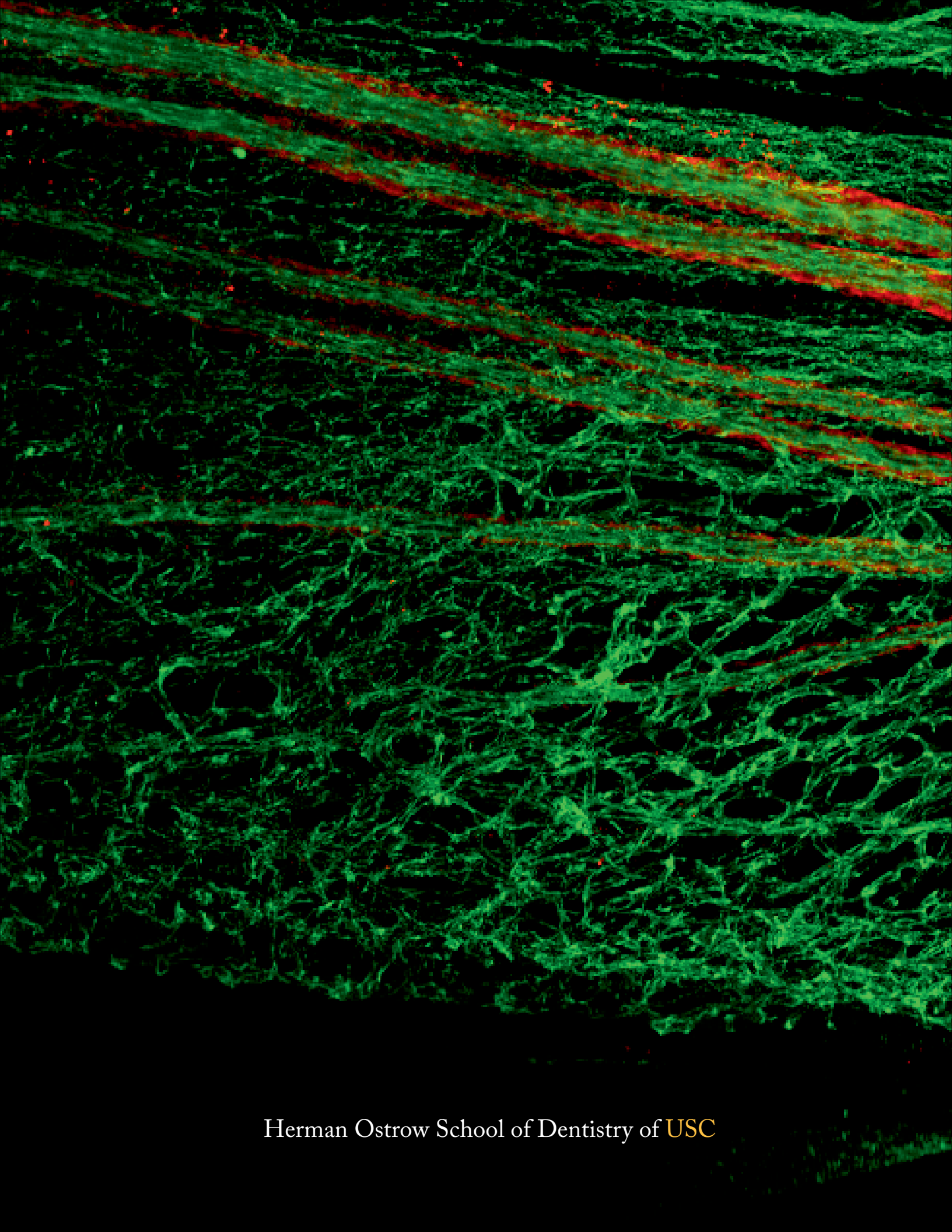

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