Herman Ostrow School of Dentistry of USC

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# THE EXPLORER

## Journal of USC Student Research

*Photo: Noura Hervani*

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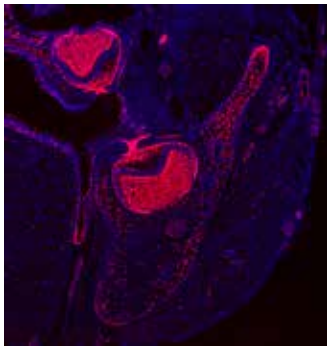

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# FROM THE **DEAN**

Dear Ostrow Students and Colleagues:

Ostrow's annual Research Day is always a highlight of the academic year for me. As an educator, I can tell you nothing compares to seeing the intellectual spark, scientific curiosity and raw enthusiasm on our students' faces whether virtually or in-person. Better still is being able to read even more about these discoveries in our award-winning *The Explorer* — put together by our Student Research Group. It gives me such pride to see our students committing themselves to the scientific foundations undergirding our profession.

Research is rocket fuel, launching our professions into ever-exciting and sometimes unexpected directions. To be successful in your careers — whether that be in the dental, biokinesiology/physical therapy or occupational science/occupational therapy professions — you will need an almost insatiable thirst for new knowledge. You must constantly consume new research, learn new technologies and be willing to evolve the way you practice. It is our 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. As you might know, Ostrow is No. 4 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 in history, and I couldn't be prouder. This accomplishment demonstrates the significant amount of trust that the NIDCR has in our school, for that I am forever grateful for our research faculty and staff and the work they do, day in and day out. And I would be remiss to not mention that our USC Chan Division of Occupational Science and Occupational Therapy and the USC Division of Biokinesiology and Physical Therapy retain their rankings as two of the best programs in the nation as determined by the *U.S. News & World Report,* with a No. 1 and No. 4 ranking respectively — a testament to their ongoing research and clinical prowess in their disciplines.

I want to congratulate all of our faculty and student researchers for the hard work, long hours and dedication it took to complete these research endeavors this year. I hope that you will take the time to really peruse this issue of *The Explorer* — not only to see what your colleagues are studying in your own field but also what your colleagues in all of our divisions are doing to continue strengthening the science undergirding their professions.

Stay safe, stay healthy, and Fight On!

# INTRODUCTION TO **RESEARCH DAY**

Dear Ostrow Students and Colleagues,

We are delighted to welcome you to the 2022 Herman Ostrow School of Dentistry of USC Research Day. Throughout this pandemic we have been working together to continue to develop our innovative research programs at our school. This is one of the proudest days for me as a Trojan, as we come together to honor the exciting science being done by our remarkable students, staff, and faculty in Dentistry, Occupational Science, Occupational Therapy, Biokinesiology, and Physical Therapy who continue to rise to the challenge of breaking new ground at the frontiers of knowledge.

As educators, it is so rewarding to share our knowledge with the next generation of students who share our passion for research. It is a rare privilege to be part of a community as dedicated to this endeavor as the Herman Ostrow School of Dentistry. Each of our students, staff, and faculty embody USC's collective commitment to our six unifying values: integrity; excellence; diversity, equity, and inclusion; well-being; open communication; and accountability. I am inspired by how our community has persevered and grown stronger as we have weathered the pandemic together.

Research Day is a shining example of how USC provides a uniquely exciting environment in which to grow during this stage of your professional journey. Our leadership and faculty are strongly committed to providing the best possible training and opportunities, positioning you well to become leaders in your respective fields. In particular, we believe that educating students in the ethically and scientifically sound conduct and research will promote innovation and discovery, and ultimately make a strong positive impact on our society.

We hope you enjoy this year's issue of *The Explorer*. In the pages to follow, you will learn about the wide spectrum of research being conducted by your colleagues, alongside articles highlighting the accomplishments of some of our outstanding faculty members at the Herman Ostrow School of Dentistry of USC. We are proud to present an exciting program for our Research Day and speakers who will cover a broad range of topics on how research innovation will change our lives. Please join me in congratulating all of our students and researchers on their successes over the past year as we come together 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

# From Plant Taxonomy to Anesthesiology: A Research Journey

*By Natalie Black and Mala Singh*

Dr. Regina Dowdy is a Southern California native who was born and raised in San Diego. She attended San Diego State University, where she received her Bachelor of Science degree in Biology. Dr. Dowdy graduated college with specific interests in pediatric dentistry. She ultimately went on to pursue her Doctor of Dental Surgery degree from the Herman Ostrow School of Dentistry at the University of Southern California.

Throughout dental school, Dowdy remained interested in pediatric dentistry while also keeping an open mind. She became a member of the Special Patients Clinic Early Selective and recognized that she really enjoyed working with patients who have special needs. At the same time, she began shadowing the attending dental anesthesiologists at the school, Dr. Michael Alanes and Dr. Ryan Wu. With a growing interest in dental anesthesia, Dowdy realized that the specialty is a perfect combination of her existing interests in pediatrics and special patient management.

After graduating dental school in 2017, Dowdy pursued her Masters of Dentistry and Certificate in Dental Anesthesiology from the Ohio State University College of Dentistry. Presently, she is an attending anesthesiologist at USC for the periodontal residents teaching general anesthesia and sedation. In addition to teaching part time, she is working full time as a dental anesthesiologist in San Diego. Though her schedule is packed, Dowdy has remained dedicated to her involvement with research.

Dowdy's interest in research began during her undergraduate career. As a biology major, she enjoyed learning about plants and plant taxonomy. Throughout her time at San Diego State University, she was able to work on two research projects which resulted in the following publications: "Recognition of Two Species in Eremocarya (Boraginaceae): Evidence From Fornix Bodies, Nutlets, Corolla Size, and Biogeography" and "Taxonomy of the winged popcorn flower: Cryptantha pterocarya (Boraginaceae)." Carefully measuring plants and reporting data introduced Dowdy to the field of research, and she quickly realized how much she enjoyed working on research projects.

Dowdy's research career continued during her anesthesiology residency. In 2019, Dowdy wrote and published a review article titled, "Ludwig's Angina: Anesthetic Management". Dowdy writes that Ludwig's Angina (LA) is a gangrenous cellulitis of the neck that spreads through the surrounding fascial planes rather than abscess formation. The condition is most commonly caused by odontogenic infection, and treatment generally consists of aggressive antibiotic therapy followed by surgical drainage in many cases. In this article, Dowdy educates readers about the anatomy and pathophysiology of LA in addition to airway management. Due to the edema and inflammation associated with LA, patients can have narrowing in the laryngeal cavity which may result in airway obstruction. Dowdy stresses that for cases requiring anesthesia, preoperative assessment is crucial in order to identify features that may cause difficulties with mask ventilation, direct laryngoscopy, or intubation. She also states that in the event that a patient cannot be mask ventilated or intubated, alternative methods of ventilation should be assessed and made immediately attainable.

Following her publications throughout residency, Dowdy was tasked with presenting a thesis in order to obtain her master's degree in Dentistry. Her thesis titled "Using Computed Tomography to Predict Difficult Tracheal Intubation" sought to research how clinicians can better predict patients with difficult airways. A difficult airway is typically thought of as the clinical scenario where a trained anesthesiologist has trouble with mask ventilation, tracheal intubation, or both. Presently, there is no one measure used to predict a difficult airway because the cause is multifactorial. Historically, patients

with larger neck sizes have been known to have more difficult airways, and it has been postulated that this is due to an increase in submental and anterior neck fat amongst patients. The Cormack-Lehane score is a universally used classification system to detail the view of the tracheal inlet. A low score indicates a full view of the glottic opening while the highest score implies that neither the glottis or epiglottis can be seen. In her thesis, Dowdy hypothesized that a higher deposition of submental fat and anterior neck fat would lead to a higher Cormack-Lehane score which ultimately would lead to a difficult view for tracheal intubation.

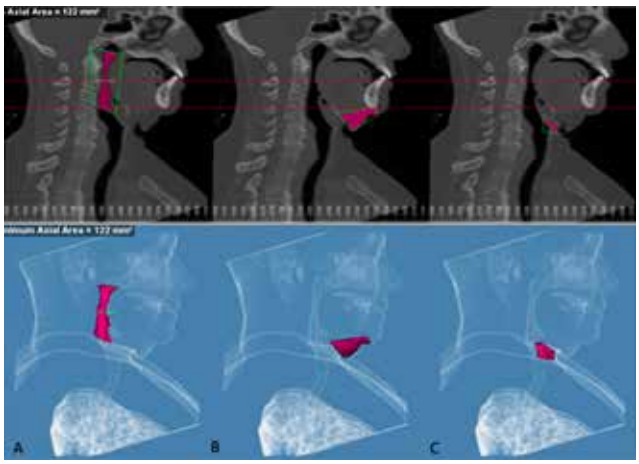



*Figure 1: CT scan and 30 reconstruction of the studied areas.* ***A. Airway volume, airway area, and minimum airway (represented as the slice at C 1). B. Submental fat volume- spanning from the chin and floor of the mouth superiorly to the hyoid bone posteriorly and the thyroid cartilage inferiorly. C. Anterior neck volume- ventral to the anterior border of the vertebral body spanning from C3 superiorly to C5 inferiorly and anteriorly to the skin.***

In order to test her hypothesis, Dowdy conducted a retrospective review of 145 patients who underwent tracheal intubation with a documented Cormack-Lehane view and a neck CT scan within 8 months of each other. Mallampati scores, which document the visibility of the uvula, were also recorded. The results show that Mallampati and Cormack-Lehane scores were related and statistically significant (p=0.0035). However, there was insufficient evidence to support the hypothesis that submental fat and anterior neck fat are predictors of a higher Cormack- Lehane score and therefore more difficult intubation. Though CT imaging can help anticipate minimum airway and airway area, Dowdy discourages the routine use preoperatively when the imaging is used solely for the purpose of examining submental fat and anterior neck fat. Dowdy concludes the thesis by cautioning clinicians to take extra care when preoperatively examining patients to ensure the prevention of an unanticipated difficult airway which can lead to higher risk of morbidity and mortality for the patient. She advises that clinicians always be prepared to manage the unexpected.

After obtaining her master's degree, Dowdy has continued to partake in research. One case report written by Dowdy highlights a 27-year-old Caucasian man with autism and behavioral problems who underwent cardiac arrest upon the induction of general anesthesia. In this article titled, "Cardiac Arrest Upon Induction of General Anesthesia," Dowdy highlights how cardiac arrest in the perioperative period can occur for several reasons. Common causes include hypovolemia, hypoxia, and increased vagal activity due to medications frequently used during general anesthesia or surgical stimulation. In this specific case report, the patient was taking propranolol and guanfacine which likely contributed to the eventual cardiac arrest due to the drug-drug interactions between the propranolol and anesthetic agents. Dowdy emphasizes how prompt recognition of cardiac arrest and immediate emergency response including cardiopulmonary resuscitation, administration of epinephrine, and use of a defibrillator when appropriate are all crucial steps in achieving return of spontaneous circulation and an optimal outcome for the patient. Additionally, Dowdy underlines the importance of understanding a patient's medications and potential interactions that may occur with drugs given during sedation and general anesthesia.

Another case report by Dowdy titled, "Medical Management of Epiglottitis" covers how anesthesiologists and other airway specialists can help treat the life-threatening condition. Epiglottitis is inflammation of the epiglottis and surrounding supraglottic structures, and this is usually caused by a bacterial infection. This article report covers case presentation, epidemiology, clinical presentation, diagnosis, and treatment of epiglottitis.

Currently, Dowdy is working on a few different projects relating to pre-operative and post-operative pain management. One project is seeking to determine if patients who undergo third molar extractions should be post-operatively medicated with oral ketamine as opposed to Percocet. Another project will be examining post-operative pain scores of patients who were pre-medicated with acetaminophen prior to third molar extraction. The hope is that patients who receive over the counter pain medications prior to surgery will have a lessened need for opioids after surgery.

Dowdy's passion and dedication to research is inspiring. When asked if she has any advice for students who are interested in pursuing research, she states, "if you think something's a good idea, or you have questions about a particular topic then someone else probably does too, and it might be worth looking into for research topics." She continues stating, "if you think you're interested and don't know where to start, you can always talk to somebody that's already involved in research." Dowdy then encourages students who are interested in research relating to anesthesiology or other topics to reach out to herself, or Dr. James Tom, to get started on their own research journey.

# Exploring New Dimensions in Craniofacial Research

*By Catherine Choi and Sneha Sharan*

Dr. Amy Merrill-Brugger, PhD is a researcher and an Associate Professor at USC's Herman Ostrow School of Dentistry and Keck School of Medicine. In addition, she has been a mentor to several PhD students, master's degree students, and postdocs who have achieved many accomplishments and grants for their research.

From childhood, science always had a special place in Dr. Merrill-Brugger's heart. She completed a Bachelor of Science degree in Molecular, Cellular, and Developmental Biology in 1997 from the University of California, Santa Barbara. There she followed her passion and worked in a research lab that was using Drosophila genetics to identify genes that regulate development. This drew her to embryonic development and genetics. She completed her PhD at USC in the lab of Dr. Rob Maxson. She stepped into the realm of craniofacial research and dental research specifically during graduate school here at USC. It was her mentor at USC who inspired her to take up research on the bones in a child's head.

She recalled with excitement the technology that was introduced to her to study human genetic syndromes. It was very innovative then to use mouse models of human disease using knockout technologies and it was fairly new at the time to study human syndromes that affected children.

Dr. Merrill-Brugger's interest in genetics and development, along with her desire to understand disease and help patients, solidified her decision to study the craniofacial complex.

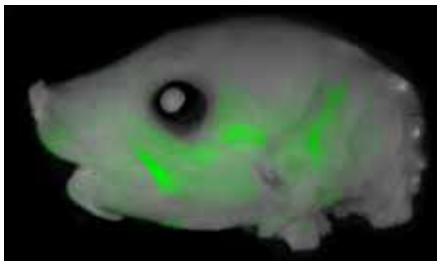
Upon completing her PhD at USC, Dr. Merrill-Brugger completed two postdoctoral fellowships. During her first fellowship at UCSF, she studied the mechanisms that regulate the timing of skeletal stem cell differentiation and patterning. Then, she went to UCLA Cedars Sinai for her second fellowship, where she used human genetics to study skeletal dysplasias. Taking the skills and knowledge she gained, she launched her own independent research program at USC in 2010 focusing on how disease-associated genetic variants cause craniofacial differences in children. By studying these conditions, she hopes to identify new targets for regenerative medicine and also gain a deeper understanding of how the skeletal system develops in the embryo and postnatally.

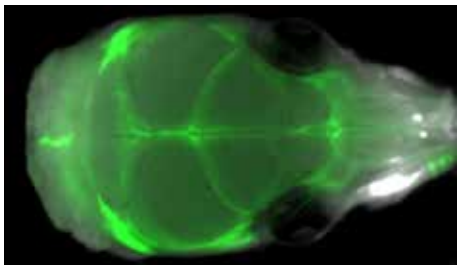
One of Dr. Merrill-Brugger's most significant contributions to date has been the discovery of the lethal genetic syndrome Bent Bone Dysplasia (MIM 614591). Her work enabled prenatal diagnosis and genetic counseling for affected families.

Bent Bone Dysplasia Syndrome is a skeletal disorder caused by specific mutations in the gene FGFR2. Dr. Merrill-Brugger revealed that this is responsible for the disease during her postdoctoral fellowship. Her initial goal was to understand how that genetic variant causes the disease and differences in the craniofacial skeleton using mouse models and molecular studies. From there, she began to study another disorder called LADD syndrome, which is caused by different genetic variants in the same gene. This led to the discovery of a novel role of FGFR2 in the regulation of skeletal stem cells during development and its importance not only in bone and cartilage, but also tendon and ligament. In particular, her lab now studies FGFR2 in the connective tissue of the temporomandibular joint( TMJ) in order to elucidate the developmental process of the TMJ and identify stem cells that may enable regenerative strategies for TMJ disorders.

Most of the disease phenotypes Dr. Merrill-Brugger studies emerge in embryonic development and are largely detected via ultrasound. Craniosynostosis, for example, is a disfiguring birth defect where the cranial sutures prematurely fuse that may cause secondary brain damage and blindness.

Dr. Merrill-Brugger describes her typical day as very





routine-based, which helps her with her productivity. Being a mother of two makes life unpredictable and she copes by being organized. She tries to structure her day by getting up as early as 5:30 AM. Her day starts with she and her husband making lunches and getting their kids dressed and out the door. Then she gets on her way to work. She likes to answer some emails that come in through the night in the morning, when her mind is fresh, and then she tries to write manuscripts to get them published. She affirms that science requires communication through writing and presenting for its positive impact on people's lives.

She usually takes some time out of her day to read scientific literature, trying to keep up with the latest things being published in her field. She also checks in with her lab members to get glimpses of their latest work and plan their next steps.

The life of a professor always involves a lot of other, different responsibilities. Sometimes Dr. Merrill-Brugger is asked to review manuscripts submitted for peer review ahead of publication, or to review grant applications for the National Institutes of Health.

She is also involved in teaching a research methodology course to dental residents. It is focused on teaching them how to execute clinical research and how to develop a clinical research protocol. This has been really rewarding because it has taught her a lot about the clinical side of dentistry, which is different from her own eduactional background, and she enjoys seeing the great ideas that the residents come up with.

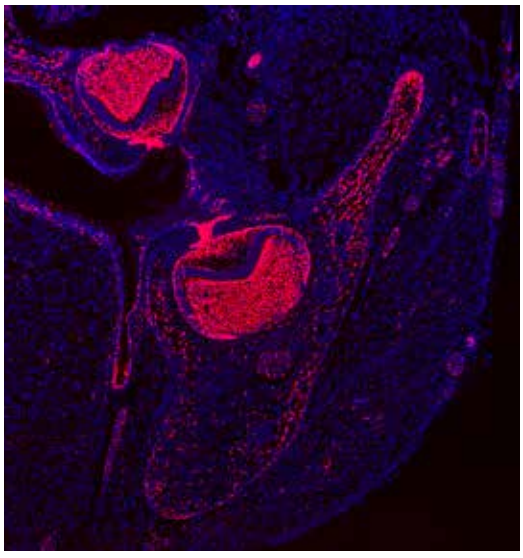
The experience of the pandemic brought to light the challenges of being a parent in science. She found herself juggling her responsibilities with that of the lab and teaching. But all difficult things come to an end, and persistence helps to overcome them. Having faith in one's self and just trying to do one's best in the face of adversity makes things work out in one's favor. In the context of the lab, it brought all of them close together and helped them undersatnd each other better.

Moreover, this pushed Dr Merill to revisit and better her teaching and mentoring techniques. She completely reformatted her research methodology course, with great results. This period motivated her to really support her students' individual interests and find new ways to capitalize on them.

This pandemic also afforded her an opportunity to learn how to use new technologies. She took a course in bioinformatics that was offered by USC Stem Cell and learned coding. She learned how to use programs that allow analysis of single-cell datasets and their application to research methodologies. The future promises to bring further exciting challenges, as Dr. Merrill-Brugger's lab received two new research grants during 2021.

While she was trained as a developmental biologist, Dr. Merrill-Brugger's work also makes strong contact with clinical challenges, which places her research into context and underscores its importance. She has been active in a research group affiliated with Born A Hero, which is a patient advocacy and support group for families with a child with craniosynostosis syndromes caused by FGFR variants. The mission of the Born A Hero Research Foundation is to improve the quality of life for patients with FGFR syndromes through innovation and research. The foundation also provides support groups for families and brings together clinicians and scientists.

Dr. Merrill finds the intersection with families and patients with her bench research to be highly rewarding, particularly as she is able to see how her research impacts and helps these families. By identifying and studying the genetic variants causing congenital diseases, Dr. Merrill hopes to give families critical information that allows them to understand the outlook of the disease and be well-prepared in making informed decisions.



# Flipping Genetic Switches with Dr. Jian Xu

*by Sumi Chung*

Dr. Jian Xu is an Assistant Professor of Dentistry in the Division of Biomedical Sciences and Center for Craniofacial Molecular Biology at the Herman Ostrow School of Dentistry of USC. She earned her B.S. at Peking University in Beijing, China. Her passion further led her to pursue a Ph.D. in Pharmacology and Cell Biophysics at the University of Cincinnati. Her Ph.D. research focused on understanding molecular signaling and transcriptional regulation of cardiac hypertrophy and heart failure using genetic mouse models. After her Ph.D., she received postdoctoral training at the University of California - San Francisco, where she focused on TGF-beta/BMP signaling and cell differentiation. With Dr. Xu's extensive knowledge of cell signaling, she has focused her studies on how regulating signaling mechanisms can lead to diseases in hopes that better understanding such mechanisms will lead to discoveries with clinical importance.

## Protein Arginine Methylation

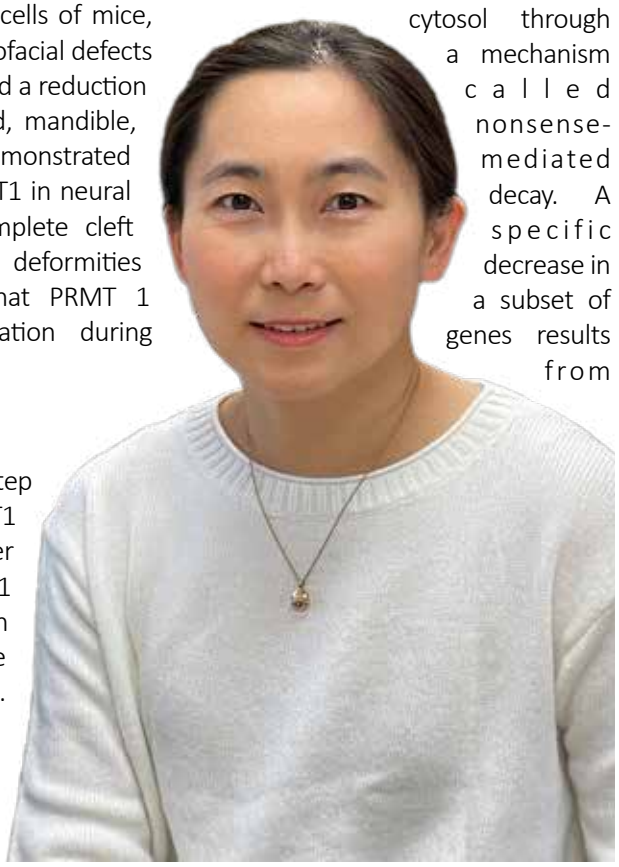
Dr. Xu's lab investigates how signaling mechanisms can lead to birth defects and diseases, such as cardiac and craniofacial deformities and periodontitis. Specifically, Dr. Xu's group focuses on protein arginine methylation and its signaling function in gene expression associated with those diseases. Protein arginine methyltransferases are enzymes responsible for the methylation of arginine on histone and nonhistone proteins. This methylation can act as a "switch" by turning on or off the function of the gene and thereby alter gene expression in a way that drives cells to become different types of cells, such as osteoblasts, fibroblasts, and many other forms. Thus, Dr. Xu's lab studies how such modification of a protein by methylation can produce different effects, and by understanding mechanisms and functions, Dr. Xu in the future hopes to connect this information and contribute to disease therapy.

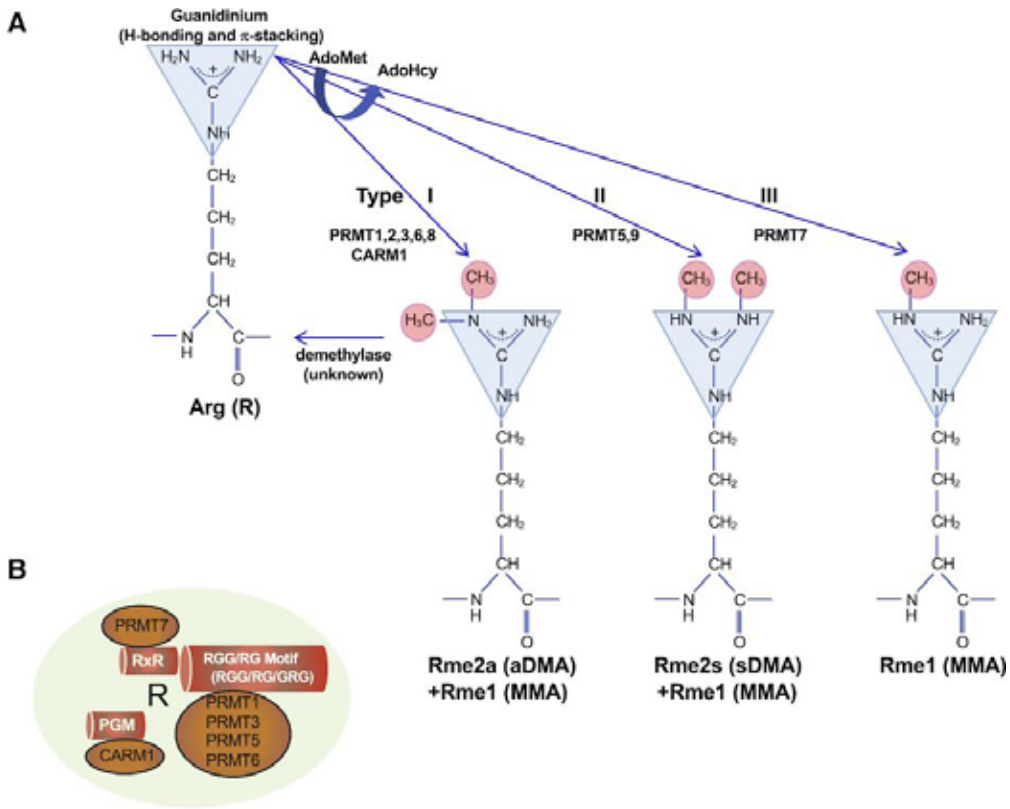
In earlier projects, Dr. Xu investigated protein arginine methyltransferase 1 (PRMT1) and its association with craniofacial malformations. PRMT1 is the most highly expressed protein arginine methyltransferase and is the major one in mammalian cells. Xu's lab discovered that when they deleted PRMT1 in neural crest cells of mice, they saw multiple craniofacial defects including cleft palate and a reduction in the size of the head, mandible, and tongue. They demonstrated that disruption of PRMT1 in neural crest cells caused complete cleft palate and craniofacial deformities as they discovered that PRMT 1 impaired cell proliferation during palate development.

## New Discoveries

Dr. Xu took a further step to examine this PRMT1 protein. She further discovered that PRMT1 also regulates intron retention, which is one type of gene splicing. In this way, PRMT1 regulates the splicing of MDM4, a protein that regulates P53 degradation. MDM4 can be expressed as either a full-length long functional form or as a shorter form, and the shorter form can actually act as a dominant-negative to block the long-form from binding to p53 and thus stabilizing p53. Consequently, the shorter form is actually antagonizing MDM4 function by regulating the alternative splicing. In other words, PRMT1 can regulate how much MDM4 activity there is in a cell, which then regulates p53 degradation and the level of p53 expression.

Dr. Xu's lab further discovered that PRMT1 also causes more mRNA to retain introns in a sequence, and these retained introns will lead to degradation when they go to the cytosol through a mechanism called nonsense-mediated decay. A specific decrease in a subset of genes results from






this, and could potentially explain the mandible dysmorphism in PRMT-deficient mice. Since this is a new finding, Dr. Xu is very excited to make such a discovery.

## Therapeutic Potential

As of now, Dr. Xu is working on several lab projects and has received several grants to support them. One of the current projects focuses on a transcription factor called Runx2. If Runx2 is expressed in mesenchymal stem cells, it can drive them towards the bone fate to become bone-forming cells, which are called osteoblasts. Dr. Xu's lab started studying how methylation of Runx2 alters the gene expression. They found a group of proteins that only binds when Runx2 is methylated and a group of proteins that does not care whether Runx2 is methylated or not. Currently, they are searching for a group of proteins that only bind when Runx2 is non-methylated. Furthermore, they discovered that when Runx2 is methylated, it recruits other cofactors and facilitates bone formation and cell migration, which is important for many processes, including cranial suture formation during skull development. Interestingly, when methylated Runx2 was deleted, it affected suture fusion and thus impaired skull development. Dr. Xu's lab investigated this mechanism further, and they discovered that it was related to decreased bone formation and decreased cell migration.

As a next step, Dr. Xu hopes to test the therapeutic potential of a related strategy for craniosynostosis, a premature fusion of the sutures that necessitates surgery in infancy and can lead to a variety of lasting problems for affected children. One difficulty in treating craniosynostosis effectively is that even after fused sutures have been removed through surgery, they may fuse again. Consequently, Dr. Xu would like to test in mouse models whether Runx2 can be used in combination with surgery as an inhibitor to prevent refusion of the suture, so that patients do not have to go through secondary or tertiary surgery.

The Xu lab continues to showcase promising findings that will potentially contribute to therapy for craniofacial deformities, periodontitis, and cardiac defects. In the future, Dr. Xu hopes to one day start human clinical trials after validating information in mice then in larger animals such as pigs. The ultimate goal of her research is to unlock its therapeutic potential and help patients with disease treatment.

Dr. Xu's passion and diligence have inspired many students in positive ways by motivating them to pursue what they are passionate about. As a mentor, she provides students with guidance and assurance and enjoys seeing their progress. She has mentored students who have now become successful educators, leaders, and clinicians. As a mentor and a professor, Dr. Xu will continue to succeed in her fields of study.

**"Anyone can conduct research as long as they are committed & tenacious in their interest"**

*- Dr. Dadresanfar*

# On Point with **Endodontics**

*By Danielle Min and Iris Yu*

Dr. Bahareh Dadresanfar completed dental school at Islamic Azad University School of Dentistry in Tehran, Iran. She went on to pursue her endodontic specialty at the Dental School of Shahid Beheshti, also in Tehran. She practiced for five years before assuming a position on the faculty at Islamic Azad University School of Dentistry in Endodontics for fifteen years and served as the Director of Research. After she moved to the United States, she volunteered at the Herman Ostrow School of Dentistry of USC as preclinical faculty member in the simulation lab and the emergency department. After receiving support from faculty who saw her passion for endodontics, she decided to pursue an endodontic degree in the United States. She currently is a second-year resident in the Advanced Endodontics Residency Program at USC.

Dr. Dadresanfar's first exposure to dentistry came from shadowing her uncle, who was a dentist. As she continued to learn and explore clinical dentistry and dental literature, she realized that she had a passion and affinity for endodontics. Dr. Dadresanfar practiced on resin blocks and spent countless hours mastering the processes and methodology of endodontics. In hindsight, she realized that she was slowly integrating portions of endodontics into her daily life and she could not see herself pursuing any other field. As she started teaching at her alma mater, the experience with her students only solidified and encouraged her further to learn more.

Dr. Dadresanfar is is passionate about research and has contributed to numerous publications. In Iran, she supported the research of dental students who were required to conduct research as part of their dental school curriculum. As the students put in a great deal of effort into conducting their research projects, she would urge them to publish their papers to share their findings with the community. Dr. Dadresanfar is very supportive of students pursuing research because she strongly believes that anyone can conduct research as long as they are committed and tenacious in their interest. She states that research can be conducted at any educational level and that a lack of top-tier technology is not a justification to be discouraged from doing research. As she transitioned from Iran to the United States, Dr. Dadresanfar notes that she experienced some challenges with language barriers but that fact did not stop her desire to continue to explore and research new topics.

Dr. Dadresanfar explains that there are always new subjects and areas that can be explored. She emphasizes that the most important aspect of a research project is the design of the study, and, if the design and format of a study are correct and all the steps are taken precisely, then it will be publishable. Dr. Dadresanfar's most recent article, a bibliographic study, was titled "Outcome of endodontic treatment: the most cited publications" and was published in the ***Journal of Endodontics*** in 2021. Bibliographic studies involve analyses that reflect which articles are highly cited to provide data for future research. Dr. Dadresanfar notes that there were no bibliographic studies on the outcomes of treatment previously, despite outcomes being one of the most important components of a treatment plan. In order to present to patients the best treatment options, peer-reviewed studies and evidence-based dentistry allow patients to have confidence in following recommended treatment plans. The paper is an embodiment of Dr. Dadresanfar's sentiment that research can be conducted at any level to achieve a research objective.

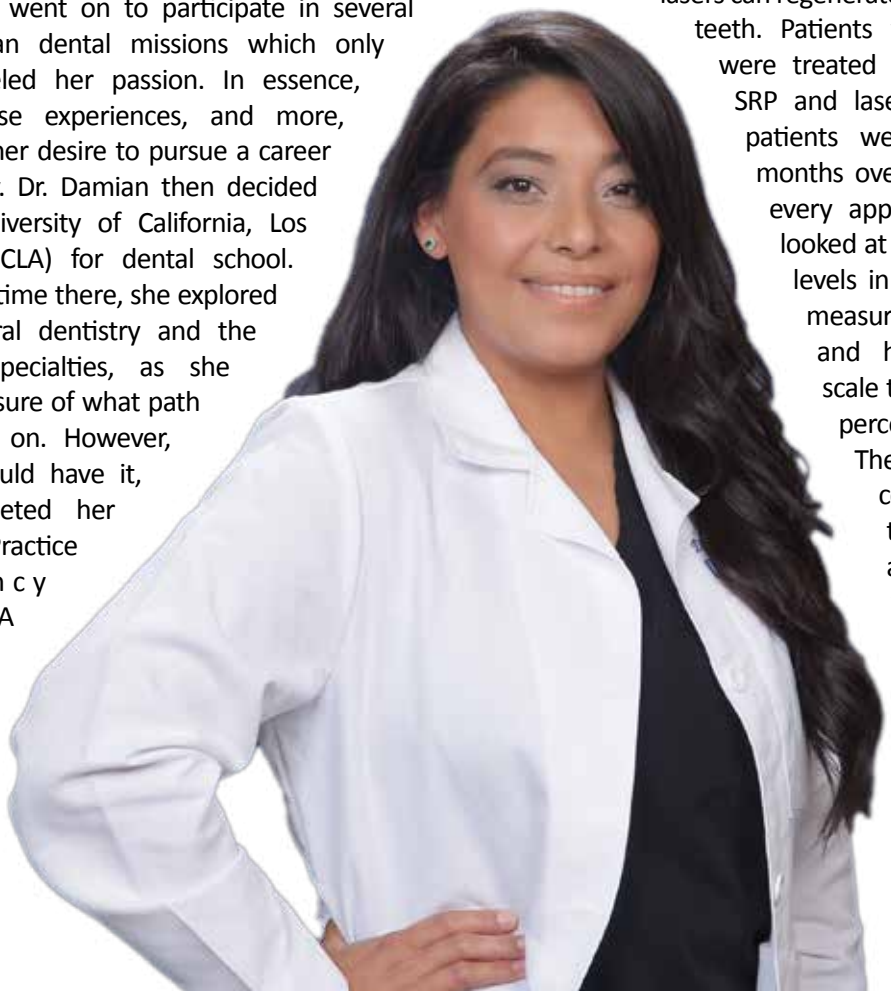
Dr. Dadresanfar encourages students to seek out new topics or modes in research and to remain intellectually curious. Some studies may have limitations but there are avenues to achieving a good research study with proper effort and tenacity.

# Finding One's Passion & the Mission to Help Others

*By Stephanie Chai and David Adelpour*

Dr. Arianna Damian grew up in Orange County, where she was first introduced to dentistry through her general dentist and orthodontist after a childhood dental trauma. In high school, she took an elective course that introduced her to a variety of healthcare professions where she learned even more about dentistry and was encouraged to seriously consider a career in the field. As the first dentist in her family, Dr. Damian has been and is continuing to carve her own path and build her own legacy with her work in general dentistry, periodontics, and research as well as inspiring others to do the same.

Dr. Damian attended the University of California, San Diego (UCSD), where she completed her Bachelor's degree in general biology. While at UCSD, Dr. Damian was part of the large pre-dental society on campus. There, she managed one of the clinics and helped with fundraising to provide care to underserved populations in San Diego, something she is very passionate about. She went on to participate in several humanitarian dental missions which only further fueled her passion. In essence, all of these experiences, and more, cemented her desire to pursue a career in dentistry. Dr. Damian then decided on the University of California, Los Angeles (UCLA) for dental school. During her time there, she explored both general dentistry and the different specialties, as she was still unsure of what path to journey on. However, as fate would have it, she completed her General Practice Residency at UCLA where she decided that she really enjoyed surgery, which led her to periodontics. Dr. Damian connected with periodontics because of the ability to work on a fine, micro-level while simultaneously being able to build relationships with her patients over time. She went on to complete her specialty training at UCLA in 2019.



### SRP and Laser Therapy

While at UCLA, Dr. Damian worked on a research project looking at the efficacy of lasers as an adjunct to scaling and root planing (SRP) in patients with chronic periodontitis. There are various types of lasers on the market with different wavelengths that affect the type of tissue they work on, and in this study they focused specifically on the erbium, chromium-doped yttrium, scandium, gallium and garnet (Er,Cr:YSGG) laser known as Waterlase. The research team was interested in assessing the claim some companies made that their lasers can regenerate bone around implants and teeth. Patients with chronic periodontitis were treated with either SRP alone or SRP and laser therapy together. The patients were assessed every three months over a period of one year. At every appointment, the researchers looked at the changes in the bacteria levels in the pockets, took probing measurements of the pockets, and had patients complete a scale that assessed their personal perception of the procedure. They also performed cone beam computed tomography (CBCT) scans at the initial, 6-month, and 1-year appointments to track the bone and other structures.

### Evaluating Efficacy

Dr. Damian and the rest of the research team

found that there was essentially no bone regeneration in any of the patients, contrary to what was claimed by the companies. The only statistically significant change they found was in the bacteria present in pockets that were >5 mm in depth. In those deeper pockets, with the adjunct laser therapy, the balance of bacteria changed from more pathogenic strains to less pathogenic ones. However, aside from the deeper pockets, there was not a huge difference between SRP alone or combined with laser therapy. However, the team noted that the scaling sites that had been treated with a laser were easier to access and that the calculus was easier to remove. Patients also reported that they found the laser treatment more comfortable than just having SRP being performed. Dr. Damian explained that although a laser may serve as an enticing advertisement to patients and dentists alike, there is no significant improvement between using the laser and conventional SRP alone. Thus, a practitioner needs to view the costs and benefits before purchasing or using one of these laser units as the efficacy may not be as promised.

After completing her specialty training, Dr. Damian came to USC to work in the Dr. Roseann Mulligan Special Patients Clinic as an adjunct clinical professor in periodontics. When asked about her time in the Special Patients Clinic, Dr. Damian highlighted the emphasis that was placed on obtaining a thorough medical history before providing any treatment to a patient. She explained how crucial it is to organize your thoughts, especially when working with patients who may have very complex medical histories. This allows a practitioner, such as herself, to truly appreciate the different dental implications or complications that can arise from different medical conditions. When referencing the sometimes complicated cases she worked with in the Special Patients Clinic, Dr. Damian said: "You don't have to know everything about everything. But you are given the resources and the template of where to look for the information you need."

## Current and New Endeavors

Today, Dr. Damian spends her time working as a contracted periodontist in various dental offices, a lecturer in Periodontology at the UCLA Dental School, and an adjunct clinical professor at LAC+USC in the Section of Oral and Maxillofacial Surgery. At LAC+USC, she works closely with dental students, General Practice residents, and Oral Surgery residents. She loves her role of being a mentor and teacher. Dr. Damian is currently interested in starting a research project at LAC+USC concerning patients with mandible resections who receive a fibula graft and then ultimately implants. Such sites are usually repaired with mostly mucosal tissue. The problem, Dr. Damian notes, is that mucosal tissue lacks the keratinization originally found at the site. Therefore, the lack of keratinization of the mucosal tissue affects the success of future implants. This is because the area may not be able to provide an adequate seal around the implant. As a result, bacteria are then able to infiltrate the implant site, causing some patients to experience bone loss and inflammation since the mucosal tissue is not optimized for the implant and cleaning. This ultimately leads to implant failure. Dr. Damian is interested in looking at the histology of the tissue layers to figure out how to place a graft on scar tissue and what changes can be made to the graft in order to achieve optimal results, and specifically for the patient to have the best possible chance for implant success.

Dr. Damian believes it was a huge advantage for her to have completed her General Practice Residency before completing her periodontics specialty program and encourages others to consider completing a General Practice Residency whether they know what they want to specialize in already or not. For her, the program opened up the door to more experiences and techniques and helped find her passion for periodontics. She also notes that the dental field is constantly changing and stresses the importance of being a lifelong learner and to always seek out knowledge.

In her spare time, Dr. Damian is heavily involved in community organizations and groups trying to make a difference locally. When she is not working, Dr. Damian loves spending time with her husband, who has been working relentlessly with COVID patients during the pandemic, her 5-year-old daughter, and their puppy, as well as cooking new recipes--and making her own. Furthermore, she continues to seek out continuing education courses and training programs to learn different techniques to come up with the best treatment plan for her patients. Dr. Damian's commitment to dentistry and exploring different ways to improve the clinical practices already in place will continue to inspire those around her to make a long-lasting impact in the field of dentistry.

# A Truly Trojan Passion for Occupational Therapy

*By Parinaz Esteghamat*

Dr. Beth Pyatak is no stranger to following her passion in a health-care profession and putting her energy towards helping people. In 2002, after receiving her bachelor's degree in psychology from USC, she attended a health professions open house on USC's health science campus, where she learned about occupational therapy (OT) for the first time and joined the pre-ot club. She found that OT combined many interests of hers, such as helping patients and having a hands-on experience. In 2004, Dr. Pyatak received her master's degree in occupational therapy from USC. Her passion and dedication to her career blossomed as she continued her education, completing her phd in occupational science in 2010 and a master's degree in clinical, biomedical and translational investigations in 2015.

**Occupational Therapy Explained**

Occupational therapy is the use of assessment and intervention to develop, recover, or maintain the meaningful activities of individuals, groups, or communities. Occupational therapists provide interventions in varied settings, including schools, hospitals, homeless shelters, nursing facilities, community clinics, private practices, corporations, executive health centers and wellness resorts. In order to provide the profession of occupational therapy with its own scientific and research base for clinical practices, the occupational science program was established at USC in 1989 to study the benefits of engaging in purposeful activities on health, development, and quality of life. The USC chan division of occupational science & occupational therapy offers various degree programs such as bachelor's to doctorate, post-professional master's, entry-level otd, post-professional otd, and phd in occupational science.

**Understand and Develop**

Since 2011, Dr. Pyatak has been a faculty member in the USC Chan division. Her work focuses on translational research in the lifestyle redesign for chronic conditions (LRCC) research lab. LRCC explores two main broad themes: first, understanding the lived experiences and challenges of the individuals with the chronic conditions; and second, developing and evaluating innovative lifestyle interventions that enhance the health and quality of life of individuals with chronic conditions. Dr. Pyatak's research in LRCC specifically focuses on applying the main principles of lifestyle redesign to enhance well-being among individuals with type i and type ii diabetes. Her research aims to promote awareness for better management of daily activities and health, and to provide guidance for individuals with chronic conditions in the process of orchestrating daily activities, habits and routines to support health and well-being.

The resilient, empowered, active living with diabetes (real diabetes) study, completed in 2018, found that a diabetes-focused lifestyle redesign ot intervention was effective in improving blood glucose control (hba1c) and diabetes-related quality of life outcomes in primarily minority and low-socioeconomic status young adults. Dr. Pyatak mentioned that conducting motivational interviews and patient-centered therapies helped to hold the patients accountable and motivated to stay consistent in their daily routines, such as managing stress, exercising, monitoring blood sugar, taking medication, and incorporating diabetes self-care task guidelines. Moreover, Dr. Pyatak emphasized that a multidisciplinary team approach bringing together a patient's occupational therapist, physician, dietitian, physical therapist, pharmacist, psychologist, nurse, and social worker is needed to optimally help the population with low health literacy, housing insecurity, food insecurity, and mental/physical disabilities. Such a team brings together the expertise and skills of different professionals to assess, plan, and manage care jointly for individuals with complex care needs.

Dr. Pyatak's current research is expanding on this work to evaluate the impact of diabetes-focused lifestyle redesign interventions delivered in primary care settings (dhs study) and via telehealth

(real-t study), as well as evaluating the impact of a telemedicine/shared medical appointment clinical care model in reaching low-socioeconomic status young adults with type 1 diabetes (coyot1 to california study). These research studies aim to evaluate innovative care delivery models for adolescents and young adults with chronic conditions, develop strategies to implement ot lifestyle interventions in primary and specialty care settings, and examine the lived experience of type 1 diabetes through innovative and emerging technologies.

In order to positively impact the quality life of a diabetic patient, one should understand the relationship among acute blood glucose fluctuations, emotional well-being, and function of daily life, yet diabetes research to date hasn't always appreciated this complexity. To overcome this limitation, the ongoing function and emotion in everyday life with type 1 diabetes (feel-t1d) study is the first large-scale study to integrate continuous glucose monitoring (CGM), ecological momentary assessment (EMA), and accelerometry to disentangle the short-term dynamic relationships between blood glucose, function, and emotional well-being in adults with type 1 diabetes. These innovative and emerging technologies will contribute to establishing basic knowledge about these relationships that will be foundational to the personalization of treatment recommendations and development of novel interventions that optimize both clinical and patient-reported outcomes.

**Lifestyle Redesign Approach**

Dr. Pyatak highlighted the importance of incorporating lifestyle redesign and patient-centered approaches into the occupational therapist's clinical practice. In "Addressing Uncontrolled Diabetes in Primary Care: A Lifestyle Redesign Approach," the feasibility of implementing an OT intervention addressing diabetes management in a primary care clinic within the Los Angeles County Department of Health Services (LAC-DHS), as well as the impact of this intervention approach on clinical outcomes, efficiency and patient-centeredness of care were examined. One hundred and forty diabetic patients aged 18-75 years with hba1c level >9.0% Participated in approximately 8 one-hour OT sessions over 4 months. Dr. Pyatak and her team of occupational therapists worked with different healthcare providers to test a new care model by coaching the providers to intervene motivational interviews, shared decision making, and action planning approaches.

To assess implementation and service evaluation, interviews and surveys with DHS staff and participants were conducted, as well as evaluating treatment notes, observing ot sessions, and reviewing the referral process. To evaluate the intervention's impact on health and quality of life outcomes, electronic medical record (emr) data on hba1c and depressive symptoms, and brief, clinically relevant self-report surveys on diabetes self-care, general health, and quality of life were collected. Qualitative data were gathered through conducting interviews and surveys with dhs staff, and participants, as well as evaluating treatment notes, observing ot sessions, and reviewing the referral process. This revealed a stronger doctor-patient relationship improving patients' overall satisfaction.

On a different but related note, Dr. Pyatak is concerned about the long-lasting adverse impact of COVID-19 pandemic on vulnerable communities, especially the underprivileged population with chronic conditions across Los Angeles. She described different barriers to care that people within susceptible populations are currently facing, which include low financial status, limited access to transportation, restricted clinical working hours at a lower capacity, and disturbed habits and routines. In one of her current projects, "evaluation of a complex behavioral intervention for young adults with diabetes: the resilient, empowered, active living-telehealth (real-t) study," dr. Pyatak is investigating the efficacy of real as delivered via telehealth (real-t), an efficient and broadly disseminable care delivery model. The results of this study will inform clinical practice through providing evidence regarding the potential of real-t to enhance health and quality of life among young adults with diabetes both immediately following the intervention and over the long term.

Today, one main objective of an occupational therapist is to coach other healthcare providers to efficiently deliver accurate information about COVID-19, solutions to anxiety regarding COVID-19 symptomatology, psycho-social support, and individualized treatment recommendations to the patients via telehealth. Dr. Pyatak emphasized how much habits and routines have been disturbed by the pandemic, recommending frequent follow-ups with patients, guiding them through self-care tasks and providing alternatives to alleviate boredom, maximize coping skills, and promote relaxation. Since anxiety has adverse effects on health, such as increasing blood sugar in diabetic patients, coping skills and stress management are two significant aspects to be addressed during telehealth sessions. Anxiety can be managed by relaxation techniques, meditation, yoga, and instilling positive thinking and a sense of hope.

*"Follow your passion, be prepared to work hard & sacrifice, &, above all, don't let anyone limit your dreams"*

- Dr. Beth Pyatak

Our trojan ambassador of occupational therapy, Dr. Beth Pyatak, is a symbol of a passionate, innovative, and diligent woman whose mission is to incorporate lifestyle redesign and future occupational science research findings into the lives of the patients with chronic conditions, to help them have a higher quality of life.

# Reimagining the use of Bisphosphonates

*By Sarina Taylor*

Dr. Parish P. Sedghizadeh is a clinician-scientist and an oral and maxillofacial pathologist. In addition, he is a Professor of Clinical Dentistry and Section Chair of Diagnostic Sciences at the Herman Ostrow School of Dentistry of USC. Not only does he teach and see patients as a faculty member, but he also consults, conducts research, and publishes. Dr. Sedghizadeh started his dental career by receiving his DDS degree from USC in 2001. As part of the first cohort to use a problem-based learning approach rather than traditional lectures and preclinical studies, he developed a passion for challenging himself and confronting the unknown. At the time, Dr. Sedghizadeh did not know much about oral and maxillofacial pathology but became interested when he diagnosed his first patient with a malignant lesion. He quickly became enthralled in the subject as he found it integrally ties research and clinical practice. After his doctorate, he pursued specialty training in Oral and Maxillofacial Pathology at Ohio State University, where he also attained a Master of Science degree in oral biology, fellowship in the Academy of Oral and Maxillofacial Pathology, and subsequently board certification.

After completing his residency, Dr. Sedghizadeh was recruited back to USC to explore new research techniques and skills relevant to biofilm microbiology. He became interested in osteonecrosis of the jaw, a dental pathology that presents as an infected and necrotic jawbone. This condition is typically seen in patients taking bisphosphonate medications for the treatment of osteoporosis or bone cancer (medication-related osteonecrosis of the jaw or MRONJ). Dr. Sedghizadeh's team designed and conducted observational clinical studies into MRONJ patients and published the first epidemiologic institutional study linking MRONJ with oral bisphosphonate drug use in osteoporosis patients. Dr. Sedghizadeh has been able to successfully use his background in pathology research, alongside his clinical expertise and the robust patient population at USC, to perform translational research, exploring the scientific aspects of diseases like MRONJ from bedside to benchtop and back.

## Bisphosphonate Pharmacology

Currently, Dr. Sedghizadeh's research focuses on the utility and mechanistic understanding of the bisphosphonate class of drugs. The study of bisphosphonate pharmacology was partly born out of dental research. In order to create a blockbuster anticariogenic toothpaste, scientists at Procter and Gamble ("P&G") conducted research on tooth decay and the solubility of enamel in acid in the 1960s. This led to the study of phosphate chemistry and phosphate compounds such as pyrophosphate (which would become known as the precursor to modern bisphosphonates). Such research at P&G verified bisphosphonates' unique affinity for calcium ions in solution and for calcium HA crystalline structures of bone and enamel. Since that time, parallel research on the effects of bisphosphonates on bone metabolism continued, while efforts in the dental field included studies of bisphosphonate effects on dental calculus, caries, and alveolar bone loss.

## Bone-Targeted Therapeutics

Recently, Dr. Sedghizadeh and his transdisciplinary collaborative team have been working on exciting advancements in bisphosphonate chemistry, such as exploiting the bone affinity of bisphosphonate drugs for creating new bone-targeted therapeutics. An ideal therapeutic drug for bone diseases should act only on bone tissue with no pharmacological activity at other anatomical sites. Given bone is not a natural pharmacokinetic reservoir for antibiotics, targeting antibiotics to bone can be challenging. Bisphosphonate drugs, on the other hand, are different from antibiotics in that

they preferentially accumulate in bone, where they are retained for periods up to several years. Even more ideal is a drug that targets the most diseased sites of the skeleton, which is an attribute that bisphosphonates provide with their propensity to favor higher bone turnover sites.

Dr. Sedghizadeh's team has synthesized novel antibiotic compounds that are comprised of bisphosphonate moieties conjugated to existing therapeutic agents for targeting bone, and treating/preventing diseases like osteomyelitis, osteoporosis, cochlear hearing loss, and multiple myeloma. These novel compounds' specific target sites are those traditionally targeted by bisphosphonate drugs. Once in bone, the drug requires an acidic environment, such as the one created by an infection, to allow the antibiotic to be released. The biochemical approach is a 'target and release strategy' whereby the bisphosphonate moiety physiologically targets the infected bone and then the antibiotic is released to kill the biofilm bacteria, which resides on the targeted bony surfaces. Dr. Sedghizadeh's research into bone-seeking medicinal agents, progressively lays the foundation for next-generation bisphosphonate 'target and release' type therapeutics that minimize systemic exposure or toxicity and maximize drug efficacy at the targeted site. Such advances in the design of potential bone-selective drugs reimagines the way we approach treatment for diseases affecting the skeleton and creates exciting new directions for multiple unmet medical and dental needs.

It's no secret Dr. Sedghizadeh has enthusiasm for his work. With nearly 100 publications in peer-reviewed journals and textbooks related to head and neck pathology, he is truly redefining his field and paving the way for the next generation. When asked to give a few words of advice to current dental students on finding their passions, Dr. Sedghizadeh noted the importance of "taking the time to get exposure to a variety of specialties and experiences while in school. This is the time to sink your teeth in, ask questions, and explore." As exemplified by his success and notable contributions to the dental field, Dr. Sedghizadeh has proven to be a role model for future dentists and an example of how to achieve one's goals through passion.

**"[Take] the time to get exposure to a variety of specialties & experiences while in school. This is the time to sink your teeth in, ask questions, and explore"**

*-Dr. Sedghizadeh*

# Breaking New Grounds in Oral Surgery

*By Sam Sheridan and Aaron Huang*

Dr. John Costandi is one of the faculty members in the Division of Oral and Maxillofacial Surgery at the Herman Ostrow School of Dentistry of USC and an attending at the Keck School of Medicine of USC. He currently practices full-scope oral and maxillofacial surgery, including dentoalveolar, dental implant, benign pathology, trauma, orthognathic, TMJ and reconstructive surgery.

Born and raised in Egypt, Dr. Costandi was destined for a career in health care. His father practiced as an anesthesiologist, his mother as a pharmacist, while three of his older siblings attended medical school and a fourth attended pharmacy school. Although Dr. Costandi took time to explore multiple avenues, the unique combination of service and the ability to work with his hands encouraged Dr. Costandi to pursue dentistry at Cairo University in Egypt at only sixteen years of age. He entered dental school with an open mind; however, his trajectory was forever changed the moment he assisted in his first impacted tooth extraction. The surgical technique, the intellectual challenge, and the ability to care for others ignited his passion for the field of oral and maxillofacial surgery.

Following graduation from Cairo University, Dr. Costandi uprooted his entire life and travelled to the United States to attend Boston University's dental program for internationally trained dentists. He spent much of his time in Boston in the Oral and Maxillofacial Surgery Department learning more about the scope of the practice.

Dr. Costandi's initial research project revolved around a case report on a residual radicular cyst (RRC). After a tooth extraction, the debris of the periodontal ligaments created a granuloma which then eventually turned into an RRC. By definition, an RRC is permanent and still easily distinguishable years after the extraction. However, Dr. Costandi's assistance in the research proved that true RRCs are rather rare as most resolve on their own. In rare circumstances, the persisting cyst may result from a failure to resolve the true etiological cause. Nevertheless, RRCs are better described as an intermediate stage of healing after a tooth extraction or a "resolving" radicular cyst, rather than a residual cyst. This first project helped show Dr. Costandi the importance of research in both personal and professional growth, and also in sharing one's findings with the greater community.

During his residency program, Dr. Costandi had the opportunity to work with Dr. Chang Lee, a leader in craniofacial research. They studied tissue-engineered, 3-D printed TMJ discs in rabbits and mini-pigs. TMJ disc scaffolds were constructed using polycaprolactone embedded with GF-encapsulated poly(lactic-co-glycolic acid) (PLGA) microspheres containing connective tissue growth factor and transforming growth factor beta-3. In the first project, perforations were created in the TMJ discs of mature rabbits, after which these scaffolds were inserted. The condyles and fossa were then harvested for analysis four weeks later. In a second project TMJ disc scaffolds for mini-pigs were constructed to mimic the mechanical properties of native tissues. These disc scaffolds were then implanted

after total discectomy. This team effort has led to a publication in the *Journal of Oral and Maxillofacial Surgeory*, and continuations of the projects are still ongoing.

In addition to primary research and publications in leading journals, Dr. Costandi has also contributed as co-author of a textbook chapter on peripheral nerve blocks in the head and neck.

Reminiscing about the impact that his father had on others through his role as an academic anesthesiologist, Dr. Costandi felt a similar desire to help improve the education and development of residents during their oral surgery training. After completing his residency at Columbia University, he spent a year working alongside residents at Weill Cornell Medicine in New York City and then traveled across the United States to Los Angeles with his family for his wife's fellowship.

Dr. Costandi worked in private practice for a year before he joined the Trojan family. He now works as a full-time faculty member in the USC Oral & Maxillofacial Surgery program. Dr. Costandi has become heavily involved in the education of both the residents and the dental students, and he has made an immediate impact since joining the program. His proactive approach and desire to push trainees to reach their full potential is evident in the operating room, the pre-doctoral oral surgery clinic, and his various ongoing research projects.

One of Dr. Costandi's strong suits involves his leadership skill in recognizing and learning from his mistakes. While some surgeons may shy from discussing clinical errors, Dr. Costandi truly believes that every clinician should utilize mistakes as an opportunity to learn. For this reason, two of Dr. Costandi's current research projects include studying the factors that contribute to the extraction of the wrong tooth, and displacement of maxillary third molars into the infratemporal fossa. Through his research, Dr. Costandi hopes to understand the etiology underlying these mistakes, such as the rates of incidence, the experience of the surgeon, common settings, and other factors that may lead to such occurrences. He hopes that these findings can help surgeons implement protocols to minimize the risk of these adverse events and improve patient outcomes.

Within the rapidly changing field of oral and maxillofacial surgery, Dr. Costandi has also recently begun researching the use of Exparel (liposomal bupivacaine) in third molar surgery. Through the combination of liposomal encapsulated and free bupivacaine, Exparel's DepoFoam delivery technology allows extended release of bupivacaine. Early studies on this prolonged pain management technique have shown improved patient comfort and reduced opioid consumption following surgery. Dr. Costandi has additionally started exploring the use of remimazolam, a faster-acting benzodiazepine alternative to midazolam, in outpatient oral surgery. This may allow for more efficient sedation with faster recovery. Each of these recent advancements have the potential to shift the practice of pain management and anesthesia in outpatient oral and maxillofacial surgery. However, additional evidence is necessary. Dr. Costandi's willingness to embrace this change and ensure the safety and efficacy of these medications through research will further support his role as a pioneer in the field and ultimately improve patient care in the years to come.

Through his research and involvement with trainees, Dr. Costandi hopes to help educate students on the significance of research, continued education, and quality improvement. Thus, he has supported his students in becoming involved with research projects, and oversees the development of their analytical and writing skills while drafting research articles.

Dr. Costandi's deeply- ooted belief in self-learning and continued educational growth ultimately drives his passion for research. He utilizes any spare time he has by reading current literature in his field, listening to recorded lectures, attending Continuing Education courses, and participating in conferences. Dr. Costandi also dedicates some time to reviewing relevant literature of other specialties, including anesthesiology and otolaryngology, to remain a well-rounded clinician.

While Dr. Costandi is deeply dedicated to his professional life, he is also a committed father and husband. He enjoys spending time with his three-year-old son, his one-year-old daughter, and his loving wife. They frequently participate in family-friendly activities and trying new restaurants. Some of his many future aspirations include continuing to live a balanced lifestyle while helping to grow the USC Oral and Maxillofacial Surgery Residency into one of the best programs in the country.

# An Algorithm-Based Notetaking System – A Work in Progress

*By Antranig Mesrobian*

Dr. Glenn Clark is an innovator, researcher, author, and mentor. These are just a few of the words that can be used to describe this faculty member at the Herman Ostrow School of Dentistry of USC. The topic of numerous articles, Dr. Clark's achievements can be found in previous editions of *The Explorer* (2017 and 2020), which highlight not only his contributions to the dental school here at USC, but to the global dental community as well.

USC's Orofacial Pain and Oral Medicine program is held in high esteem and today is quite unique in that residents learn about both disciplines. Currently, Dr. Clark is the director of the Master's degree program in Orofacial Pain and Oral Medicine, which was launched in 2012 when Dr. Clark proposed a hybrid Master's degree/certificate program that allows dental practitioners to further their knowledge of Orofacial Pain and Oral Medicine while remaining in practice. "Traditionally, you had to quit your dental practice career to get training. Now you can continue your career, work hard, get advanced training and change the direction of your practice and the mix of patients you see," Clark notes. This progressive form of graduate education allows dental practitioners to never miss a beat, while expanding their knowledge in a growing field.

Dr. Clark's research accomplishments and projects span a wide array of topics such as sleep bruxism, sleep apnea, temporomandibular joint disorders, and treatment modalities in chronic orofacial pain. One of Dr. Clark's current projects involves the creation of a highly structured notetaking system that utilizes machine learning for the purpose of developing medical algorithms.

## Orofacial Pain and Oral Medicine

With the advent of machine learning and artificial intelligence gaining more and more momentum, Dr. Clark envisions its place within the field of Orofacial Pain and Oral Medicine.

Once fully developed, these tools will help clinicians differentiate between 100 different diagnoses (see Table 1 for a partial list). Moreover, in Oral Medicine, the number of potential diagnoses is about twice that number. The sheer amount of potential outcomes can prove to be difficult for any clinician to ascertain. This reality coupled with the complexity of the disease and clinical medicine only contributes to the margin of potential error. Therefore, misdiagnosis is probable if a clinician fails to collect the needed data during a patient encounter or if data is not interpreted correctly.

The current notetaking protocol most clinicians use consists of patient interview notes, physical examination findings, imaging and laboratory tests, and patient-facing questionnaires. Clinicians record their findings during patient encounters by writing them down or inputting them in a computer, an electronic medical record. The fundamental issue is that there is not any uniformity across the notes, and the data contained in these narrative notes is often not structured enough to analyze. Therefore, there is a need for a new, highly structured notetaking system that will allow machine learning analysis.

## Machine Learning and Medical Algorithms

Medical algorithms are a form of artificial intelligence that comprise computational, statistical, and formulaic surveys within a healthcare setting. These processes are utilized to generate predictions for risk, diagnostic probabilities, and optimal treatment modalities. To date, an algorithm-enhanced medical record has yet to be achieved. Nearly ten years ago, a collaboration between M.D. Anderson Cancer Center and IBM attempted to build a comprehensive algorithm in order to aid doctors in with diagnoses and treatments. However, the program was shuttered, as M.D. Anderson was unable to develop a tool that could be utilized past the piloting stage. This shortcoming by two highly capable organizations highlights the degree of difficulty in creating such a complex system. Nonetheless, where there is a will, there is a way.

## An Agent of Change

Dr. Clark's vision is a highly structured note-taking system that both produces a readable electronic medical record note and stores de-identified data in a database. This will allow for machine learning analysis and the creation of medical algorithms. Machine learning will allow for the identification of non-obvious relationships between data and diagnosis, risk of future disease, and potentially the best treatment protocols. Once enough data is gathered, algorithms can be created and incorporated into the note-taking system, which will suggest diagnoses based on the inputted data. The clinician will then have the option to reconsider, reject, or revise their diagnosis and possible treatment options.

The highly structured note-taking system currently being created by Dr. Clark and his colleagues consists of a number of features, including:

1. Several levels of branching checkbox-based data collection system (Figure 1)
2. Two integrated pre-encounter questionnaires

3. Built-in predictive diagnostic algorithms (currently 76 + more coming).
4. It will be a "hybrid system" with checkboxes and supplemental note fields.
5. Each diagnosis selected will have written criteria and suggested treatment options.
6. All positive interview and examination findings will be exportable as an EMR Note.
7. All follow-up encounters have outcome assessment questions.
8. Backend database stores data available for machine learning analysis.

Data itself is a sensitive topic in any industry, especially in healthcare. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) is a federal law that protects sensitive patient health information from being disclosed without the patient's consent or knowledge.

**Table 1: A list of Orofacial Pain related diseases, disorders and dysfunctions.**

| | |
|---|---|
| 2nd Burning Mouth (mucosal disease) | Mandibular Hyperplasia |
| 7th Nerve trauma | Masticatory Muscle Hypertrophy |
| Acute Malocclusion due to Lateral Pterygoid Trismus | Masticatory Myalgia/Myofascial Pain |
| Acute Mechanical Cervical Disease | Medication Induced Jaw Muscle Hyperactivity |
| Anomaly of Dental Arch (various types) | Medication Overuse Headache |
| Arthralgia/Capsulitis | Nerve Injury with sensory deficit |
| Atypical Burning Mouth Disorder | New daily-persistent headache (NDPH) |
| Bell's Palsy | Numbness (NOS) |
| Bony Ankylosis | Occipital Neuralgia |
| Burning Tongue Syndrome | Open Jaw Dislocation |
| Candidiasis | Open Jaw Locking |
| Cervical Myalgia/Myofascial Pain | Ophthalmic Migraine |
| Cervical Nerve Impingement | Oral Infection (NOS) |
| Cervical Osteoarthritis | Orofacial Dyskinesia |
| Cervicogenic Headache | Orofacial Dystonia |
| Chronic Daily Headache (chronic migraine) | Osteochondroma |
| Chronic Daily Headache (Medication oversuse) | Other Facial Asymmetries (NOS) |
| Chronic Daily Headache (NOS) | Paroxysmal Hemicrania |
| Chronic Jaw Muscle Trismus | Peri-menstrual Migraine |
| Chronic Trigeminal Neuropathy | Periodontal Infection |
| Cluster Headache | Posterior Disk Displacement |
| Complicated Migraine | Primary cough headache |
| Condylar Hypertrophy | Primary exertion headache |
| Connective Tissue Disorder associated paresthesia | Primary Idiopathic Stabbing Headache |
| Continuous Disk Displacement without reduction | Primary thunderclap headache |
| Contracture of Masticatory Closers | Psoriatic TMJ Arthritis |
| Coronoid-Zygoma Impingement | Psychogenic Hypertonicity of Jaw Muscles |
| Cracked/Broken tooth | Pulpal Infection |
| Disk Displacement with reduction | Pulsatile Tinnitus |
| Dysesthesia NOS | Radiation Fibrosis |
| Dysgeusia (various) | Salivary Gland Infection |
| Episodic Disk Displacement without reduction | Secondary Otalgia |
| Episodic Migraine | Severe Bruxism |
| Episodic TTHA | Sinus Headache |
| Familial Migraine | Sinusitis |
| Fibrous Ankylosis | SUNA |
| Frequent Migraine | SUNCT |
| Frequent TTHA | Systemic Sclerosis |
| Glossopharyngeal Neuralgia | Temporal Arteritis |
| Gout related TMJ Arthritis | Tensor Tympani Syndrome |
| Hemicrania Continua | TMJ Headache |
| Hypnic headache | TMJ Neoplasia (NOS) |
| Iatrogenic Bite Change (NOS) | TMJ Osteoarthritis |
| Iatrogenic Dental Occlusion Anomaly | TMJ Rheumatoid Arthritis |
| Idiopathic Condylar Resorption | Traumatic Dental Arch Anomaly |
| Intracapsular Adhesions | Trigeminal Neuralgia |
| Jaw Closer Muscle Trismus | Trigeminal Neuritis |
| Lyme Disease related TMJ Arthritis | Trigeminal Neuropathic Headache |
| Malignancy related trigeminal sensory disorder | Typical Tinnitus |

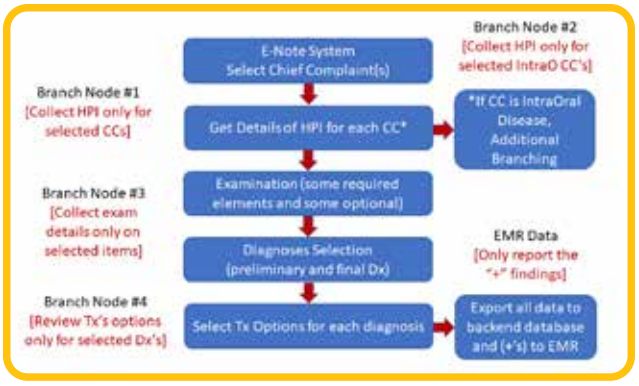



***Figure 1:*** *The basic architecture of the notetaking system. There are four branching nodes. For the final EMR report only (+) positive findings are copied into the EMR record and all data (positive and negative) is stored in a backend database.*

Therefore, the use of the data within the algorithm-based note-taking system will not include any personally identifying information such as names, numbers, geographic location, SSN, patient-specific dates, or any other unique or identifying information. By doing so, patient information remains private and safe from any potential breaches.

As the note-taking system gathers more data and improves the diagnostic algorithms, machine learning will also analyze data to create evidence-based treatment choice algorithms. Initially, every diagnosis will have empirically recommended treatment options, but eventually, the best treatment option will also be determined utilizing machine learning. This will be achieved by the systematic collection of outcomes based on different treatment approaches. That data can then be categorized by patients that respond versus those that do not respond. Achieving this would mean achieving a form of personalized medicine, which is a long-term goal of this project.

Will this tool be utilized by every practitioner? That depends on whether or not the clinician wants a data-driven diagnostic approach to treating their patients.

Dr. Clark is pushing the boundaries in the way clinicians utilize tools at their disposal to provide the best standard of care for their patients. By bringing together experts from different fields to build out this revolutionary tool, new frontiers such as algorithmic-driven clinical decision-making can be explored. As students, colleagues, and fellow Trojans, there is much we can learn from Dr. Clark's vision and ambition. We can all strive to function as catalysts and agents of change, contributing to our respective fields with time, effort, joy, and innovation.

Readers who are interested in learning more about Dr. Clark's algorithm-based notetaking system can read about it in recently published articles in *The Proceedings of the AIMA Annual Symposium* (2020) and *The Japanese Dental Science Review* (2021).

# **InBrace:** The Future of Digital Orthodontics is Behind Your Smile

*By Luke Aguilar and Daniel Kohanghadosh*

Dr. Andre Weissheimer was born and raised in Palmas, Paranà, a small city in the countryside of Brazil. When he was 16 years old, he ventured away from his home and family to a larger city in pursuit of his dreams of a better education. Dr. Weissheimer completed the DDS program in 2002 at the Federal University of Santa Catarina (UFSC), one of the most respected dental schools in Brazil. He was fascinated by Oral Surgery and Orthodontics. From 2004 to 2006 he completed his first orthodontic residency at UFSC. He describes this residency as an excellent and diverse program, providing a strong clinical and scientific background. He trained in various techniques, including the Edgewise Standard technique, Tweed Mechanics, pre-adjusted appliances, and the Segmented Arch technique. He was also involved in interdisciplinary and complex cases, including orthognathic surgery, cleft lip, and cleft palate. Through working with his patients, especially those afflicted by oral clefts, he learned how dentistry impacts and improves people's lives. He gave his patients happiness, and his passion for orthodontics grew. "The more you learn, the more you get passionate for what you are doing," Dr. Weissheimer says. During this residency, he published his first article about non-surgical rapid maxillary expansion in an adult patient. The article was featured on the cover of the Brazilian Journal of Clinical Orthodontics. It was a remarkable experience that inspired him to continue in scientific research and publication. It was just the beginning of his journey. Once Dr. Weissheimer completed his first orthodontic residency, he was still striving for excellence. He continued his education by doing a second orthodontic residency: a special two-year master's degree orthodontic program, designed for those who were already orthodontists and wished to achieve a higher level of clinical excellence and research. Dr. Weissheimer completed this second orthodontic residency in 2008, at the Pontifical Catholic University of Rio Grande do Sul (PUCRS) in Porto Alegre, Brazil. In that program, he gained experience in treating more complex cases and began clinical research. He participated in two randomized clinical trials, later published in the American Journal of Orthodontics and Dentofacial Orthopedics (AJO-DO) and The Angle Orthodontist. He rapidly became an expert in 3D imaging and Cone Beam Computed Tomography (CBCT).

When Dr. Weissheimer completed his master's degree, he simultaneously began practicing privately as an orthodontist in a multidisciplinary practice and attending a PUCRS to obtain his PhD. In his PhD program, he focused on clinical research and digital technologies. He completed his degree in 2013. During this PhD program, he came to USC as a Visiting Scholar. It was "where everything started," Dr. Weissheimer says. He is very grateful for this opportunity and for having Dr. Glenn Sameshima as his mentor.

While doing his research at USC, he met Dr. John Pham, a first-year orthodontic resident. Dr. Pham was a former aerospace engineer at Boeing with a business background from the USC Marshall School of Business. They formed a friendship, through which Dr. Weissheimer taught Dr. Pham clinical aspects and the history of orthodontics, and Dr. Pham taught Dr. Weissheimer to think and dream big. He also used his engineering background to help Dr. Weissheimer with his PhD thesis about CAD technology and 3D superimposition of the cranial base for orthodontic treatment evaluation. Together they have developed and pioneered digital orthodontic research and published several articles that are the foundation of much of today's digital treatment planning in orthodontics. Dr. Weissheimer and Dr. Pham worked closely with Dr. Robert Lee and Dr. Hongsheng Tong, who is a brilliant faculty member in the USC Graduate Orthodontic Program. These friends and colleagues became a team, working towards revolutionizing the orthodontic landscape. They conducted research involving digital orthodontics, CBCT and CAD/CAM technology, and applied them to Dr. Tong's ideas to create a customized orthodontic appliance, designed digitally on a computer and placed behind the teeth, hidden behind the smile. The goal was to "automate" the orthodontic treatment process. "Nowadays we have Tesla cars with autopilot. It's the same concept. How can we apply engineering technology to orthodontics?" Dr. Weissheimer asks.

He recalls staying late hours at USC, often until 9 or 10 at night, to work on his projects. Dr. Weissheimer explains how Dr. Edward H. Angle, the father of modern orthodontics, created the traditional metal braces in Pasadena, CA, in 1925. Traditional metal braces have been used for almost 100 years without major advancements in technology. "The world is becoming more digital. However, orthodontics has not been evolving at the same pace as other fields of science," Dr. Weissheimer says. He continues, explaining that "Invisalign did come in and make a disruption using digital technology with plastic aligners. However, there is a subset of the adult population that does not consider orthodontics because of the lack of a treatment option that fits their lifestyle, especially regarding esthetics and convenience." The treatment options available are either too visible, such as metal or clear braces, or they require ideal compliance with plastic aligners. The lack of a treatment option for these patients fueled the team's desire to collaborate and explore how

***Figure 1.*** *Orthodontic treatment with InBrace. (A) Pre-treatment, (B) after bonding the appliance, (C) 2 months' progress with Smartwire in autopilot, (D) 5 months' progress, (E) 12 months' progress, (F) case finished and appliance removed.*

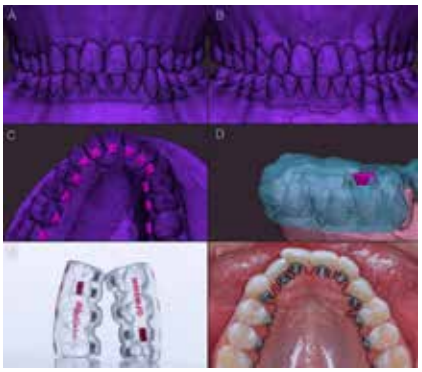


***Figure 2.*** *CAD/CAM technology used with InBrace. (A) Initial digital models, (B) Frontal view of the Ideal occlusion and smile design, (C) Lingual view showing virtual brackets positioned in the the ideal location using AI technology, (D) CAD Design of the indirect bonding trays, (E) 3D printed indirect bonded trays loaded with InBrace brackets, (F) brackets bonded to the planned position and Smartwire inserted.*

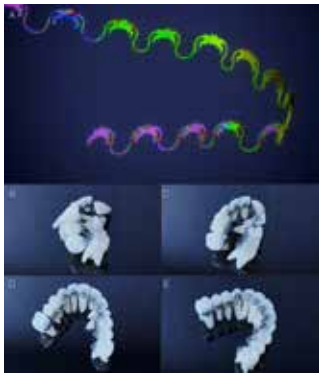


***Figure 3.*** *Smartwire Generation 2. (A) Smartwire digitally designed and programmed with autopilot and Gentleforce technology. (B-E) Smartwire returning from the malocclusion shape to the ideal occlusion and smile with full control of tooth movement in all six degrees of freedom.*

to merge engineering with orthodontics to disrupt conventional orthodontics and modernize the field. Through this collaboration, they reinvented lingual orthodontics and created an innovative technology, called InBrace. This new orthodontic appliance is the result of collaboration among researchers at USC's Herman Ostrow School of Dentistry and Viterbi School of Engineering, supported by the Stevens Center for Innovation. The core technology driving InBrace's innovation was developed at USC Orthodontics with 1/3 of net patent royalties committed to the Herman Ostrow School of Dentistry of USC. Since 2014, InBrace has raised over $180,000,000 in venture capital funding to expand this innovation worldwide.

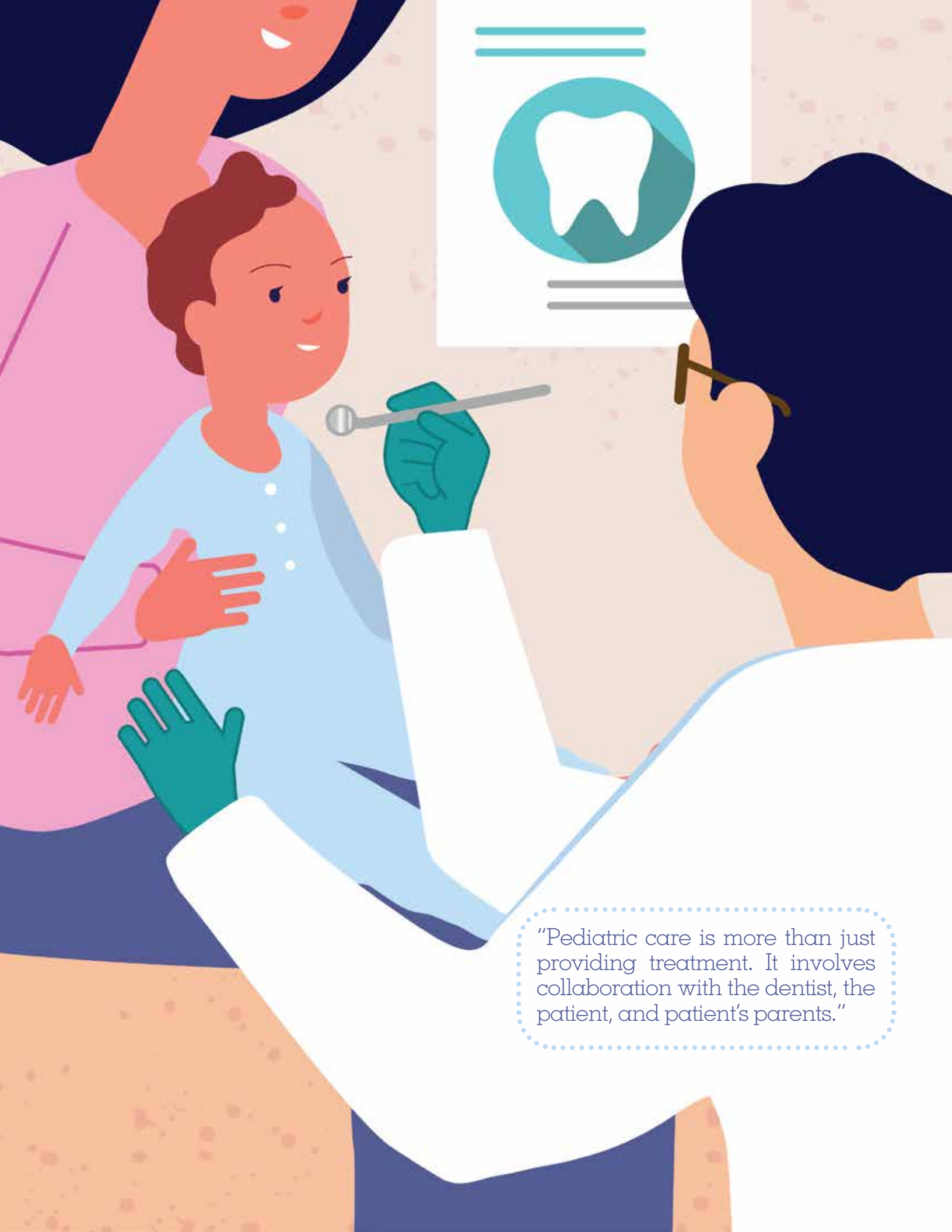
According to Dr. Weissheimer, "the InBrace system is a behind-the-teeth customized orthodontic treatment, on autopilot" and is shown in Figure 1. InBrace diverges fundamentally from previous types of braces, which all use sliding mechanics. While sliding mechanics work efficiently on the labial side, especially when paired with digital treatment planning, this same type of efficacy has not been achieved with sliding mechanics on the lingual side for several reasons. To achieve predictable and efficient behind-the-teeth orthodontic treatment, Dr. Weissheimer and Dr. Tong developed a different mechanism to move teeth, which they named Programmed Non-Sliding Mechanics (PNM). PNM enables tooth movement in all six degrees of freedom, including opening and closing spaces simultaneously and automatically from day one of orthodontic treatment. This "autopilot" feature minimizes the need for interventions, such as placing elastic chains or coil springs. It improves the ease of use, efficiency, and convenience of the treatment. PNM is made possible by the InBrace appliance design, which features a novel, vertical-insertion, self-ligating bracket in conjunction with a programmed Smartwire that is fully customized to each patient's unique smile. InBrace uses the latest advancements in CAD/CAM technology, Smartwires, and 3D-printed indirect bonding (Figure 2).

Since 2017, Dr. Weissheimer has been teaching clinical and digital orthodontics, 3D imaging, and InBrace to USC orthodontic residents, helping them differentiate themselves and prepare for the competitive world outside of the school. Dr. Weissheimer also represents the Herman Ostrow School of Dentistry of USC and USC Orthodontics across the nation through his lectures at universities including Harvard, Tufts, the University of Texas Health Science Center at San Antonio, the University of the Pacific, and many others.

In 2019, after thinking more about his future, Dr. Weissheimer realized the only way to achieve his life and professional goals as a clinician, researcher, and professor was to complete an orthodontic residency in the United States. Dr. Weissheimer applied and was accepted to his third orthodontic residency at USC. He is the first faculty member in the history of the department to also become a resident. He is currently a second-year resident, in the Class of 2023, which provides him a unique perspective on teaching and learning. He loves sharing knowledge with his co-residents. In addition, he is honored to be a member of the Edward H. Angle Society of Orthodontists and a reviewer for several orthodontic journals.

Dr. Weissheimer begins every morning at 4:50 am. He exercises for 25 minutes and commutes from Orange County to USC. He believes that it is important to stay up-to-date with the latest technology and research in the field of orthodontics, and he tries to read one article every day.

Over the past 13 years, Dr. Weissheimer has published over 40 articles, book chapters, and patents. Five of his innovative research articles about digital orthodontics have been featured on the cover pages of academic publications: the AJO-DO twice and Journal of Clinical Orthodontics three times. He is looking to the future and focusing on producing research and technologies that can disrupt orthodontics and improve patient care, like Generation 2 of the InBrace appliance, which has just been introduced and has the most advanced Smartwire in the world (Figure 3).



"Pediatric care is more than just providing treatment. It involves collaboration with the dentist, the patient, and patient's parents."

# A Passion for Pediatrics

*By Iris Yu and Danielle Min*

Dr. Philip Yoong is an adjunct assistant professor of clinical dentistry at the Herman Ostrow School of Dentistry of USC. He is also currently the course director for the pediatrics module for the d2 predoctoral students and an attending for the pediatrics residents at USC. In addition to his position at USC, he is working in a private pediatric practice in Orange County. Dr. Yoong is a native of southern California and received his bachelor's degree from the University of California San Diego (UCSD), after which he obtained his dental degree from the University of Michigan School of Dentistry. In 2021, Dr. Yoong received his certification in pediatric dentistry following his residency at the Herman Ostrow School of Dentistry of USC. As one of the newest additions to the pediatric dentistry team at USC, Dr. Yoong notes the significance of taking on the role of an educator through his faculty position, which has allowed him to bring that experience to become a better clinician.

Dr. Yoong is a first-generation dentist. Despite having had traumatic experiences with the dentist as a child, he found his passion for dentistry during his time at ucsd. While volunteering on a dental mission trip to Africa as a UCSD undergraduate, he had the opportunity to alleviate the pain of the patients who came to the clinic and experience the gratitude of those individuals whom he was able to help. After reflecting upon his own experiences and seeing the positive impact of early dental intervention on an individual's oral health, Dr. Yoong decided to pursue his degree in pediatric dentistry.

During his time at the University of Michigan, Dr. Yoong and his classmates started a nonprofit organization called Bridge of Disciplines. Bridge of Disciplines focused on building interprofessional collaborations (medical, social work, nursing, pharmacy, and undergraduate) in clinical, volunteer, and service-based events while keeping dentistry as its core focus. In his position within Bridge of Disciplines, Dr. Yoong worked with 17 project directors to spearhead some of the following collaborations: University of Michigan ENT/Otolaryngology department for oral/head and neck cancer screenings; social work students to provide services to the Ann Arbor community; initiating an immigration clinic collaboration between practicing physicians and dental students; starting a fluoride varnish treatment campaign for children in the community; organizing an oral health education week at local elementary and middle schools; and promoting a dental health ambassador program to explain the importance of dental education to students of non-dental health care disciplines.

Dr. Yoong conducted research as a pediatrics resident through a collaboration with a student at the USC Suzanne Dworak-Peck School of Social Work. The project surveyed the parents of patients who were to receive treatment under general anesthesia to determine the patient's comfort level before and after treatment using various intervention levels such as videos, narratives or both. Despite the difficulties of conducting research due to COVID-19 that limited resources and communication, Dr. Yoong and the students from Dworak-Peck were able to determine that interventions including any form of videos increased the levels of comfort for the patients. Through the collaboration with the social work students, Dr. Yoong notes that the study allowed him to understand the importance of social work in the healthcare setting and that social workers have a unique perspective and opportunity to make a difference, in that they are able to interact with patients on a level that is usually untouched by clinicians.

Dr. Yoong encourages dental students to be open to new experiences and to get exposure that can positively impact a child's oral health. He explains that pediatric care is more than just providing treatment. It involves collaboration with the dentist, the patient, and patient's parents, all of which are experiences that may be new to predoctoral dental students. Dr. Yoong urges all students at Ostrow to take advantage of all the resources and opportunities available to them while they are in dental school, as what they will learn in these few shorts will greatly impact and benefit the patients they treat in the future.

# Teaching Periodontology– A Love Story

*By Jessica Kim*

Dr. Kian Kar is currently Associate Professor of Clinical Dentistry and Director of the Advanced Periodontology Program at the Herman Ostrow School of Dentistry of USC. During his career, he has excelled in providing clinical care for patients, mentoring students, and guiding future professionals on their path in the field of periodontology.

Dr. Kar's passion to pursue a dental career was inspired by his parents' love and dedication to service in the health care setting. Growing up, he recalled flipping through anatomy figures from his mother's textbooks and pouring diagnostic models at his father's dental office. He was amazed and interested in his parents' work, and all these moments sparked joy and interest. Ultimately, they inspired Dr. Kar to pursue dentistry. He was attracted to the dental field as he admired the work-life balance and the ability to provide personalized care to every individual.

Dr. Kar grew up in Iran, where he completed his primary and secondary education. It was also where he started his dental journey. To enter dental school in Iran, a student must qualify and rank on the National Entrance Examination after high school or any other higher education. The length of dental training is six years, with the first two years dedicated to basic biomedical sciences and general courses and the following four years in dental sciences and clinic.

After his dental training in Iran, Dr. Kar's interest led him to advance his career in the United States by attending USC, where he was awarded his Doctor of Dental Surgery degree through the Advanced Standing Program for International Dentists (ASPID) program, as well as a Certificate in Periodontology, and Master of Science degree in Craniofacial Biology with research on the immunology of periodontal disease. Over the years, he has published in peer-reviewed journals and presented his findings at scientific meetings such as the American Academy of Periodontology, California Society of Periodontists, and International Association of Dental Research. In the end, all of Dr. Kar's experience and education ultimately led him to a career in academia, where he continues to teach and provide his expertise on periodontology at USC. When he reflects on his career, he relates that he loves sharing his passion and knowledge with students. He describes the enjoyment he has for being a supportive figure to the future generation of dentists and periodontists.

Periodontology is the specialty of dentistry that studies the supporting and surrounding structures of teeth and dental implants. A periodontist is a dentist who specializes in the prevention, diagnosis, and treatment of periodontal diseases and conditions. The goal of dentistry is to maintain and restore oral and dental health and functions. Many of these goals are achieved through restorative dentistry, such as restorations of decay or of broken and missing teeth. Although Dr. Kar appreciates that aspect of dentistry, he decided to pursue periodontology to gain a deeper understanding of the supporting structures of teeth and provide his patients with a functional and healthy foundation to restore the health and function of the dentition. He also greatly values the biological aspects of periodontology, such as microbiology, immunology, and pathology of periodontal disease.

Periodontal disease is a chronic inflammatory disease of the periodontium initiated and progressed by anindividual's immune response to bacterial and viral components present in the mouth and biofilm around teeth. In the course of the disease, intrinsic factors (i.e., individual inflammatory response) and extrinsic ones (i.e., composition of biofilm or tobacco use) influence the clinical progression of disease severity. To provide the best patient care, the necessary steps of gathering all the facts for creating a clear diagnosis are crucial to helping determine specific treatment plans for the patient's goals and well-being. To Dr. Kar, periodontology has been a rewarding specialty as it employs a multi-disciplinary approach to patient care that can involve collaborations of other dental specialties. Clinically, Dr. Kar finds excitement for taking on many periodontal-related cases. His clinical procedures can consist of surgical and non-surgical approaches

with the main goal of controlling the inflammation of the periodontium and preventing the advancement of periodontal disease.

Notably, Dr. Kar has a special interest in managing and teaching implant dentistry at USC. Implants are today considered the primary treatment modality for replacing missing teeth. At USC, Dr. Kar strives to make sure that DDS students are knowledgeable about this treatment modality, with the appropriate clinical exposure to this mode of treatment to plan for their patients' treatment needs. At the post-doctoral level, surgical implant dentistry is an integral component of training competent periodontists who can diagnose and treat patients affected by periodontal diseases and conditions who may need replacement of missing teeth, maintenance of peri-implant tissue health, and management of peri-implant diseases.

Since 1999, Dr. Kar has been able to inspire students through his teaching and practice. In his early career, he worked part-time as a clinical faculty member at USC while running his own practice. However, with his love for teaching, when the right opportunity arose, he found himself switching gears by landing a full-time faculty position at USC while managing his practice part-time in Mission Viejo, California. Since then, he has enjoyed his balance of being a clinician and an educator. At the Ostrow School, Dr. Kar and his colleagues have taken great care to shape the periodontology program in both pre-doctoral and post-doctoral courses. Through this opportunity, he loves how much he has been able to provide an impact to students by sharing his expertise. As a clinician and educator, he admires the eagerness that students express to learn and become compassionate health care providers. In particular, he appreciates the communication and interactions he has with students when conversations become complex and ideas become creative. He describes it as if everyone is always looking into the future. "Teaching at USC keeps me young," says Dr. Kar when asked about his life as an educator. From the start, he has been thankful for how rewarding his career has become, and for having the ability to be a part of a wonderful teaching and learning environment.

Dr. Kar admits that serving as the Program Director of the Advanced Periodontology program has been a challenging yet highly rewarding endeavor. His responsibilities include guiding students from the start to the finish. This includes interviewing prospective trainees, training them once admitted, guiding their education, encouraging them to conduct research, propelling them towards completion, and helping find the next career opportunity for everyone enrolled in the program. The administrative responsibilities are heavy for Dr. Kar; however, he realizes they are necessary to advance the program and achieve excellence at the Herman Ostrow School of Dentistry of USC. Although these tasks are important, he always prefers hands-on clinical teaching and case-based discussions on the clinic floor with students. To him, watching students grow to become the professionals they dreamed of is something that brings him joy and satisfaction.

Teaching and helping individuals achieve their dreams is what Dr. Kar wants to continue lifelong. The experiences and opportunities that he has achieved in his life with support from his family (especially his wife, Nakisa), faculty, students, and friends have made him appreciate his journey with no regret. He is grateful to his mentors Dr. Nowzari, Dr. Slots, Dr. Chee, Dr, Cho, Dr. Zadeh, and Dr. Chen, who provided him with the opportunity to do what he loves. Being a part of academia has motivated him to want to improve his efforts, such as by keeping updated with current news, collaborating with students, and learning new techniques. Dr. Kar is content with his current position and his future goals consist of continuously providing excellence and improving USC students' education. At home, he enjoys spending time with his wonderful family.

Dr. Kar wants to remind us that the answer to success is to follow your passion and seek the things that bring you happiness. He believes that every individual's path towards success is unique. Over the years, he has watched students take diverse paths and achieve successful careers as general dentists or as specialists. For those who might be facing challenges, Dr. Kar emphasizes the importance of persistence. Becoming discouraged is a natural process. However, learning to attempt a goal with challenges will teach you the value of success and enlighten you about the hard work and dedication required to make something happen: a life you imagined. In the end, individuals will learn what they enjoy in life and solidify their passion to a greater level than before. No matter what path each individual takes, Dr. Kar advises everyone to take on opportunities that will help them become better clinicians and practice with good ethics and honesty for themselves and for their patients' well-being.

# Dr. Stacey Dusing at the Forefront of Pediatric Rehabilitation

*By Candice Shahandeh-Rad, Ilan Kaboud, and Aaron Huang*

Dr. Stacey Dusing joined the Trojan family in April 2020 as the Sykes Family Chair of Pediatric Physical Therapy, Health, and Development and Associate Professor in the USC Division of Biokinesiology and Physical Therapy. Her research brings together evidence on the early detection of developmental disabilities with design and evaluation of effective interventions for infants at high risk of disability including those born very prematurely or with neonatal brain injury.

Dr. Dusing began her career as a clinically practicing physical therapist. She graduated with a bachelor of science in physical therapy from Daemen College in Amherst, New York. Following her lifelong passion for working with children, she worked with young infants, children, and their families during acute hospitalizations, recovery from injury, and in developmental follow-up clinics. However, she was and still is a constant learner, always more curious and posing new questions in response to each answer. Constantly seeking the answers to clinical questions in the literature, from mentors, or continuing education, Dusing often came back with bigger questions. The field of pediatric rehabilitation needed more evidence to guide practice. Eventually, a mentor encouraged her to look into the research world as they saw a fire of curiosity burning bright. Dr. Dusing initially debated and sought advice to decide whether she wanted an to obtain an advanced clinical degree such as a clinical doctorate in physical therapy (DPT), or to pursue a PhD with a focus on research and research training. The two degrees are drastically different and represent two ends of a large spectrum. In the end, Dr. Dusing completed her master's degree and then her Ph.D. in human movement science from the University of North Carolina - Chapel Hill. Upon completion of her Ph.D. in 2006, Dr. Dusing continued her research on infant development with an emphasis on infant motor control.

Dr. Dusing continued to work clinically as a physical therapist throughout her graduate education and during the 14 years she was on the physical therapy faculty at Virginia Commonwealth University and the Children's Hospital of Richmond. She described her clinical work as "a lot of fun" - reflecting enthusiasm for her work. With the ultimate goal of improving clinical care of infants and families, Dusing knew she wanted to be part of the clinical team, and not only partake in research.

At the start of her graduate training in the early 2000s, Dr. Dusing wanted to evaluate how infants who were born preterm moved their head, trunk and limbs early in development. She had noticed in the clinical setting that many preterm infants did not know how to flex their body forward but tended to arch their back. Although this was considered a common clinical observation, there had been no significant documentation of this phenomenon. Thus, her first study was to validate the clinical findings. After gathering data, the results showed that preterm infants were in fact more likely to arch their back rather than flex their body forward. Building upon this finding, Dr. Dusing went on to further study how this movement strategy impacted infants' development and why this atypical movement was so critical. The initial study became a stepping stone to future research questions.

Subsequent research investigated the impact of atypical postural control strategies when learning the movement of reaching and head control, and how infant motor control develops with play. Using her initial and follow-up studies as the basis, Dr. Dusing was able to develop interventions to help mitigate developmental delays due to the lack of typical postural control in the first months of life. This intervention, which is now known as Supporting Play Exploration and Early Development Interventions (SPEEDI), was developed by Dr. Dusing and its feasibility was assessed in a series of small studies, including gathering feedback from parents. Two pilot studies were completed, in the US and Australia, and a large multi-site clinical trial is in its final years. The goal of the intervention is to enhance parents' and infants' abilities to work together to support the development of the infant and reduce the degree of developmental delays or even eliminate them entirely.

SPEEDI is unique in its focus on supporting parents and infants during the transition from the neonatal intensive care unit to the home environment, empowering parents to learn how to communicate with their infant and providing daily motor and learning experiences. In addition, it works by targeting the most common motor and postural control deficits in infants. Dr. Dusing's team recognizes that intervention provided for a few weeks or months will not lead to the best outcomes; rather, the research team strives to influence the way parents interact with their child, changing the way they play with their child for life. Parents can integrate play-based intervention into their daily routine, increasing the amount of practice and improving outcomes. Unfortunately, a lot of infants born preterm start receiving interventions at a later time in life, after their early motor skills have begun developing and parents have established their own routine for interaction, which may not be ideal for targeting the infants' atypical movements. In addition, there is a high unmet need for therapy services for young infants. Dr. Dusing's goal is to provide targeted intervention or learning opportunities before the critical developmental window in the infant's first months of life has even begun. Ongoing research on the efficacy of SPEEDI will continue in a recently funded project to evaluate delivery of SPEEDI along with a parent mental health support program through telemedicine. This will allow the research to reach a greater context and allow infants and their families to receive the beneficial intervention while in the hospital and also gain continual support for the first year via telemedicine.

In addition, Dr. Dusing is working on another ongoing project known as SIT-PT. SIT-PT is led by Dr. Dusing and Dr. Regina Harbourne from Duquesne University in Pittsburgh, Pennsylvania, as well as six co-investigators across the nation. This multi-site clinical trial will compare the efficacy of two distinct physical therapy interventions: Movement Orientation Repetition Exercise - PT (MORE-PT) and Sitting Together and Reaching to Play (START-Play). This work began in 2009 with a planning grant that brought together a group of collaborators all interested in enhancing the quality of interventions available for infants and young children with motor impairments. The team recently completed a 6-year study comparing START-Play to usual care in the community. The primary outcomes suggested that START-Play could enhance development, even 9 months after intervention ended, in children with significant motor delays. Three-year follow up outcomes are due for publication in the near future. While some of the intervention principles in SPEEDI and START-Play are the same, the SIT-PT interventions focus on older children. The SIT-PT study is currently enrolling infants 7 to 24 months of age with motor impairments. When the infant is learning how to sit, he or she is then placed into a randomized arm of the clinical trial. Regardless of which intervention they are selected to receive, all families will receive guidance while helping the research team compare the effects of the two interventions, a win-win for all.

The SIT-PT project, combined with previous research, will allow the research team to understand if simply receiving more therapy is beneficial (a dosagee effect) or if there is a specific intervention or intervention principle that creates a more drastic difference in developmental outcomes. MORE-PT was designed, using observations from a previous study, to replicate current physical therapy provided to infants in the United States. The program was developed after observing interventions happening in clinical practice around the country. This includes activities to improve strength, range of motion, help the infant learn to sit on their own, or teach the infant to move on their hands and knees. On the other hand, START-Play is designed to bring together motor and thinking skills simultaneously. So instead of focusing strictly on the motor skills, the intervention focuses on providing opportunities to practice thinking skills through motor actions. START-Play was developed and refined by the research team brought together in the 2009 planning grant. While the core team has been stable, including Drs. Regina Harbourne, Sally Westcott-McCoy, Michelle Lobo, James Bovaird, and Stacey Dusing, the team has played an important role in training the next generation of pediatric rehabilitation researchers. Two post-doctoral fellows on the initial project have moved into roles as investigators on SIT-PT: Drs. Lin-Ya Hsu and Natalie Koziol. More than a dozen PhD students, 8 post-doctoral fellows, and 15 clinician-scientists have participated in this research, enhancing their training, career development, and ability to work as part of a large team.

Dr. Dusing has always worked with children in some capacity, and as an athlete is also fascinated by how the body moves. Her passion for physical therapy specifically with infants and children merges these two interests. She hopes to push the bounds of physical therapy to a new frontier with her ongoing research. She notes, "As we understand which infants are at the highest risk of having disabilities we can customize interventions, provide support early, and elicit neuroplastic changes to overcome early brain injury." Although it is challenging, Dr. Dusing exclaims that she would not trade her work for any other profession in the world. The goal of improving care for infants drove Dusing into a career in research, and supporting the development of the next generation of pediatric researchers keeps her striving to grow her team, provide outstanding research mentoring, and instill a passion for research in others.

# Bonding Social Work with Dentistry

*By Catherine Frusetta*

I met Professor Margarita Artavia over a Zoom session on a sunny November morning. She exuded warmth as she expressed her enthusiasm and gratitude to be featured in the public health spotlight in the Explorer. Professor Artavia and her team are great assets to the Herman Ostrow School of Dentistry of USC for their supervision of the collaboration between the Master of Social Work Interns and dental students and their public health service to the community of Los Angeles.

Professor Artavia started her academic career at Cal State University - Long Beach, where she was initially interested in criminology. Her goal was to become a warden in order to reform prisons. After she earned her BS in Criminal Law Corrections in 1983, her experience with interviewing prisoners contributed to her shifting interest to social work and primary prevention. Subsequently, Professor Artavia achieved her Master of Social Work degree from USC in 1985, and eventually became a licensed clinical social worker. She was working at the Venice Family Clinic when she first became involved with administrative program development. This was a big career change for her but she fit into the role perfectly and is still heavily involved in program development today.

Currently, Professor Artavia is working as clinical field faculty in the Suzanne Dworak-Peck School of Social Work at USC. When she first arrived at USC, Professor Artavia developed interdisciplinary internships between the Schools of Social Work, Education, Nursing, and Public Administration. Additionally, she is a Professor of Clinical dentistry at the Herman Ostrow School of Dentistry of USC, leading a team of social workers who are Ostrow faculty. The Master of Social Work Interns are crucial in several different disciplines at the Ostrow School, including the Special Patients Clinic, the Pediatric Clinic at the school, the Ostrow affiliated Pediatric Dental Clinic at the LAC + USC Medical Center, and most recently the Mobile Clinic.

The Special Patients Clinic is attended to by second-year advanced social work students. Social workers attend pre-sessions with oral health providers prior to clinic, and then enter the operatories as needed for counseling or for providing information on available resources for the patient's general health and well-being. Many patients within the Special Patients Clinic are afflicted with HIV/AIDS, for which the County of Los Angeles has funded oral health care costs. This allows Professor Artavia and the Social Work Interns to be involved with the DDS students in treating and providing resources to this patient population.

Social work interns have also had a history in the Pediatric Clinic at USC. Many children come from families in need of healthcare and other resources, which can be identified by the social workers. Additionally, if a child needs to undergo general anesthesia during treatment, social workers can assist with behavioral management of the child and alleviate the anxieties of the caregiver. While there is currently a pause on the pediatric clinic program this year, Professor Artavia is hopeful to re-establish social workers at this site in the future. In the meantime, the social work interns and faculty work together with the Ostrow Pediatric Dentistry Residents and DDS students to actively engage at-risk children, their parents, and foster parents at the Pediatric Dental Clinic at LAC + USC Medical Center.

Professor Artavia helped to coordinate the Master of Social Work Interns with Professor Kristine Parungao through field outreach centers, such as the Ostrow Mobile Dental Clinic. Through these programs, social work interns were each assigned to a dental provider, allowing dentists or hygienists and social work interns to collaborate in community oral health events outside the walls of the dental school.

Professor Artavia was first invited to be a part of Ostrow's outreach programs upon the establishment of the Children's Health and Maintenance Program (CHAMP). This began as a program that traveled to areas of need, such as women's shelters and preschools, to provide dental treatment to children five years and under. This program served 63,000 children in Los Angeles County. Under CHAMP, dental students served the children by providing cleanings, fluoride, oral hygiene instruction, and more, while students from the USC Suzanne Dworak-Peck School of Social Work provided follow-up assistance to the families in accessing routine dental care or secure dental homes.

At the end of five years, the CHAMP project was replaced by the Local Dental Pilot Program (LDPP) that was part of the Dental Transformation Initiative to improve oral health for children in the state's Medi-Cal system. There were thirteen LDPP programs throughout the state, and Professor Artavia and her colleagues were a part of the Ostrow team focused on Los Angeles County. This program used multiple interventions to increase access to oral health care for those in need, including professional oral health education, assistance with resource navigation, and oral health screening and education for patients and their families. This project successfully served over 38,000 children in Los Angeles County.

Public health organizations are great platforms for the bonding of social work and dentistry due to the inherently interdisciplinary nature of community health efforts. Many services, such as the ones we see at the USC Mobile Clinic, will provide medical and dental care, support from social workers, and other specialists in a centralized network. Professor Artavia describes how patients have complex needs, and therefore a comprehensive model is needed so it is easier for patients to access many different types of services under one entity.

The integration between social work and community oral health, an important component of public health, is vital because it can greatly improve access to patient care and quality of life through the unification of other services. In fact, research indicates that it takes only three minutes to engage with a patient. Getting to know the patient may not always be the first priority for a dentist during stressful and time-limited procedures; a social worker present before or after the appointment can engage with the patient to reduce anxiety, build a relationship between the patient and the healthcare system, increase engagement, and identify any obstacles the patient may face. A social worker can identify relevant resources for each unique patient, such as access to food pantries, child care, transportation, intimate partner violence programs, substance abuse programs, legal assistance, translators, and other mental health resources. These issues have become even more important during the COVID-19 pandemic, when many families have developed more complex needs. Additionally, increasing patient engagement has been shown to make patients more receptive and compliant to information about oral health care. Patients who are well versed in oral health care are more likely to place a higher value on their oral health and consequently to have healthier mouths. Recognizing this, the Herman Ostrow School of Dentistry has established a strong connection with the Suzanne Dworak-Peck School of Social Work. In the future, social workers may be more involved with community dentists and even private practices.

Through experience partnering with social workers in the clinics, students at the Herman Ostrow School of Dentistry can become more involved in, and knowledgeable about, the social work aspect of dentistry. For example, clinical training on motivational interviewing, smoking cessation, and other aspects of dentistry improve a dental student's communication skills and ultimately improve overall health care standards. The intermingling of the two professions can benefit and educate both DDS students and social work interns about community oral health, interprofessional collaboration, and how to best engage patients in establishing healthy habits.

Professor Artavia ended the interview emphasizing the teamwork it takes at every step of each program, whether writing administrative protocols, developing the educational curriculum, or clinical implementation. She spotlights her administrators, Dr. Roseann Mulligan and Dr. Piedad Suarez, along with her colleagues, Dr. Catherine Pham, Dr. Thanh Ton, Dr. Sanaz Fereshteh and Professors Kristine Parungao, Marsha Cunha, Daniel Jacob, Christine Edwards, and many other oral health providers and staff who have collaborated with her to enact their combined vision. Lastly, Professor Artavia emphasized that she looks forward to continuing collaboration with oral health providers and the social work team through the Herman Ostrow School of Dentistry and through community oral efforts in Los Angeles County as a whole.

# SCHEDULE OF **EVENTS**

2022 Annual Research Day | March 23, 2022 | USC Galen Center

**11:30 AM - 12:00 PM** — **GENERAL REGISTRATION & LUNCH**

**12:30 - 12:45 PM** — **OPENING REMARKS**

***Ishwar Puri*** *- PhD, Vice President of Research, USC*

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

***Yang Chai*** *- DDS, PhD, Associate Dean of Research, Herman Ostrow School of Dentistry of USC*

**12:45 - 01:30 PM** — **KEYNOTE SPEAKER**

***Peter Kuhn,*** *PhD*
*Dean's Professor of Biological Sciences*
*Professor of Medicine, Biomedical Engineering, and Aerospace & Mechanical Engineering*
*USC Dornsife College of Letters, Arts, and Sciences*

**1:35 - 02:10 PM** — **KEYNOTE SPEAKER**

***Abdi Sameni,*** *DDS, FACD*
*Clinical Associate Professor*
*Herman Ostrow School of Dentistry of USC*

**02:15 - 02:55 PM** — **KEYNOTE SPEAKER**

***Bobbi Pineda,*** *PhD, OTR/L, CNT*
*Assistant Professor, USC Chan Division of Occupational Science and Occupational Therapy*
*Herman Ostrow School of Dentistry of USC*

**03:00 - 04:20 PM** — **STUDENT PRESENTATIONS**

**04:20 - 05:20 PM** — **POSTER VIEWING**

**05:20 - 05:35 PM** — **AWARD PRESENTATIONS**

**05:35 - 06:30 PM** — **RECEPTION**

# KEYNOTE SPEAKERS

**Peter Kuhn,**

*PhD,* ***Dean's Professor of Biological Sciences***

**USC Dana & David Dornsife College of Letters, Arts, & Sciences**

**12:45-1:30 PM**

Dr. Kuhn is a scientist, educator and entrepreneur with a career long commitment in personalized medicine and individualized patient care. He is focused on the re-design of cancer care. The first product from technology developed by Dr. Kuhn became available for cancer care in June 2016. Dr. Kuhn is the Dean's Professor of Biological Sciences and Professor of Medicine and Engineering, a founding member of the Michelson Center for Convergent Biosciences at USC and is leading CSI-Cancer at USC. Prof. Kuhn's strategy is to advance our understanding of the human body to improve the human condition. His research is shedding new light at how cancer spreads through the body and evolves over time. This new science will lead to a personalized care strategy that is biologically informed and clinically actionable.

Dr. Kuhn is a physicist who trained initially at the Julius Maximilians Universität Würzburg, Germany, before receiving his Masters in Physics at the University of Albany, Albany, NY in 1993 and his Ph.D. in 1995. He then moved to Stanford University where he joined the faculties of Medicine and Accelerator Physics. From 2002 to 2014 he established the Physics Oncology program at the Scripps Research in La Jolla, CA before joining USC in 2014. He has published over 200 peer scientific articles and patents as a result of his research. He founded Epic Sciences, Inc. in 2009 to develop cancer diagnostic products. In June 2016, Epic Sciences' first CLIA certified LDT became available for patient care following the publication of clinical data demonstrating its predictive power.

**Abdi Sameni,**

*DDS, FACD,* ***Clinical Associate Professor***

**Herman Ostrow School of Dentistry of USC**

**1:35-2:10 PM**

Dr. Abdi Sameni is a Clinical Associate Professor of Dentistry and a 1991 graduate of the Herman Ostrow School of Dentistry of USC. He is a former faculty for the "esthetic selective" which emphasizes a "biomimetic approach" to restorative and esthetic care. He was the original director of the USC Advanced Esthetic Dentistry Continuum for the portion relating to indirect porcelain veneers. He is the former chairman and developer of the "USC International Restorative Dentistry Symposium" for the Herman Ostrow School of Dentistry of USC. In 2019 He founded the Los Angeles Dental Symposium.

Dr. Sameni lectures nationally and internationally on topics related to interdisciplinary dentistry, digital photography and its applications for dentistry, and various aspects of biomimetic and esthetic dentistry. Dr. Sameni is a member of numerous professional organizations and societies, which include The American College of Dentists, The American Academy of Esthetic Dentistry, OKU National Dental Honor Society and the Pierre Fauchard Academy. He maintains a private practice in West Los Angeles, California.

**Bobbi Pineda,**

*PhD, OTR/L, CNT,* ***Assistant Professor***

**USC Chan Division of Occupational Science & Occupational Therapy**

**2:15-2:55 PM**

Dr. Roberta "Bobbi" Pineda is an Assistant Professor of the USC Chan Division of Occupational Science and Occupational Therapy. Dr. Pineda served in pediatric clinical roles at Tampa General Rehabilitation, All Children's Hospital, Duke University Medical Center and University of Florida Shands Hospital from 1992 through 2006, where she gained expertise with outpatient and inpatient pediatric therapy, including services to fragile infants in the neonatal intensive care unit. The premature birth of her first child in addition to her ongoing interest in learning, led her to pursue her doctorate to conduct research with premature infants. Her dissertation investigated an educational intervention to promote breastfeeding in very low birth weight infants. Upon graduation with her doctorate in 2006, she began working at Washington University, where she spent 12 years exploring factors that can improve the lives of infants born prematurely.

# RESEARCH DAY POSTER ABSTRACTS

## ADVANCED SPECIALTY PROGRAM RESIDENTS

### Poster #1

**Title**: Effectiveness of late maxillary protraction vs. surgery in cleft patients

**Authors**: Allison Kawata, Lamia Binhuwaishel, Jaemin Ko, Xuanyu Lu, Ramon Durazo-Arvizu, Stephen Yen, & Ji Hyun Ahn

**Faculty advisor**: Ji Hyun Ahn

**Background:** Cleft lip and palate (CLP) is the most common facial birth anomaly with 1/950 live birth occurrence rate in the U.S. 22-73% of cleft lip and palate patients develop Class III malocclusion. The standard of care in CLP patients with Class III malocclusion is to advance the maxilla with a Lefort I osteotomy at the completion of adolescent growth. Scarring from previous cleft repair surgeries restricts the amount of advancement that can be performed. Non-surgical orthopedic maxillary protraction using reverse pull headgear can be used at 6-12 years of age. Late maxillary protraction (LMP), a modification of Liou's alternating rapid maxillary expansion and constriction (Alt-RAMEC) protocol, was developed to treat patients with CLP and Class III malocclusion who would typically be treated with orthognathic surgery. This technique loosens the circum-maxillary sutures to mobilize and advance the maxilla. **Purpose**: The objective of this prospective study was to compare skeletal and dentoalveolar changes in patients with Class III malocclusion associated with isolated cleft lip and palate treated with LMP vs. maxillary advancement surgery. **Methods**: 115 patients were enrolled in the study: 55 were treated with LMP (age 11-14 years) and 60 were treated with surgical maxillary advancement (age 16-21 years). Patients selected which treatment modality they underwent. Records were taken at pretreatment, maximal correction, deband, and 1-year follow-up. **Results**: Statistical analysis pending. We will analyze significant differences across timepoints for various lateral cephalometric landmarks to determine if LMP produces treatment outcomes comparable to surgical maxillary advancement. **Conclusions**: Pending.

### Poster #2

**Title**: Efficacy of topical ketamine in peripheral neuropathic pain compared to placebo or combination therapy

**Authors**: Mona Albatniji, Bruce Vafa, & Anchita Venkatesh

**Faculty advisor**: Reyes Enciso

**Background:** Neuropathic pain (NP) is the process resulting from a primary lesion or a disease of the somatosensory nervous system. Most common conditions that determine the onset of NP are post- herpetic neuralgia, peripheral diabetic neuropathy, chemotherapy induced peripheral neuropathies, and hereditary neuropathies. Patients with NP experience more frequent and severe sleep disturbances, anxiety and depression which significantly impacts their quality of life. The purpose of this study is to find the efficacy of ketamine to treat the NP and compare with placebo or other combination therapy. The article is based on meta-analysis systematic review. Low dose ketamine generates effective analgesia in NP cases by inhibiting the NMDA receptors which have a major role in generation of the pain. There is limited proof of NMDAR efficacy to treat NP, however the non-selective NMDR antagonist ketamine is recognized to be the most effective one. Ketamine releases the adenosine in the periphery which is responsible for inhibiting the secretion pro-inflammatory cytokines. Ketamine is applied topically, but it is not clear that result is because of cutaneous structure effect or systemic effects of transdermal administration. Chronic NP was one of the first reported indications for treating chronic pain with ketamine, however current data shows that ketamine has limited efficacy on long term use in cases of chronic pain.

### Poster #3

**Title**: Burnout and Fulfillment Amongst California Pediatric Dentists and Dental Residents

**Authors**: Jessica Ton & Alexander Alcaraz

**Faculty advisor**: Alexander Alcaraz

**Purpose**: The purpose of this study is to investigate the prevalence of professional fulfillment and its relation to occupational burnout in California pediatric dentists and dental residents. **Methods:** A survey was sent to approximately 650 pediatric dentists and dental residents who are members of the California Society of Pediatric Dentistry. The survey utilized the Professional Fulfillment Scale and the Overall Burnout Scale from Physician Wellness Research. **Results:** Of the 132 returned surveys, 10.6% of responses were from dental residents, 87.9% are currently practicing pediatric dentists, and 1.5% are retired. Private practice is the predominant primary practice setting (84.1%), with majority of pediatric dentists working more than 30 hours per week (78%). Fifty two percent of respondents were found to have positive professional fulfillment. Based on bivariate analysis, overall negative professional fulfillment is significantly associated with overall burnout (p=0.005). Participants with positive professional fulfillment are less likely to have burnout after adjusting for work hours per week and practice years (OR=0.02, 95% CI=0.001 – 0.33, p=0.006). **Conclusion:** Pediatric dentists and dental residents in California who have positive professional fulfillment are shown to be less likely to experience occupational burnout compared to those who had negative professional fulfillment.

### Poster #4

**Title**: Quality of Life in Adolescents with Cleft Lip and Palate

**Authors**: Cathrine Fong, Alexis Johns, Bocheng Gu, Cynthia Gong, Amarjit Dass, & Stephen Yen

**Faculty advisor**: Stephen Yen

**Purpose**: This study aimed to describe the quality of life in youth with cleft lip and palate (CLP) based on medical and sociodemographic variables. **Methods:** Participants with CLP completed the Youth Quality of Life – Facial Differences, which yields 5 Perceptual subscales: Positive Consequences, Coping, Negative Consequences, Negative Self-Image, and Stigma. Multi-

ple regression analyses were run for each subscale with predictors including sex, age, cleft type, surgery number, Great Ormond Street, London and Oslo (GOSLON) Yardstick rating, household size, socioeconomic status (SES), and insurance type. **Results:** Participants (N=114) were 11-22 years old (Mean=17.8, SD=2.9) with unilateral (88%) or bilateral (22%) CLP and GOSLON ratings of 3 (14%), 4 (51%), or 5 (35%). The majority were female (57%), Latinx (68%), and had public insurance (62%). Household size was 2-15 (M=4.7, SD=1.8) and SES was mostly in the lowest category (43%). All the regression models were significant (P<.05) and explained 16-26% of subscale variance. Public insurance was a significant predictor for lower Positive Consequences (β=-0.29, P=.023) and Coping (β=-0.31, P=.018). Higher Negative Consequences was predicted by having a bilateral CLP (β=0.29, P=.009). Higher Negative Self-Image was predicted by older age (β=0.24, P=.033) and having a bilateral CLP (β=0.30, P=.005). Higher Stigma was predicted by having a bilateral CLP (β=0.46, P<.001). **Conclusion:** Quality of life in youth with CLP varied based on multiple variables that can assist providers in identifying potential risk factors for lower quality of life, which included adolescents with bilateral CLP, aged 16 years or older, and with public insurance.

## Poster #5

**Title**: The Accuracy of Intra-oral Scans Spaces With and Without Saliva

**Authors**: Cory Nasoff, Andre Weissheimer, Katie Nasoff, & Ji Hyun Ahn

**Faculty advisor**: Ji Hyun Ahn

**Background:** Digital workflow in orthodontic treatment planning relies on the accuracy of scanners to generate 3D models from patients' malocclusion. At the end of treatment, undiagnosed diastemas lead to spaces that are both unhygienic and unaesthetic, often requiring further treatment. **Purpose:** The purpose of this clinical study is to evaluate whether the presence of saliva affects the accuracy of interproximal spaces of digital models made from intraoral The spaces were measured intraorally. The arches were scanned with saliva and without saliva using the iTero Element® and 3Shape TRIOS3® Intraoral Scanners. An orthodontist and two orthodontic residents were asked to identify, measure and record spaces on each model a total of two times generating two different trials of measurements (single blind). **Results:** Measurements of spaces on models generated with and without saliva were not significantly different (P value > 0.05) from the intraoral measurements of the same spaces. Models with and without saliva did not accurately represent spaces less than 0.3 mm. Model measurements for spaces 0.4 mm and above, regardless of the presence of saliva, were significantly different than the intraoral measurements. The absence of saliva did not lead to more accurate measurements, although digital models appeared visually clearer without saliva.

**Conclusion:** Regardless the presence of saliva, small spaces ( □ 0.3 mm) were not diagnosed on intraoral scans while spaces 0.4 mm and above, could be recognized but not accurately measured. For small interproximal spaces, diagnosis still remains a challenge in the orthodontic digital workflow when intra-oral scans obtained.

## Poster #6

**Title**: Full Digital workflow for Oral Occlusal Appliances: A Literature Review

**Authors**: Heba Khorshid, Mohammad Masoudian Khouzani, & Mariela Padilla

**Faculty advisor**: Mariela Padilla

**Background:** With the development of digital technology, the design, fabrication and cutting precision of occlusal appliances is fast, efficient, cheap and reduces errors. **Purpose:** The aim of this study is to review the literature on studies that evaluate the effect of Full Digital Workflow on the Occlusion, Retention, Stability, Clinical appliance adjustment Time and Patient Satisfaction of Digital Occlusal Stabilization Appliances. **Methods:** A literature review was performed using the following keywords: 3D Printing, Occlusal appliance, Night Guard, Digital dentistry, Splints, Additive Manufacturing and CAD/CAM. Electronic search of MEDLINE through the PubMed and Web of Science databases was conducted. The inclusion criteria included studies performed on occlusal appliances manufactured either by 3D printing or milling technology using a full digital workflow. With the collected information, a proposed workflow is created for the Orofacial Pain and Oral Medicine Center. **Results:** An initial search yielded 35 studies, and 5 additional studies were identified through cross referencing and manual search. A total of 12 studies were identified as relevant based on the abstracts, but only 6 studies met the inclusion criteria from which we were able to extract a reliable digital workflow. The digital workflow process included digital impressions, preparing the models, CAD software designing, importing data into CAM equipment for 3D printing. **Conclusion:** Digitalization can provide an easier, cheaper and faster method to deliver equally fit, retentive and stable occlusal appliances. This study will help provide other researchers and clinicians with the know-how of constructing digitalized occlusal splints using a free software program.

## Poster #7

**Title**: High-resolution Ultrasonography of Gingival Biomarkers for Periodontal Diagnosis in Healthy and Diseased Subjects

**Authors**: Jane K. Law, Colman A. Moore, Christopher T. Pham, Kai Chiao J. Chang, Casey K. Chen, & Jesse V. Jokerst

**Faculty advisor**: Dr. Casey Chen

**Background:** Diagnosing periodontal and peri-implant diseases relies on precise clinical assessment. Clinical assessment of periodontium includes data collection of periodontal probing depths (PPD), alveolar bone crest (ABC), clinical attachment loss (CAL), gingival phenotype, gingival recession, and inflammation. However, clinic examination is often time-consuming and painful for the patient, with large intra- and inter-operator variations. Ultrasound imaging technique may provide a non-invasive approach in periodontal examination. **Purpose:** The objective of this study is to compare periodontal examination by ultrasound imaging and conventional clinical assessment. **Methods:** A pilot study was performed on ex-vivo pig jaws by direct examination and ultrasound imaging of the periodontal supporting structures. Subsequently, maxillary anterior and mandibular anterior sextants were examined clinically in 30 human subjects, followed by ultrasound imaging of the same sextants. **Results:** The ultrasound imaging identified marginal gingiva, CEJ, ABC, measured CAL, gingival recession, and thickness in both the pig jaws and the human subjects. The results of periodontal examination by imaging and clinical examination were comparable. The ultrasound imaging has the advantage of providing a precise measurement of the gingival thickness and the direct visualization of the CEJ and ABC and other anatomic features underneath the gingiva. **Conclusion:** Ultrasound imaging is comparable to clinical examination and is promising as a fast, accurate, and non-invasive approach for periodontal examination.

Poster #8

**Title**: Artificial Intelligence for Rapid Clinical Diagnosis in Oral Medicine

**Authors**: Jouliana Davoudi Chegani, Michael Asadoorian, & Parish P. Sedghizadeh

**Faculty advisor**: Parish P. Sedghizadeh

**Background:** Delayed diagnosis of oral pathology, such as oral cancer or immune mediated conditions, can result in significant morbidity and in some cases mortality. The purpose of this study and method was to improve clinical diagnosis by providing a simple Artificial Intelligence (AI) tool to increase efficiency and accuracy in clinical diagnostics, while reducing misdiagnosis. We used a classification scheme for oral lesion image classification based on deep convolutional neural networks (CNN). At the first training batch we used two lesions in lichen planus, mucocele, for proof of concept and second step added oral cancer. **Purpose:** The purpose of this study was to create and apply an Artificial Intelligence tool (Oromed AI®) to aid in oral medicine diagnostics. For proof of concept to train the AI system and show it can work. **Methods:** Proof of concept used about 2500 pictures. These images are taken by clinical experts in oral medicine and pathology with training in intraoral photography. We used a classification scheme for oral lesion image classification based on CNN. **Results:** Our testing model and Oromed AI software achieved an accuracy of 84.9% in lichen planus recognition and 76.02% for mucocele. Currently the AI training with the addition of oral cancer is in progress. **Conclusions:** AI can revolutionize healthcare by accessing multiple sources of data and providing rapid real-time analyzing capability to assist healthcare clinicians in diagnostics and predictions.

Poster #9

**Title**: Radiographic alveolar bone loss prevalence in predoctoral clinic population

**Authors**: Julianna Ko, Jessica Huang, Saeed Bigdeli, Edward Lee, Alex Kiss, Jeffrey Liu, Paul Levi Jr. & Kian Kar

**Faculty advisor**: Kian Kar

**Background:** Few studies have investigated the prevalence of radiographic alveolar bone loss and its association with several risk factors in both young and old patients. **Purpose:** To determine 1) the prevalence of RBL among Herman Ostrow School of Dentistry pre-doctoral patients 2) which age groups had greater prevalence of RBL and 3) associations between RBL and gender, smoking, and self-reported medical conditions (SRMC). **Methods:** 1073 patients (ages 15-64) from the Herman Ostrow School of Dentistry predoctoral clinic were reviewed and divided into ten five-year age cohorts. Patients with RBL had at least one site ≥2.5mm from the cemento-enamel junction to the alveolar crest on posterior interproximal radiographs. **Results:** An overall RBL prevalence of 37.1% was observed. In a multivariable logistic regression model that controlled for gender and medical comorbidities, age was significantly associated with increased RBL in the following age groups: 40-44, 45-49, 50-54, 55-59, 60-64. RBL was significantly decreased in patients under the age of 24 (age groups 15-19, 20-24). Males were significantly associated with increased RBL compared to females (OR=1.532, 95% 1.105-2.123). Of SMRC, cancer was significantly associated with increased RBL (OR=4.717, 95% 1.342-16.579). **Conclusions:** Our results suggest that patients above 40 years of age, male patients, and patients with current or historic cancer status have increased risk for RBL.

Poster #10

**Title**: A Retrospective Comparison of USC Orthodontic Patients to Statistical Norms

**Authors**: Gina Johnson, Anisha Kurukulasuriya, Kimberlin Low, & Judith Naziri

**Faculty advisor**: Ji Hyun Ahn

**Background**: In order to better understand and serve the patients at the graduate USC Orthodontics clinic, a research study was conducted to categorize the types of patients at our facility. Patients seen from 2018 to 2020 were taken and categorized by skeletal, dental, and soft tissue diagnoses, followed by if the patient began treatment, categorized by treatment objective and modality. Lateral cephalograms and panoramic radiographs were evaluated as well as intraoral and extraoral photos. After the data mining was complete, key findings were compared to landmark orthodontic literature to compare if the population being treated at USC Orthodontics is representative of the general population. Our findings showed that a higher number of complex cases are treated in the USC Orthodontics clinic in comparison to private practice orthodontic clinics.

Poster #11

**Title**: Plaque Scores: Relationship Between Intraoral Photos and Clinical Examination

**Authors**: Letitia Edwards, Jose Polido, Leah Stein Duker, Cheryl Vigen, & Sharon Cermak

**Faculty advisor**: Jose Polido

**Background**: Advances in technology, including introduction of intraoral cameras with plaque recognition technology, may aid dentists in objectively evaluating the health status of patients with autism spectrum disorder (ASD). **Purpose:** To evaluate validity of the SOPROCare intraoral camera compared to clinical examination to determine plaque presence and severity for children with ASD.
**Methods:** This study is part of a larger randomized clinical trial which examined the efficacy of modifying sensory characteristics of the dental environment to reduce children's distress and enhance quality of care. This paper compares plaque scores determined by clinical examination and the SOPROCare intraoral camera prior to dental treatment. Participants were 144 children 6.2-15.1 years old with ASD (total n=249 dental encounters included in analyses). Children were seen for a dental examination and prophylaxis in a regular dental environment (RDE) and sensory adapted dental environment (SADE). During oral examination, patient plaque status was assessed clinically using the Plaque Index (PI). Immediately following clinical examination, intraoral photographs of buccal and lingual surfaces of six teeth were taken with the camera on plaque mode. Plaque presence and severity was scored by a trained and reliable dental resident at a later time using a modified version of the PI. Correlations between total PI assessed during the exam vs. determined from the photos and overall differences between these measures were calculated using mixed effects regression models to account for repeated measures by child. Correlations and differences were similarly investigated for components of the total PI. **Results/Conclusion:** In Progress.

Poster #12

**Title**: Transcutaneous Electrical Nerve Stimulation for the treatment of salivary hypofunction

**Authors**: Mariam Siddiqui, George Ayoub, Sara Abdelhai, Reyes Enciso, & Kamal Al-Eryani

**Faculty advisor**: Reyes Enciso & Kamal Al-Eryani

**Background**: Salivary gland hypofunction refers to a decrease in salivary flow based on an objective measurement of saliva produced. Medications, radiation therapy, hormonal disorders and various

systemic conditions can cause dry mouth. **Purpose:** To evaluate the efficacy of Transcutaneous Electrical Nerve Stimulation (TENS) for the treatment of dry mouth compared to sham intervention. **Methods:** We searched four electronic databases including PubMed, EMBASE, Web of Science, and Cochrane library, along with hand searching of the references published up to February 2021, to identify randomized controlled trials (RCTs) investigating TENS compared to placebo. The authors assessed risk of bias following Cochrane handbook. **Results:** The initial search strategy yielded 169 unduplicated references, which were assessed independently by three review authors. After evaluation, this number was reduced to six RCTs (one unclear risk of bias and five high risk of bias). Due to the high risk of bias and inconsistency of the outcomes the evidence's quality was low. Meta-analyses showed that post-treatment unstimulated and stimulated salivary flow as well as quality of life were not statistically significantly different when comparing TENS versus sham therapy ($p>0.05$). However, TENS increased significantly the stimulated salivary flow and quality of life in one study compared to usual care ($p<0.001$). **Conclusion:** This systematic review highlights the need for further studies to understand the effect of mechanical and electrical stimulation of the skin covering the salivary glands as TENS performed better than usual care but not sham therapy.

## Poster #13

**Title**: Profile of the OSA patients in the Orofacial Pain Center

**Authors**: Mohammad Masoudian Khouzani, Jaqueline Venturin, George Sheppard, & Heba Khorshid

**Faculty advisor**: Mariela Padilla

**Background**: Obstructive sleep apnea (OSA) occurs when there are recurrent episodes of upper airway collapse and obstruction during sleep associated with arousals with or without oxygen desaturations. Prevalence studies have shown that this condition affects mostly males (Vensel, 2019), increases with age and in patients with higher body-mass index (Senaratna et al, 2017), and is a common comorbidity of conditions. **Purpose:** This study examined the profile of the patients referred to the OFPOM center with a diagnosis of Obstructive Sleep Apnea. **Methods:** This is a retrospective study conducted at the Orofacial Pain and Oral Medicine Center of the University of Southern California (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 created a de-identified database of 50 patients which included age, sex, BMI, AHI, and oxygen saturation (nadir, average, and time <88%). All data is analyzed using descriptive statistics. **Results:** The most affected gender is male (66%) and age average 56.48 years old. In general, the patients had an average BMI of 28 (considered overweight), the average AHI is 18.6, which is moderate. Regarding oxygen saturation the average is 91.8, and nadir is 81.44. Oxygen saturation below 88%/ minute is 7. The results indicate moderate OSA in the reported cases. **Conclusion:** Understanding the characteristics of the patients allows the clinician to identify risk factors for OSA and to address possible consequences of this condition.

## Poster #14

**Title**: Gingipain activity in subgingival plaque is correlated with disease severity

**Authors**: Mohammed Hayati, Colman Moore, Natalia Tjokro, Kai Chiao Joe Chang, Young Cheng, Jesse V. Jokerst, & Casey Chen

**Faculty advisor**: Casey Chen

**Introduction**: Periodontitis results in dental pain, tooth loss, reduced quality of life and systemic effects. Periodontists solely rely on periodontal clinical parameters such as probing pocket depth, bleeding on probing, mobility, recession and clinical attachment loss to diagnose/treat periodontal disease. However, those parameters do not reflect the actual bacterial activity and its relationship to disease severity and activity. The aims of this study are to assess the presence of *P. gingivalis* gingipains and its role in disease severity, and to assess the ability of a new photoacoustic molecular tool in mapping *P. gingivalis* gingipains in the gingival tissues.

**Methods**: 17 patients, aged 27-79 were recruited to participate in this study. Full periodontal evaluation was completed, and a diagnosis made in accordance to the 2017 World Workshop. For both test group (n=11, Periodontitis) and a control group (n=6, Healthy periodontioum), paper point sampling was done to enable the detection of *P. gingivalis* gingipains. Additional imaging using a high-frequency photoacoustic-ultrasound system Visualsonics (Vevo LAZR) was done to map out *P. gingivalis* gingipains. **Results:** The amount of *P. gingivalis* detected was higher in periodontitis patients vs. healthy subjects. The detection of *P. gingivalis* corresponded with higher CAL, BOP & PPD. The photoacoustic imaging was able to assess the presence of *P. gingivalis* gingipains in the gingival tissues in some diseased subjects. **Conclusion:** The virulence factor of *P. gingivalis* gingipains exhibited higher predilection for disease severity when present in periodontal pockets. However, the imaging modality used in this study did not provide consistent results and its use is subject to further research.

## Poster #15

**Title**: Efficacy of topical ketamine on peripheral neuropathic pain.

**Authors**: Mona Albatniji, Bruce Vafa, Anchita Venkatesh, Mariela Padilla, & Reyes Enciso

**Faculty advisor**: Reyes Enciso & Mariela Padilla.

**Background**: Neuropathic pain (NP) is defined as a painful response resulting from a primary lesion or a disease of the somatosensory nervous system. Most often peripheral NP is described based on its anatomical location and etiology. **Purpose:** To evaluate the efficacy of topical ketamine or combination therapy on peripheral NP compared to placebo. **Methods:** Electronic search of databases including PubMed, EMBASE, Web of Science, and Cochrane library, along with hand searching of the references published up to February 2021, was conducted to identify randomized controlled trials (RCTs) investigating topical ketamine or combination therapy in the treatment of peripheral NP compared to placebo. The authors assessed risk of bias following Cochrane handbook. **Results:** The initial search strategy yielded 235 unduplicated references, which were assessed independently by three review authors. After evaluation, this number was reduced to six RCTs (two unclear risk of bias and four high risk of bias). Due to the high risk of bias and small sample size, the evidence's quality was low. In three RCTs there was a significant improvement in pain intensity in the ketamine and placebo groups, with no differences in the improvement between intervention and placebo groups. Meta-analyses showed no statistically significant differences in the improvement of pain intensity from baseline in two studies comparing ketamine and placebo groups ($p=0.103$). **Conclusion:** Further long-term studies with follow-up are needed to assess topical ketamine in treating peripheral NP, alone or in combination with amitriptyline.

## Poster #16

**Title**: Trend Analysis of Reporting Quality of Cohort Studies in Periodontology

**Authors**: Shira Scholten, Yael

Breziner, Satish Kumar, & Kian Kar

**Faculty advisor**: Kian Kar, &Satish Kumar

**Background**: Observational studies are an important source of evidence in guiding clinical practice. The Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) checklist was originally developed in 2007 to systematically improve reporting quality in observational research, including cohort studies. **Purpose:** To assess the reporting quality of cohort studies published between 2000 and 2018 in two high impact periodontology journals using the STROBE checklist. **Methods:** The PubMed electronic database was used to select cohort studies published in the *Journal of Periodontology* (JOP) and the *Journal of Clinical Periodontology* (JCP) in two different years preceding the publication of STROBE (2000 and 2006) and two different years after publication of STROBE (2012 and 2018). Seven cohort articles were randomly selected from each journal at each time point, totaling 56 articles. Articles were analyzed and scored based on the STROBE checklist criteria, and a trend analysis of articles' adherence to STROBE checklist across different time points, and journals was completed. **Results:** The average adherence to the STROBE checklist of all articles was 73% and the STROBE score increased significantly over time (63% average score in year 2000 compared to 80% average score in 2018). Notable areas of inadequate reporting included attempts to address biases, explanation of sample size calculations, reporting of participation/follow-up, and reporting of the number of participants with missing data. **Conclusion:** Though the quality of cohort studies published in periodontology has improved since the STROBE publication, many items from the checklist remained unmet across all years, leaving room for improvement.

## CBY/PIBBS GRADUATE STUDENTS

### Poster #17

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

**Authors**: Ali Can Savas, Tingyu Wang, Chao Qin, Mehrnaz Zarinfar, & Pinghui Feng

**Faculty advisor**: Pinghui Feng

**Background**: IkB kinase (IKK) epsilon is a member of non-canonical inhibitor of kB kinases (IKKs) that regulates inflammation and cancer. IKKepsilon was shown to be overexpressed in diverse tumors. Kaposi's sarcoma (KS)-associated herpesvirus (KSHV) is a human oncogenic virus, causatively linked to KS and two types of lymphoma, i.e., primary effusion lymphoma (PEL) and multicentric Castleman's disease. We previously reported that IKKepsilon is required for KSHV GPCR-induced transformation of endothelial cells. In this study, we explored KSHV-positive PEL cells to examine the roles of IKKepsilon in metabolism and proliferation. **Results:** showed that latency related KSHV proteins, including vCyclin and Kaposin, activate IKKepsilon to enable cell proliferation. To further understand the molecular action of IKKepsilon, we employed high throughput phospho-proteomics to profile the phosphorylation landscape altered by IKKepsilon-depletion. IKKepsilon-depletion installed distinct changes of phosphorylated proteins enriched in cell cycle and nucleotide metabolism. Interestingly, significant changes in phosphorylation of glutamine amidotransferases in nucleotide metabolism were detected, e.g., CAD, CTPS1, PFAS and GMPS. In addition to catalyzing nucleotide synthesis, glutamine amidotransferases have intrinsic activities to deamidate key signaling proteins and alter fundamental biological processes. Indeed, we showed that IKKepsilon physically interacted, and phosphorylated GMPS and PFAS. **Conclusion:** de novo nucleotide synthesis and cell proliferation were significantly impeded by IKKepsilon depletion in PEL cells, which were restored by wildtype or phosphorylation-mimetic mutants of PFAS and GMPS, but not phosphorylation-resistant mutants. These findings uncover that KSHV deploys latent proteins to activate IKKepsilon, which promotes nucleotide synthesis and fuel cell proliferation in PEL cells.

### Poster #18

**Title**: Mechanisms of Craniosynostosis in Bent Bone Dysplasia Syndrome

**Authors**: Audrey Nickle & Amy Merrill

**Faculty advisor**: Amy Merrill

**Background**: Craniosynostosis, or premature suture fusion, is one of the most common craniofacial defects and a symptom of numerous inherited skeletal disorders. The most recently characterized of these disorders, Bent Bone Dysplasia Syndrome (BBDS), is caused by mutations to Fibroblast Growth Receptor 2 (*FGFR2*). **Purpose:** The pattern of suture fusion in BBDS is distinct from other well-characterized FGFR2 disorders. Our lab has recently developed a Cre-inducible mouse model for BBDS which is an excellent tool to study how these distinct *Fgfr2* mutations impact suture development and maintenance. **Methods/ Results:** Using the Wnt1-Cre driver mouse, we induced the $Fgfr2^{M391R}$ mutation in the neural crest cell population of the skull, producing a multi-suture craniosynostosis phenotype. This was interesting given that several of these affected sutures are primary derived from the paraxial mesoderm rather than the neural crest. Lineage tracing with Wnt1-Cre shows, however, that there is a contribution of the neural crest to the dense connective tissues of each cranial suture. This suggests a role of Fgfr2 in maintaining this non-osteogenic tissue to prevent unwanted osteogenic differentiation and subsequent suture fusion. Sequencing analysis revealed changes in several key factors, including members of the Wnt and p53 pathways, which play a demonstrated role in suture development. **Conclusion:** Our findings so far highlight a novel role of Fgfr2 in maintaining balance in the fate of dense connective tissue. Further research will continue to investigate this and how it is disrupted in BBDS.

### Poster #19

**Title**: Chitosan hydrogel enhances stability of amelogenin-derived peptides P26 and P32

**Authors**: Erika Bauza Nowotny & Janet Moradian-Oldak

**Faculty advisor**: Janet Moradian-Oldak

**Background**: Our chitosan-based peptide hydrogel possesses unique benefits conferred by chitosan (CS), which include biocompatibility, non-toxicity, and anti-microbial properties. However, it is not known how CS affects the stability of amelogenin-derived peptides P26 or P32. **Purpose:** To investigate whether CS has any effect on the in vitro stability of P26 or P32, and to characterize any degradation products after incubation of P26 and P32 aqueous solutions. **Methods:** In vitro stability of P26, P32, P26-CS, and P32-CS was assessed by HPLC analysis. Peptide degradation, including presence of cleavage products or dephosphorylation was assessed by mass spectrometry (MS). **Results:** Our results show statistically significant differences for the effect of time and treatment group (P26, P32, P26-CS, P32-CS) on HPLC peak area at room temperature (RT; $p<0.0001$) and 37°C ($p<0.0001$; ANOVA). All samples were stable after one day at RT and at 37°C. After 7 days, P26-CS and P32-CS demonstrated greater stability at RT (94% and 88%

respectively) when compared to their respective peptides in aqueous solution. The peptides were marginally degraded after 7 days at 37°C as indicated by MS. The main peptide peak presented less degradation in P32 (~4% dephosphorylation and ~19% loss of methionine) than in P26 (~9% dephosphorylation and ~25% loss of aspartic acid). **Conclusions :** The increased stability of peptide-CS samples and minimal peptide degradation indicates a protective role of CS. This suggests potentially enhanced peptide viability in the oral cavity, a key feature that will increase the shelf life and facilitate the clinical use of our hydrogel.

## Poster #20

**Title**: Ameloblastin Promotes Polarization of Ameloblast Lineage Cells (ALC) in a 3D Cell Culture System

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

**Faculty advisor**: Janet Moradian-Oldak

**Background**: Several functions of ameloblastin have been proposed including but not limited to a role in ameloblast cell adhesion. Here, we demonstrate the differential response of immortalized ameloblast like cells in 3D culture to ameloblastin compared to controls. We seek to further this by elucidation of the mechanisms involved. **Purpose:** Can ameloblastin induce overt morphological changes and polarization in ALC in 3D culture? **Methods:** ALC were cultured in modified DMEM supplemented with 10% FBS and 1% Strep/Penicillin. 3D on top type culture was carried out on 96 well plates using 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. ALC cells were added atop the set gel. Cells were labeled using antibodies against polarity proteins and cell membrane and imaged using Keyence BZX810 and Leica SP8 confocal microscope. **Results:** 3D culture of ALC in the presence of enamel matrix proteins resulted in the formation of cell clusters with selective elongation along the Z axis with a 3-times greater aspect ratio achieved with Ambn compared to Amel.The clusters formed with Ambn display polarized distribution of E-cadherin, Par-3 and Claudin-1 proteins. Heat denaturing Ambn or removal of the exon 5 encoded region results in a reversal of these effects **Conclusion:** Culturing ALC in the presence of Ambn leads to a change in cell morphology and polarization status in 3D. This suggests a functional significance of ameloblastin in establishing ameloblast morphology and in Tomes' process formation.

## Poster #21

**Title**: Fgfr2 regulates fibrous connective tissue development of calvarial sutures

**Authors**: Lauren Bobzin & Amy Merrill

**Faculty advisor**: Amy Merrill

**Background**: The anterior fontanelle (AF) is the fibrous soft spot in the front of an infant's head, which forms at the intersection of the frontal (metopic), coronal, and sagittal sutures. During postnatal development of the calvaria, closure of the AF correlates with formation of the posterior frontal suture (PFS). However, persistence or premature fusion of the AF in congenital disorders, such as cleidocranial dysplasia, campomelic dysplasia, and frontal suture craniosynostosis can distort calvarial growth and alter intracranial pressure. Fibroblast Growth Factor Receptor-2 (FGFR2) is a key regulator of calvarial development. This is underscored by human diseases caused by FGFR2 mutations, which often feature both fontanelle and suture defects. While extensive research has been done into the role of Fgfr2 in bone formation, little is known about its role in the formation of other connective tissues of the calvaria. Our aim is to test the hypothesis that Fgfr2 regulates development of the AF and PFS connective tissue by dually regulating specification and differentiation of Scx+/Runx2+ and Scx+/Sox9+ skeletal progenitors which are essential for proper formation and fusion of the frontal suture. Here, we use mouse genetics to identify the dual roles of Fgfr2 in the establishment and eventual lineage commitment of skeletal progenitor cells and demonstrate that conditional knockout of Fgfr2 delays AF closure and blocks formation of the PFS suture cartilage.

## Poster #22

**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-inflammatory response. It is characterized by bone destruction, irreversible damage of the periodontal ligaments, and eventually tooth loss. Arginine methylation has been implicated in many biological contexts including regulation of inflammatory pathways as in BMP and TGF-β signaling. **Purpose:** SMAD6 arginine (Arg) methylation has been indicated to exacerbate inflammation and bone loss in experimental periodontitis. Arg can also be modified by another family of enzymes, PADs, to citrulline. Citrullinated proteins have been detected in periodontitis and many other inflammatory diseases such as rheumatoid arthritis, Multiple Sclerosis, and Alzheimer's disease, as well as many cancers. Therefore, we hypothesized that the interplay between PADs and PRMTs may affect the way oral inflammations occur and progress. **Methods:** To tackle this hypothesis, we will perform gain and loss of function experiments on oral gingival epithelial cells. Additionally, ligature suture will be inserted on WT and transgenic mice to induce experimental periodontitis that will assist in the study of inflammation. **Results:** Our preliminary results have shown that the level of citrullination and arginine methylation in the inflamed tissue assessed by immunofluorescence was significantly higher than in non-inflamed tissue. Furthermore, inhibition of citrullination in the mouse periodontitis model limits bone destruction, while inhibition of arginine methylation aggravates inflammation and bone destruction. **Conclusion:** Future experiments will directly investigate the molecular events that underpin the interaction between methylation and citrullination in oral inflammatory diseases.

## Poster #23

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

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

**Faculty advisor**: Jian Xu

**Background**: Runx2 is the master transcription factor for bone formation. Mutations of Runx2 in human are associated with cleidocranial dysplasia that displays craniofacial defects including open metopic suture. Because of its importance, Runx2 is tightly regulated by various post-translational modifications. Our Preliminary data shows that Runx2 is methylated by PRMT3 and PRMT4, which are highly expressed in the osteoblast lineages and Runx2 methylation occurs at four specific 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. Furthermore, cell differentiation and behavior assays were carried out to assess the function of Runx2 WT vs mutants in osteogenesis and migration.

**Results:** Runx2 arginine methylation is required for osteogenic differentiation and essential in promoting osteoblast migration in cultured osteoblasts. Neural crest specific Prmt4 deficiency inhibited osteoprogenitor migration at the osteogenic fronts of frontal bones, and resulted in 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:** Runx2 arginine methylation is essential for osteogenesis and osteoprogenitor migration. PRMT4-methylated Runx2 at the osteogenic fronts is essential for posterior frontal suture closure in vivo.

Poster #24

**Title**: Ribosome biogenesis selectively regulates complement pathway in mesenchymal stem cells.

**Authors**: Supawadee Jariyasakulroj, Wei Zhang, Li Ma, & Jian-Fu Chen

**Faculty advisor**: Jian-Fu Chen

**Background**: Craniosynostosis is a birth defect which occurs as a consequence of premature fusion of cranial sutures. Loss of mesenchymal stem cells (MSCs), such as Gli1+MSCs, from the suture disrupts cranial suture homeostasis and consequently leads to suture fusion. In addition, ribobosome biogenesis has been found to be related to craniosynostosis. However, the functions of ribosome biogenesis in MSCs in craniofacial tissues remain largely unknown. **Purpose:** To investigate the functions of ribosome biogenesis in MSCs during cranial suture homeostasis. **Methods:** Snord118, a snoRNA involving in ribosome biogenesis, was used as a genetic tool to perturb ribosome biogenesis in MSCs in human iPSC-derived MSCs and in *Gli1-CreERT2;Snord118$^{f/f}$* mice. RNA-sequencing analysis and western blot were performed in Snord118 mutant iPSC-derived MSCs. *Gli1-CreERT2;Snord-118$^{f/f}$* mice were injected with tamoxifen at P20 and examined phenotypes one month after induction by microCT, H&E staining, and immunofluorescence staining. **Results** *Gli1-CreERT2;Snord118$^{f/f}$* mice exhibited reduced suture volume and narrower sutures compared to wild-type mice. Snor118 mutant mice also showed increased expression of Runx2 osteogenic marker and reduced osteoclast numbers in suture mesenchyme. In addition, complement pathway was downregulated in Snord118 mutant iPSC-derived MSCs. The decreased expression of complement proteins C1S, C3, and MASP1 were also found in both Snord118 mutant iPSC-derived MSCs and in suture mesenchyme of *Gli1-CreERT2;Snord118$^{f/f}$* mice. **Conclusion:** Ribosome biogenesis selectively regulates complement pathway in MSCs. The novel functions of complement pathway have been identified in craniofacial tissue homeostasis. Moreover, perturbation of ribosome biogenesis in Gli1+MSCs results in disruption of suture homeostasis.

## DENTISTRY /CCMB POST-DOCTORAL FELLOWS

Poster #25

**Title**: Maxillomanibular Development after Mandibular Distraction Osteogenesis in Pierre Robin Sequence Patients

**Authors**: Abdullah Albawardi, Kimiko Agari, Lamia Binhuwaishel, Laya Jacob, Mark Urata, Jeffrey Hammoudeh, & Stephen Yen

**Faculty advisor**: Stephen Yen

**Background**: Micrognathia presents in many craniofacial disorders and may have immediate and long-term effects on the neonatal airway. Airway obstruction is a critical condition that often requires immediate intervention—ranging from intubation to tracheostomy, and mandibular distraction osteogenesis. **Methods:** Retrospectively identified patients who underwent mandibular distraction osteogenesis (MDO) prior to 12 months of age from 2004 to 2016 at Children's Hospital of Los Angeles. Identified patients with isolated Pierre Robin Sequence (iPRS), and patients with post-distraction imaging from which lateral cephalometric data could be traced using Steiner's analysis for skeletal classification. Pre- and post-distraction lateral profile photos were used to assessed for skeletal classification. **Results:** 82 patients underwent distraction from 2004-2016.From this group, there were 38 patients with iPRS without other craniofacial anomalies or syndromes. Of these, 22 (57.9%) had at least one post-operative lateral cephalogram. Average time from surgery/distraction to initial lateral cephalogram (TAS) was 62.96 months for all patients (range 10.67 to 128.1 months). 16 patients (TAS 61.30 months) had an ANB > 4°. 4 patients (TAS 74.31 months) had an ANB from 0-4°. 2 patients (both with prior cleft palate repair) had an ANB < 0° (TAS 32.2 and 74.87 months). 3 total patients had prior cleft palate repair. **Conclusion:** A majority of patients with iPRS may revert back to a skeletal class II relationship by 5 years after distraction. This transition from a skeletal class III to a skeletal class I or II is due to the inherent delayed growth of the micrognathic mandible.

Poster #26

**Title**: SARS-CoV-2 Couples Evasion of Inflammatory Response to Activated Nucleotide Synthesis

**Authors**: Chao Qin, Youliang Rao, Hao Yuan, Ting-yu Wang, Jun Zhao, Ali Savas, Bianca Espinosa, Chao Zhang, & Pinghui Feng

**Faculty advisor**: Pinghui Feng

**Background**: Although ongoing vaccination drastically reduces SARS-CoV-2 infection, mutant viruses are emerging under the pressure of neutralizing antibodies, calling for new antiviral strategies. **Purpose:** The goal of this study is to characterize a novel strategy to restore cytokine production and deplete pyrimidine in SARS-CoV-2-infected cells, thus impeding viral replication. **Methods:** real-time PCR, western blot, LC/MS, co-IP, and protein charge analysis. **Results** We report that targeting a pyrimidine synthesis enzyme restores inflammatory response and depletes nucleotide pool to impede SARS-CoV-2 infection. SARS-CoV-2 deploys Nsp9 to activate CAD that catalyzes the rate-limiting steps of de novo pyrimidine synthesis. Activated CAD not only fuels de novo nucleotide synthesis, but also deamidates RelA. While RelA deamidation shuts down NF-κB activation and consequent inflammatory response, it upregulates key glycolytic enzymes to promote aerobic glycolysis that provides metabolites for de novo nucleotide synthesis. A de novo synthesized small molecule inhibitor of CAD restores antiviral inflammatory response and depletes the pyrimidine pool, thus efficiently impeding SARS-CoV-2 replication. **Conclusion:** SARS-CoV-2 couples evasion of inflammatory response to activate nucleotide synthesis. Inhibition of the key metabolic enzyme not only depletes nucleotide pool, but also restores host inflammatory defense, thereby reducing SARS-CoV-2 replication. Targeting cellular enzymes offers an avenue to combat rapidly evolving SARS-CoV-2 variants.

Poster #27

**Title**: Monitoring in real time the formation and inhibition of biofilms from clinical related pathogens using an impedance-based technology

**Authors**: Parish P. Sedghizadeh, Esmat Sodagar, Shuting Sun, Adam F. Junka, Philip Cherian, Jeffrey Neighbors, R. Graham G. Russell, Charles E. McKenna, & Frank H. Ebetino

**Faculty advisor**: Dr. 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. **Conclusions:** 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 #28

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

**Authors**: Eva Janečková, Jifan Feng, Tingwei Guo, Aileen Ghobadi, Vu Thach Ho, & 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:** Histologic analyses, RNAscope, immunofluorescence staining, and RNA-sequencing were performed on *Osr2-Cre;*β*-catenin*$^{fl/fl}$, and β*-catenin*$^{fl/fl}$. **Results:** We confirmed our hypothesis that Wnt signaling is necessary in CNC-derived mesenchymal cells to regulate soft palate muscle development through tissue-tissue interactions by generating *Osr2-Cre;*β*-catenin*$^{fl/fl}$ mice. Soft palatal muscles of *Osr2-Cre;*β*-catenin*$^{fl/fl}$ mice were significantly reduced in size. Analysis of cellular activities revealed significantly reduced proliferation of soft palatal mesenchymal cells. To uncover the molecular mechanism, RNA-sequencing revealed increased ciliary gene expression (*Ttll3*) in *Osr2-Cre;*β*-catenin*$^{fl/fl}$ mice. These data suggest that the disturbed cell cycle progression might be caused by dysfunctional ciliary disassembly, and that mesenchymal Wnt signaling causes changes in ciliogenesis, ultimately leading to defective soft palatal muscle development. To further investigate this mechanism, functional experiments are being conducted. **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 #29

**Title**: Sensory nerve regulates mesenchymal stem cell homeostasis via FGF signaling

**Authors**: Fei Pei, Li Ma, Junjun Jing, Jifan Feng, Yuan Yuan, Tingwei Guo, Thach-Vu Ho, Jie Lei, Xia Han, Jinzhi He, Jian-Fu Chen, & Yang Chai

**Faculty advisor**: Yang Chai

**Background**: Mesenchymal stem cells (MSCs) reside in microenvironments, referred to as niches, which give them structural support and molecular signals. Sensory nerves are niche components in the homeostasis of tissues such as skin, bone marrow and hematopoietic system. However, the mechanism by which sensory nerves regulate MSCs is still unclear.

**Purpose:** To investigate how the sensory nerve affects the behavior of MSCs. **Methods:** *Advillin-CreER;DTA* mice were used to explore the role of sensory nerve. SnRNAseq of the trigeminal ganglion and Cellchat were performed to analyze the secreted ligands of sensory nerve. *Gli1-CreER;F-gfr1*$^{f/f}$ mice were generated to explore how FGF1 secreted from the sensory nerve regulates MSCs in adult mouse incisor. Cellular and molecular experiments used in this study included immunohistochemistry, in situ hybridization (RNAscope), and RNA-seq. **Results:** Loss of sensory innervation leads to mesenchymal disorder and a decrease in MSCs. Mechanistically, FGF signaling connects between sensory nerves and MSCs. Specifically, FGF1 directly targets MSCs by binding to FGFR1. Loss of FGF signaling results in decreased MSCs and transit amplifying cells (TACs), increased apoptosis, impaired differentiation capacity, slow mesenchymal migration, abnormal dentin formation and decreased incisor growth rate. FGF signaling activates the p-JNK/mTOR/autophagy axis to sustain MSCs and tissue homeostasis. Re-activation of autophagy restored the MSCs and TACs, decreased apoptosis in MSCs, and rescued the mesenchymal tissue disorder in the adult mouse incisor. **Conclusion:** Sensory nerves serve as a stem cell niche to regulate mesenchymal stem cells in adult mouse incisor. Sensory nerves regulate MSCs via FGF/mTOR/autophagy axis.

Poster #30

**Title**: Targeting the Ribosome Biogenesis Key Molecule Fibrillarin to Prevent Fibrosis

**Authors**: Jiang Qian & Jian Xu

**Faculty advisor**: Jian Xu

**Background**: Fibrotic disease affects nearly every tissue in the body and causes considerable morbidity and mortality. A hallmark of fibrosis is the excessive accumulation of extracellular matrix-secreting myofibroblasts, mainly differentiated from resident fibroblast populations. Fibrillarin (FBL), a nucleolar methyltransferase and ribosome biogenesis reg-

ulator, has been reported as a regulator in collagen synthesis of fibroblasts. Whether it regulates fibroblasts/myofibroblasts transdifferentiation has not been exploited yet. **Methods:** We inhibited the FBL gene expression in the cultured human cardiac fibroblasts with small interference RNA and assessed the differentiation of fibroblasts by checking the protein and gene levels of fibrosis markers. We also studied the association of FBL with an upstream regulator, arginine methyltransferase PRMT1, by immune precipitation and detected the in-situ interaction of these two proteins within fibroblasts by Proximity Ligation Assay. **Results:** We found that depletion of FBL by siRNA in TGFbeta-stimulated fibroblasts downregulated the expression of myofibroblasts marker alpha-SMA by immunostaining. Knockdown of FBL also downregulated the fibrosis related genes, such as Serpine2, tropomyosin, periostin, and IL11. In addition, FBL-siRNA treatment decreased the acetylation of histone 4, a mark for gene activation. Furthermore, we found that PRMT1 was the dominant methylation enzyme for FBL. PRMT1 associated with FBL and regulated its function via methylation. Depletion of FBL expression or inhibition of PRMT1 in cultured fibroblasts prevented their activation and differentiation into myofibroblasts, probably through regulating H4 acetylation. **Conclusion:** Targeting key protein rRNA methyltransferase FBL and its upstream regulator PRMT1 show great potential in preventing the development of fibrosis.

## Poster #31

**Title**: TGF-β Signaling Regulates Soft-palate Myogenesis via Mediating Cell-cell Interaction

**Authors**: Jifan Feng, Xia Han, Yuan Yuan, Courtney Kyeong Cho, Eva Janečková, Tingwei Guo, Bi Jing, Junjun Jing, Mingyi Zhang, Thach-Vu Ho, & Yang Chai

**Faculty advisor**: Yang Chai

**Objectives**: 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. We thus hypothesized that the CNC-derived cells surrounding the myogenic cells, known as perimysial cells, regulate soft palate myogenesis through tissue-tissue interaction. **Methods:** *Osr2-Cre;Alk5*$^{fl/fl}$ mice were generated to specifically target the TGF-β signaling pathway in CNC-derived cells in the soft palate. Single-cell RNA sequencing analysis was performed to compare cell-type specific gene expression profiles in E14.5 *Osr2-Cre;Alk-5*$^{fl/fl}$ and control soft palates. **Results:** During late pharyngeal myogenesis, TGF-β signaling is specifically activated in the CNC-derived perimysial cells in the developing soft palate. Loss of TGF-β signaling in the CNC-derived cells in *Osr2-Cre;Alk5*$^{fl/fl}$ mice leads to defective soft palate formation including disrupted soft palatal myogenesis. Single-cell analysis further identified several reduced signaling molecules in the perimysial cells in the E14.5 *Osr2-Cre;Alk5*$^{fl/fl}$ mouse soft palate, including Fgf18. We further confirmed that these Fgf18+ perimysial cells, overlapping with pSmad2+ cells, were reduced in the absence of TGF-β signaling in *Osr2-Cre;Alk5*$^{fl/fl}$ mice. Furthermore, Fgf18 bead treatment can restore the loss of myogenic cells in *Osr2-Cre;Alk5*$^{fl/fl}$ mouse soft palate slice cultures. **Conclusions:** Specific activation of TGF-β signaling pathway in CNC-derived perimysial cells may determine the fate of these cells and instruct them to produce key signaling molecules (such as Fgf18) to regulate soft palate muscle formation.

## Poster #32

**Title**: Amelogenin-derived Peptide-Chitosan Hydrogel for Dentin Repair

**Authors**: Jing Cai & Janet Moradian-Oldak

**Faculty Advisor:** Janet Moradian-Oldak

**Background**: Amelogenin-derived peptides (P26 and P32) interacted with collagen and promoted in situ dentin remineralization. **Purpose:** To facilitate clinical application of these peptides by incorporating them into a chitosan (CS) hydrogel and investigate their efficacy in remineralizing partially demineralized dentin. **Methods:** Amelogenin-derived peptides were incorporated into a CS gel. Cross-sectional dentin discs were placed in a demineralizing solution for 5 days and subjected to a remineralization process in artificial saliva (AS) containing 1 ppm fluoride, for 10 days, with application of hydrogels on Days 1, 3, and 7. The morphology, mineral phase and density of remineralized dentin were examined by scanning electron microscopy (SEM), X-ray diffraction (XRD) and micro-CT. **Results:** Following mineralization in AS, rod-like crystals were observed on demineralized dentin surfaces. In the presence of either P26 or P32, a thicker layer (over 10 μm) of bundled rod-like crystals was formed on dentin surfaces compared to those treated with CS hydrogels only. XRD analyses indicated the newly formed crystals contained fluorapatite. The presence of either P26 or P32 contributed to the formation of crystals that were more preferentially oriented along the c-axis, with greater crystallinity. Additionally, while CS hydrogel only led to the formation of a mineralized layer on dentin surfaces, P26-CS and P32-CS hydrogels also increased the mineral density of subsurface. **Conclusion:** Amelogenin-derived peptide-CS hydrogels promoted the formation of a mineralized layer on demineralized dentin. The presence of P26 and P32 in CS hydrogel mediated the formation of oriented crystals with high crystallinity and enhanced dentin subsurface remineralization.

## Poster #33

**Title**: Co-emergence of amphipathic helix on ameloblastin and mammalian prismatic enamel

**Authors**: Jingtan Su, Rucha Arun Bapat, Gayathri Visakan, & Janet Moradian-Oldak

**Faculty advisor**: Janet Moradian-Oldak

**Background**: We recently reported that ameloblastin (Ambn) contains an functional amphipathic helix (AH) domain within the sequence encoded by exon 5, and this AH domain is highly conserved among mammalian species with prismatic structure. **Purpose:** To investigate correlation between the molecular evolution of ameloblastin (Ambn) and the emergence of prismatic enamel, a notable event in the evolution of ectodermal hard tissues. **Methods:** Helical wheel prediction, phylogenetic tree construction, peptides design and sysnthesis, liposome synthesis, fluorescence and CD spectroscopy, RT-PCR. **Results:** A predicted amphipathic helix (AH) within the sequence encoded by exon 5 of *Ambn* was only found in mammals with prismatic enamel and three whales without prismatic enamel. A blue shift in fluorescent spectroscopy suggested that the peptides of mammals interacted with liposomes. A downward shift at around 222 nm in CD spectroscopy of the peptides in the presence of liposomes suggested that the water-soluble peptides of mammals with prismatic enamel underwent a transition from disordered to helical protein structure. Membrane leakage and cell spreading assays showed that the peptides of mammals with prismatic enamel, including those with a middle proline, caused liposome leakage and inhibited LS8 and ALC cell spreading, suggesting that these peptides have a functional AH that can interact with

cell membrane. RT-PCR showed that AH is involved in Ambn's upregulation of cell polarization genes like *Vangl2, Vangl1, Prickle1, ROCK1, ROCK2* and *Par3*. **Conclusion:** AH in Ambn is closely related to the emergence of enamel prismatic structure, through its involvement in cell polarization and/or cell morphological changes.

Poster #34

**Title**: Spatiotemporal single-cell regulatory atlas reveals neural crest lineage diversification and cellular function during tooth morphogenesis

**Authors**: Junjun Jing, Jifan Feng, Yuan Yuan, Thach-Vu Ho, & Yang Chai

**Faculty advisor**: Yang Chai

**Background**: Cranial neural crest cells (CNCCs) are an evolutionary innovation of vertebrates for craniofacial development and function, yet the mechanisms that govern the cell fate decisions of postmigratory CNCCs remain largely unknown. Using the mouse molar as a model, we performed single-cell transcriptome profiling to interrogate the cell fate diversification of postmigratory CNCCs. We revealed the landscape of transcriptional heterogeneity and defined the specific cellular domains during the progression of CNCC-derived dental lineage diversification, and found that each domain makes a specific contribution to distinct molar mesenchymal tissues. Furthermore, IGF signaling-mediated cell-cell interaction between the cellular domains highlights the pivotal role of autonomous regulation of the dental mesenchyme. Importantly, we identified cell-type-specific gene regulatory networks in the dental mesenchyme and discovered that Foxp4 is indispensable for the differentiation of periodontal ligament. Our single-cell atlas provides comprehensive mechanistic insight into the cell fate diversification process of the CNCC-derived odontogenic populations.

Poster #35

**Title**: Calvarial injury repair and suture regeneration at single-cell resolution

**Authors**: Li Ma, Jing Wang, & Jian-fu Chen

**Faculty advisor**: Jian-fu Chen

**Background**: Cranial sutures are fibrous joints connecting the skull bones. The premature fusion of the suture during infancy is known as craniosynostosis, which leads to abnormal skull growth and head shape. In our recent work, we successfully regenerated coronal sutures in *Twist1*$^{+/-}$ mice with bilateral craniosynostosis by implantation of Gli1+ MSCs mixed with biodegradable scaffold. Mechanistic studies have shown that dura cells could migrate to the suture regeneration site and actively contribute to suture reformation. However, a very small proportion of dura cells were Gli1+ stem cells, indicating that other cell types from the dura were also involved in the suture regeneration. 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. By immunostaining of different cell type markers, we found that B, T cells and macrophages in the suture regeneration site. ScRNA-seq analysis revealed that immune cells dominated the suture regeneration area, and the immune cell composition as well as B cells, monocyte lineages and neutrophils exhibited dramatic changes during different suture injury repair stages. We also found some signaling pathways such as complement pathway with dynamic changes throughout suture regeneration process.

Poster #36

**Title**: Arid1a-Plagl1-Hh regulates differentiation-associated cell cycle arrest of tooth root progenitors

**Authors**: Jiahui Du, Junjun Jing, Yuan Yuan,Jifan Feng, Xia Han, Shuo Chen, Xiang Li, Weiqun Peng, Jian Xu,

Thach-Vu Ho, Xinquan Jiang, & Yang Chai

**Faculty advisor**: Yang Chai

**Background**: Chromatin remodelers often show broad expression patterns in multiple cell types yet can elicit cell-specific effects in development and diseases. Arid1a binds DNA and regulates gene expression during tissue development and homeostasis. **Purpose:** To detect how Arid1a achieves its functional specificity in regulating progenitor cells. **Methods:**Using the tooth root as a model, we show that loss of Arid1a impairs the differentiation-associated cell cycle arrest of tooth root progenitors through Hedgehog (Hh) signaling regulation, leading to shortened roots. Our data suggest that Plagl1, as a co-factor, endows Arid1a with its cell-type/spatial functional specificity. Furthermore, we show that loss of Arid1a leads to increased expression of Arid1b, which is also indispensable for odontoblast differentiation but is not involved in regulation of Hh signaling. **Results:** This study expands our knowledge of the intricate interactions among chromatin remodelers, transcription factors, and signaling molecules during progenitor cell fate determination and lineage commitment. **Conclusion:** Arid1a-Plagl1-Hh signaling is indispensable for differentiation-associated cell cycle arrest of tooth root progenitors.

Poster #37

**Title**: Arid1b is Indispensable in Regulating Mesenchymal Stem Cell Homeostasis

**Authors**: Mingyi Zhang, Jifan Feng, Jiahui Du, Junjun Jing, Tingwei Guo, Fei Pei, 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 supports its continuous growth throughout the lifetime, thus offering an excellent model to study MSC fate during tissue homeostasis. **Purpose:** The aim of this study is to investigate the role of Arid1b in regulating cell fate commitment of MSCs and their homeostasis using the adult mouse incisor model. **Methods:** *Gli1-CreERT2;Arid1b*$^{fl/fl}$ mice were generated to study the roles of Arid1b in mouse incisor MSCs. **Results:** In this study, we found that Arid1b is widely expressed in the mouse incisor and colocalized with a subset of Gli1+ MSCs. We found that the growth rate of the mouse incisor was impaired and dentin formation was abnormal in the *Gli1-CreERT2;Arid1b*$^{fl/fl}$ mice. We further revealed that loss of Arid1b in the *Gli1-CreERT2;Arid1b*$^{fl/fl}$ mice reduces the population of MSCs as well as transit-amplifying cells, causing compromised differentiation of these cells into odontoblasts. **Conclusion:** Our study reveals the functional significance of Arid1b in regulating cell fate commitment of MSCs and maintaining tissue homeostasis.

Poster #38

**Title**: Investigating the Enamel Phenotype in Novel *Odam-IRESCre/Stim1* Conditional Knockout Mice

**Authors**: Rucha Arun Bapat, Yanbin Ji, Yan Zhou, Albert W. Zhou, & Michael L. Paine

**Faculty advisor**: Michael L. Paine

**Background and Purpose**: Novel *Odam-IRESCre* mouse line facilitates maturation stage ameloblast-specific Cre expression in developing enamel. Here, we evaluate the efficacy of the *Odam-IRESCre* line by analyzing the enamel phenotype of *Odam-IRES-Cre$^{+/-}$/Stim1$^{fl/fl}$* mice. **Methods:** *Odam-IRESCre$^{+/-}$/Stim1$^{fl/fl}$* (cKO) mice were generated to study dental enamel. Age-matched pairs of cKO and wild type (WT) littermates were analyzed at 8 (n=7) and 12 weeks (n=3). The mineral density (MD) of mandibular incisor enamel was measured using $\mu$CT. Gene expression analysis was performed on isolated mandibular first molar enamel organs from postnatal day (PN) 14 mice. **Results:** The MD of the cKO incisor enamel was significantly lower ($P<0.05$) than that of WT throughout the length of the incisor in 8-week-old mice. In 12-week-old incisors, no significant difference was observed in the MD of cKO and WT enamel post-eruption, but the cKO enamel was significantly hypomineralized ($P<0.05$) in the unerupted regions of the incisors. Upregulation of *Stim2* (a homologue of Stim1) was observed in preliminary gene expression analysis. **Conclusion:** The incisor enamel of *Odam-IRESCre$^{+/-}$/Stim1$^{fl/fl}$* had a unique delayed mineralization phenotype which was different from the previously studied *Krt14-Cre/Stim1* cKO animals. The hypomineralization of *Odam-IRESCre$^{+/-}$/Stim1$^{fl/fl}$* enamel was less severe than *Krt14-Cre/Stim1* cKO as the deletion of Stim1 started only at PN7/8. Our data indicate that the *Odam-IRESCre* line is a valuable tool to study the ameloblast-specific ablation of various genes at the maturation-stage of enamel development.

Poster #39

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

**Authors**: Takahiko Yamada, Jesse Anderson-Ramirez, Samuel Sheridan, Jian-fu 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. Heterozygous loss-of-function mutations in *TWIST1* or *TCF12*, which can form a heterodimer, cause coronal suture fusion in human. Craniosynostosis is observed both in *Twist1* mutant mice and *Tcf12* mutant mice. Neurocognitive abnormalities were also observed in *Twist1* mutant mice, but whether *Tcf12* mutation induces neurocognitive abnormalities in mice is unknown. **Purpose:** The present study was designed to understand the relation between *Tcf12* mutation and neurocognitive dysfunction. **Methods:** The incidence rate of cranial suture fusion and the morphology of the skull in 3-month-old mice were studied by $\mu$CT images in *Tcf12$^{fl/fl}$* (Control) and *Wnt1-Cre;Mesp1-Cre;Tcf12$^{fl/fl}$* (*Tcf12* mutant). Behavioral tests were performed to evaluate neurocognitive abnormalities in each mouse. **Results:** Though skull shape and suture fusion in *Tcf12* mutant mice were less severe than those in *Twist1* mutant mice, *Tcf12* mutant mice showed coronal suture and interparieto-occipital suture fusion with their posterior calvaria volume decreased. In behavioral tests, motor learning ability were reduced in *Tcf12* mutant mice. **Conclusion:** Interparieto-occipital suture fusion in *Tcf12* mutant mice might reduce the expansion of posterior intracranial volume during development, affecting motor learning ability which is one of cerebellum functions.

Poster #40

**Title**: KDM6B interacts with TFDP1 to activate P53 signalling druing palatogenesis

**Authors**: Tingwei Guo, Xia Han, Jinzhi He, Jifan Feng, Junjun Jing, Eva Janečková, Jie Lei, Thach-Vu Ho, Jian Xu, & Yang Chai

**Faculty advisor**: Yang Chai

**Background:** Epigenetic regulation plays extensive roles in diseases and development. Disruption of epigenetic regulation not only increases the risk of cancer, but can also cause various developmental defects. However, the question of how epigenetic changes lead to tissue-specific responses during neural crest fate determination and differentiation remains understudied. **Purpose:** To investigate the potential roles of Kdm6b as an epigenetic regulator in organogenesis. **Methods:** The transgenic mouse model used in this study is *Wnt1-Cre;Kdm6b$^{fl/fl}$*. Other experiments used in this study included immunohistochemistry, in situ hybridization (RNAscope), CoIP, RNA-seq, ATAC-seq and ChIP-qPCR. **Results:** Using palatogenesis as a model, we reveal the functional significance of Kdm6b in regulating mouse embryonic development. Our study shows that Kdm6b plays an essential role in cranial neural crest development, and loss of Kdm6b disturbs P53 pathway-mediated activity, leading to complete cleft palate along with cell proliferation and differentiation defects. Furthermore, activity of H3K27me3 on the promoter of Trp53 is antagonistically controlled by Kdm6b, and Ezh2 in cranial neural crest cells. More importantly, without Kdm6b, the transcription factor TFDP1, which normally binds to the promoter of Trp53, cannot activate Trp53 expression in palatal mesenchymal cells. Furthermore, the function of Kdm6b in activating Trp53 in these cells cannot be compensated for by the closely related histone demethylase Kdm6a. **Conclusion:** Collectively, our results highlight the important role of the epigenetic regulator KDM6B and how it specifically interacts with TFDP1 to achieve its functional specificity in regulating Trp53 expression, and further provide mechanistic insights into the epigenetic regulatory network during organogenesis.

Poster #41

**Title**: Cell type-dependent functions of ribosome biogenesis in brain development and disease

**Authors**: Wei Zhang, Jianhui Bai,Supawadee Jariyasakulroj, Li Ma, & Jian-fu Chen

**Faculty advisor**: Jian-fu Chen

Ribosomopathies are a group of human disorders caused by mutations in ribosomal proteins or ribosome biogenesis factors. How dysregulation of a universal ribosome biogenesis process leads to tissue-specific phenotypes remains to be defined. To address these questions, we focus on a newly identified ribosomopathy disease gene, *SNORD118*, which causes the first neurologically exclusive ribosomopathy, named leukoencephalopathy with calcifications and cysts (LCC). *SNORD118* encodes the box C/D snoRNA U8 that guides ribosomal RNAs (rRNAs) processing. Interestingly, LCC due to *SNORD118* mutations affects only the brain, not other organs. Therefore we generated forebrain-specific *Snord118* conditional knockout (KO) mice and found that they exhibited cortical neurogenesis impairment and microcephaly. We also produced mutant human cerebral organoids that were size reduced due to the cell death and impaired differentiation of neural progenitor cells (NPCs), which resemble neurodevelopmental deficits in KO mice. Mechanistic studies reveal that loss of snoRNA U8 caused abnormally nucleolar structure and upregulated p-eiF2α by integrated stress response (IRS) which leads to cell death. Our studies provide new insights into reconciling the neurological phenotype specificity of ribosomopathies with the global requirement for ribosome biogenesis.

Poster #42

**Title**: Targeting CTP Synthetase 1 to Restore Interferon Induction and Deplete Nucleotide pool in SARS-CoV-2 Infection

**Authors**: Youliang Rao, Ting-Yu Wang, Qizhi Liu, Bianca Espinosa, Chao Qin, Jun Zhao, Arunika Ekanayake, Ali Can Savas, Shu Zhang, Mehrnaz Zarinfar, Yongzhen Liu, Wenjie Zhu, Nicholas Graham, Taijiao Jiang, Chao Zhang, & Pinghui Feng

**Faculty advisor**: Pinghui Feng

**Background:** The emerged SARS-CoV-2 caused a global pandemic with astonishing mortality and morbidity. To propagate in infected cells, viruses evolved strategies to evade host innate immune system and exploit cellular machinery to synthesize macromolecules and biomaterials to fuel viral replication. However, how SARS-CoV-2 interacts with innate immune system and modulates cellular metabolism remains poorly understood. **Purpose:** The purpose of this study was to investigate the mechanism that SARS-CoV-2 evades host innate immune defense, while promoting macromolecule synthesis. **Methods:** We performed biochemical analyses to define virus-host interactions by co-immunoprecipitation assays, two-dimensional gel electrophoresis, innate immune response by real-time PCR and ELISA, viral replication by real-time PCR and plaque assay, metabolite profiling by liquid-chromatography coupled with mass spectrometry, and pathological analysis in mouse model. **Results:** We found that SARS-CoV-2 exploits CTPS1 to promote CTP synthesis and suppress IFN induction. Screening a SARS-CoV-2 expression library identified ORF7b and ORF8 that suppressed IFN induction via inducing the deamidation of interferon regulatory factor 3 (IRF3). Deamidated IRF3 fails to bind the promoters of classic IRF3-responsible genes, thus muting IFN induction. ORF7b and ORF8 also activate CTPS1 to promote CTP synthesis. De novo synthesis of small-molecule inhibitors of CTPS1 enabled CTP depletion and IFN induction upon SARS-CoV-2 infection, thus impeding SARS-CoV-2 replication and pathogenesis in mouse models. **Conclusion:** Our work uncovers a strategy that a viral pathogen couples immune evasion to metabolic activation to fuel viral replication. Inhibition of the cellular CTPS1 offers an attractive means for developing antiviral therapy that would be resistant to SARS-CoV-2 mutation.

## UNDERGRADUATE & DDS STUDENTS BASIC SCIENCES

Poster #43

**Title**: Mouse Model comparison Morphological Differences in Skeletal Development

**Authors**: Aaron Huang, Lauren Bobzin, & Amy Merrill

**Faculty advisor**: Amy Merrill

**Background:** An human infant skull is composed of bones and gaps that allow for compression of the head during childbirth and postnatal growth of the cranium. The anatomical areas, often termed as "soft spots," later ossify to form a more structured skull. The anterior fontanelle is the soft spot found in the front of an infant's head, and the last to close in humans. Persistence or premature closing of the anterior fontanelle will lead to changes in intracranial pressure. Fibroblast growth factor receptor 2 (*FGFR2*) is a key regulator of bone formation including calvarial development. Mutations within this gene have led to multiple congenital disorders featuring abnormal craniofacial development including Apert syndrome, Bent Bone dysplasia, Crouzon syndrome, and Pfeiffer syndrome. Many of these diseases feature frontal suture defects ranging from persistent anterior fontanelles to craniosynostosis. However, it remains unclear how the receptor plays a role in the formation of other tissues of the calvaria. The aim of this project is to compare the phenotypic differences in mice featuring FGFR2 loss of function versus control and to what extent they correlate to the phenotypes seen in human syndromes caused by *FGFR2* mutations. Utilizing mouse models, we targeted deletion of the *FGFR2* gene to examine effects on the lineage commitment of skeletal progenitor cells to uncover the morphological differences created in skeletal development.

Poster #44

**Title**: Regulation of the mesenchymal stem cell niche in mouse incisor

**Authors**: Aileen Ghobadi, Angelita Araujo-Villalba, Eva Janečková, & Yang Chai

**Faculty advisor**: Yang Chai

**Background**: The continual growth of mouse incisor is enabled throughout the entire lifespan of the animal by the presence of mesenchymal stem cells (MSCs). MSCs are essential for regeneration and adult tissue homeostasis. MSCs' progeny are transient amplifying cells (TACs). The rate of MSC to TAC transition and subsequent rates of TAC proliferation and differentiation into odontoblasts and dental pulp cells maintain incisor homeostasis. These processes are crucially regulated by the stem cell niche microenvironment. **Purpose:** To explore the role of Tgf-β and Shh signalling in maintaining tissue homeostasis and regulating the incisor MSC niche. **Methods:** Histological analysis, immunofluorescence, and RNAscope were performed on *Gli-CreER;Tgfbr2*$^{fl/fl}$ and *Gli-CreER;Smo*$^{fl/fl}$ conditional knockout mice and *Gli1-LacZ* reporter mice. **Results:** Severely impaired odontogenesis can be observed in *Gli-CreER;Smo*$^{fl/fl}$ and *Gli-CreER;Tgfbr2*$^{fl/fl}$ mice two months after tamoxifen injection; both dentinogenesis and amelogenesis are increased. The proliferation activity in the area of the cervical loop, where TACs are located, is impaired both in the mesenchyme and epithelium, resulting in premature differentiation of odontoblasts and ameloblasts that in *Gli-CreER;Smo*$^{fl/fl}$ can already be observed two weeks after tamoxifen induction. Of particular interest is the impaired expression of Axin2, Dspp and Pax9, which are markers of individual cellular identities in the incisors. **Conclusion:** Tgf-β and Shh signalling play crucial roles in stem cell niche regulation, homeostasis of the mouse incisor and consequently odontogenesis. Further functional experiments are necessary to reveal the exact role of these signalling pathways in the regulation of MSC fate and the incisor stem cell niche.

Poster #45

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

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

**Faculty advisor**: Yang Chai

**Background**: Osteoporosis is a metabolic bone disorder and is the most common bone disease. 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 has yet to be elucidated. **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-CreERT2;Runx2*$^{fl/fl}$, sham-operated *Gli1-CreERT2;Runx2*$^{fl/fl}$, ovariectomized *Runx2*$^{fl/fl}$, and sham-operated *Runx2*$^{fl/fl}$ mice

were induced with tamoxifen 1 week after surgery. MicroCT analysis of distal femurs was performed to assess bone tissue homeostasis at regular intervals 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 #46

**Title**: Regulatory Functions of Nonsense-Mediated Decay in Prmt1-Deficient Neural Crest Cells

**Authors**: Greg S. Park, Nicha Ungvijanpunya, Qing Chen, Weiqun Peng, & Jian Xu

**Faculty advisor**: Jian Xu

**Background**: Intron retention (IR) is a major type of alternative splicing in plants and fungi to decrease unwanted transcripts, but its roles in mammalian systems during craniofacial morphogenesis are just emerging. Protein-arginine methyltransferase-1 (PRMT1) is an enzyme that methylates various RNA-binding proteins to control splicing in embryonic development. Preliminary data from *Prmt1* conditional knockout (CKO) mice using the neural crest-specific Wnt1-cre displayed multiple craniofacial defects. Furthermore, increased IR events in 96% of the genes and decreased spliced ECM transcripts were observed. However, how spliced transcripts are decreased in *Prmt1* CKO neural crest cells remain unclear. **Purpose:** We aimed to understand the molecular mechanisms by which retained introns regulate gene expression during mandibular development. **Methods:** We collected neural crest-derived cells from control or Prmt1-deficient mandibles using *Wnt1-Cre;R26R*$^{Td}$, *Wnt1-Cre;Prmt1*$^{fl/wt}$*;R26R*$^{Td}$ and *Wnt1-Cre;Prmt1*$^{fl/fl}$*;R-26R*$^{Td}$ mice at E13.5, analyzed the transcript levels of ECM genes and quantified their intron retention. **Results:** We first demonstrated increased intron retention and decreased spliced ECM transcripts in neural crest-derived cells from *Prmt1*-deficient mandibles, when compared to control mandibles at E13.5, therefore validating findings from our bioinformatic analysis. We further inhibited the nonsense-mediated decay (NMD) machinery via depletion of key NMD components Smg1 and Upf1. NMD-depleted NCC with *Prmt1* deletion exhibited a significantly decreased levels of intron transcripts of TNN and BMP7 and an increased level of spliced TNN transcripts, a set of matrix genes involved in craniofacial development. Meanwhile, NMD-deficient NCC exhibited increased level of TNN's spliced transcripts. **Conclusion:** Intron retention-triggered NMD regulated the ECM transcripts during mandibular morphogenesis.

## Poster #47

**Title**: Tooth Root Development, Epigenetics, and Future Perspectives

**Authors**: Natalie Black & 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. **Purpose:** Based on the literature and our recent studies, we provide an outlook on tooth root development, morphology, and function. In addition, we have explored 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. One study highlights how genes such as *Ezh2* and *Arid1a* are crucial components in the development of tooth root furcation patterning. Another study shows that loss of Arid1a ultimately leads to shortened root morphology. Furthermore, 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). **Conclusion:** 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 #48

**Title**: Impact of Hybrid Learning on USC Dental Students During Covid-19

**Authors**: Oussama Hefnawi, Xi Chen, & Mahvash Navazesh

**Faculty advisor**: Mahvash Navazesh

**Background**: Hybrid Learning has been adopted by school curriculums to adapt to the Covid-19 pandemic restrictions. **Purpose:** The purpose of this study was to evaluate the implementation of hybrid learning during the Covid-19 pandemic on the Ostrow School of Dentistry of USC first- and second-year students. **Methods:** Students' biomedical sciences grades were studied to compare in-person and hybrid cohorts. Independent t-tests were used to compare overall biomedical science grades for in-person instructional methods fall trimester 2019 and the same cohort that studied through hybrid learning during the fall 2020 trimester. Chi-square tests were used to examine the grade distribution in relation to the instructional method. Paired t-tests compared student performance on subcomponents of their biomedical science grade: Multiple choice question (MCQ), computer-based objective test (COMBOT), and triple jump (T3). **Results:** Overall biomedical science grades in D1 and D2 was similar when comparing hybrid learning and in-person delivery methods ($\square$ [D1] < 0.05, n = 288; $\square$ [D2] < 0.05, n = 284). Students scored higher on MCQ, COMBOT and T3 when taught via hybrid learning. Exams from hybrid instructions were slightly higher than their scores from in-person instructions ($\square$ [MCQ], $\square$ [COMBOT], $\square$ [T3] < 0.0001, n=144). **Conclusion:** A hybrid learning model is effective for learning fundamental biomedical knowledge among dental students during the Covid-19 pandemic.

## Poster #49

**Title**: Effect of Citalopram Exposure in Twist1 Mutants on Craniosynostosis Exacerbation

**Authors**: Sam Sheridan, Takahiko Yamada, Eloise Stanton, Jian-Fu Chen, Yang Chai

**Faculty advisor**: Dr. Yang Chai

**Background**: Craniosynostosis is characterized by the pre-mature fusion of cranial sutures, often presenting with skull dysmorphology, increased intracranial pressure and significant neurocognitive deficits. It is well-documented that 80% of craniosynostosis cases have no known direct genetic cause, suggesting an environmental or gene-environment interaction etiology. Previous studies have shown that *Twist1*$^{+/-}$ mice and those with maternal exposure to citalopram experience a higher incidence of craniosynostosis. **Purpose:** In this study, we utilize $\mu$CT and behavioral testing on mice to better understand the interaction of the *Twist1*$^{+/-}$

mutation with the maternal use of citalopram. **Methods:** This study explores the potential gene-environment interaction through utilizing *Twist1*$^{+/-}$ mutant mice and maternal citalopram exposure. $\mu$CT imaging was used to study the frequency and changes in skull morphology in wildtype (WT), WT with citalopram exposure, *Twist1*$^{+/-}$, and *Twist1*$^{+/-}$ with citalopram exposure mice. Additional behavioral tests were performed to evaluate neurocognitive abnormalities in each mouse. **Results:** *Twist1*$^{+/-}$ and maternal citalopram exposure induced coronal suture fusion in mice both independently and in conjunction. Maternal citalopram exposure in *Twist1*$^{+/-}$ mice exposure increased the incidence coronal suture fusion but did not exacerbate the severity of their skull deformities. Behavioral studies revealed that maternal citalopram exposure in *Twist1*$^{+/-}$ mice also decreased sociability and worsened motor learning. **Conclusion:** These results reveal a potential additive or synergistic interaction between *Twist1* mutation and citalopram in the incidence of craniosynostosis and suggests an exacerbation of neurocognitive deficits.

## UNDERGRADUATE & DDS STUDENTS CLINICAL SCIENCES

Poster #50

**Title**: A Catalyst for Patient Care Advancement: The Paradigm of Teledentistry

**Authors**: Antranig Mesrobian, Karam Korya, & Kamal Al-Eryani

**Faculty advisor**: Kamal Al-Eryani

**Background:** The start of the new decade brought an inconceivable affliction. In the first quarter of 2020, humanity faced an invisible enemy, Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2), known infamously as COVID-19. The virus left every facet of life in a state of disarray, and as we adjust to the new normal, the necessary changes are evident. This review provides an overview of the history, legality, billing, and infrastructure needed for teledentistry service. Healthcare infrastructure was one of the most impacted sectors due to the virus. From the beginning, hospitals, healthcare workers, medical supplies, etc., were in shortage. Having timely and safe access to the healthcare system was a concern of patients and health care providers alike. A simple solution emerged: technology. Technology is embedded in medicine, and telehealth was a solution utilized by healthcare practitioners during the pandemic. Dental professionals, in particular, were instructed to suspend dental procedures due to the probability of transmitting SARS-CoV-2. Nevertheless, teledentistry afforded dentists continuity of care along with the onboarding of new patients. The ability to offer remote care in such difficult times only highlighted the value of utilizing telehealth. Through synchronous or asynchronous interactions, the efficiency, convenience, and cost-effectiveness of telehealth remain unparalleled. Therefore, as society attempts to move past the pandemic, the progression of patient care and management will be a catalyst in the transformation of healthcare systems. Considering the precedent set by teledentistry during the pandemic, the widespread incorporation of this digital medium will benefit both patients and dentists.

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Poster #51

**Title**: Clinical Analysis of Oral manifestations of COVID-19 disease

**Authors**: Aravindhan Karunakaran

**Background:** The oral lesions observed in COVID-19–positive patients may be directly due to the viable virus in saliva, decreased immunity, or a reaction to antiviral medications. There have been reports that oral manifestations precede typical respiratory symptoms seen with COVID-19 disease. Symptoms such as anosmia and dysgeusia were also reported in many COVID-19 studies. These manifestations suggest that SARS-CoV-2 virus might have the ability to target the oral mucous membrane. **Purpose:** Our study recorded and analyzed the presenting oral lesions and conditions and corroborated with the chronology of other general symptoms and severity of the disease. **Methods:** Konaseema Institute of Medical Sciences is a 600-bedded COVID-19 hospital. The study was conducted here for a period of 1 year from March 2020 till March 2021. 12600 COVID-19 positive hospitalized patients and home quarantined 48700 COVID-19 positive patients underwent oral examination and the oral lesions and conditions were recorded and analyzed. **Results:** The most common oral lesions were palatal petechiae, erosive lesions, non-specific oral ulcers, necrotic white lesions, erythema, loss of tongue papillae, and oral mucositis. Oral lesions were observed 800% higher among the hospitalized patients than the home quarantined patients. Hospitalized patients with respiratory distress had oral lesions 6 times higher than those without respiratory illness. **Conclusion:** This study will help in understanding the pattern of oral lesions in COVID-19 patients and might be a useful screening, diagnostic, and prognostic criteria for COVID-19 disease.

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Poster #52

**Title**: Aural Symptoms in Temporomandibular Disorders: Evolutionary, Anatomical, and Physiological Approach

**Authors**: Bahar Khalilian Gourtani

**Faculty advisor**: Dennis Tartakow

**Background**: A considerable proportion of temporomandibular disorders (TMD) patients experience one or a combination of hearing symptoms including loss of hearing, tinnitus, feeling of ear fullness, and dizziness, which are not explained by an apparent existing ear condition.

**Purpose:** This article aims to explain aural symptoms in TMD by reviewing what is currently known about the evolution, anatomy, and physiology of the middle ear and the structures associated with the jaw joint. **Methods:** Articles containing the keywords TMD, tensor tympani (TT), tensor veli palatini (TVP), hearing or auditory or otological symptoms in their title were reviewed using the PubMed, EBSCO, and Google Scholar search engines. **Results:** During the reptile to mammalian evolution, two bones named the quadrate and articular moved to the middle ear, leading to formation of a new jaw joint. Along with this movement, two muscles originating from the medial pterygoid, TT and TVP, also moved to the middle ear while keeping their trigeminal neural innervation. Due to this anatomical and neurological connection between these muscles and the chewing muscles, TT and TVP may follow the abnormal masticatory muscle activity seen in TMD patients, leading to otological symptoms. **Conclusion:** Hearing symptoms experienced by TMD patients remain one of the factors that significantly affect their quality of life. In chronic or recurring cases of TMD, where TMD cannot be treated with the available methods, understanding the mechanism behind these symptoms can help in developing a more targeted and effective treatment.

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Poster #53

**Title**: Skid Row Oral Health Disparities in People Experiencing Homelessness

**Authors**: Sam Sheridan, Sarina Taylor, & Mehdi Mohammadi

**Faculty advisor**: Mehdi Mohammadi

**Background:** The current evidence on the oral health status of the homeless popula-

tions remains severely limited. While previous research has shown the lack of access to dental care amongst these populations, this study aims to provide updated information regarding the state of oral health in the Skid Row population seen at the Union Rescue Mission (URM) dental clinic. Through screening 500 patients at the Union Rescue Mission, researchers obtained information of the patient population including the presence of missing teeth, edentulism, dental and oral pain, existing restorations, dental visits within the past year, and the frequency of flossing, in addition to other data. This data was collected through interviewing the patients and a thorough extra-oral and intra-oral examination during the initial screening appointment. All data was collected between 2016 and 2020. In comparison to national databases, such as the National Health and Nutrition Examination Survey (NHANES), the URM patient population reports fewer dental visits within the past year, increased rates of oral and dental pain, more missing teeth, higher rates of edentulism, and decreased frequency of flossing. Statistical significance has not yet been addressed. These preliminary results suggest both a lack of oral health literacy and poor access to care. By improving awareness of this disparity, this paper hopes that clinicians and other organizations will work together to address this issue and improve the oral health of the Skid Row and other populations experiencing homelessness throughout the nation.

Poster #54

**Title**: Optimization of large MOD restorations: Composite resin inlays vs. short fiber-reinforced direct restorations.

**Authors**: Taban Milani & Pascal Magne

**Faculty advisor**: Pascal Magne

**Background:** The aim of this study is to evaluate and compare mechanical performance and enamel-crack propensity of large MOD composite-resin restorations with undermining cusps using direct, semi- direct approaches with (micro-hybrid composite resin, flowable short fiber-reinforced composite and CAD-CAM Hybrid ceramic). Extracted maxillary third molars undergo standardized slot-type preparation (5- mm depth and bucco-palatal width) along with dentin removal of buccal and palatal cusps using round diamond bur to leave 1 mm thickness of enamel behind. Immediate dentin sealing (Optibond FL) is used in all three groups. Gradia Direct Posterior used for direct approach, Short-fiber reinforced composite-resin (EverX Flow covered by Gradia Direct Posterior) for the direct approach, and Cerasmart composite resin blocks for CAD/CAM inlays. Artificial masticatory forces are stimulated using closed-loop servo-hydraulics (MTS Systems). Each specimen will be placed in the load chamber at a 30-degree angulation and situated with a positioning device, touching specimens with single contacts at the palatal cusp (load is equidistant from the cusp tip and central groove). Cyclic load is applied at a frequency of 5Hz, starting with a load of 200N (5,000 cycles of warm-up), followed by stages of 400, 600, 800, 1000, 1200 and 1400N, at a maximum of 30,000 cycles each. Samples are loaded until fracture or to a maximum of 185,000 cycles and the number of endured cycles and failure modes of each specimen is recorded. Each sample will be again evaluated and a visual distinction between restorable failures (above CEJ) vs. non-restorable failures (below CEJ) will be made.

Poster #55

**Title**: Periodontitis metabolomic profiling reveals distinct metabolic signature of periodontal inflammation

**Authors**: Yuefeng Zhang, Yidan Zhang, Zheming He, Nathan Eshoiee, Pinghui Feng, Casey Chen, & Sing-wai Wong

**Faculty advisor**: Sing-wai Wong

**Background**: Periodontitis as a prevalent chronic inflammatory disease affects about half of US adult population and 11% worldwide. Upon microbial infections, susceptible hosts mount an exaggerated inflammatory response in the tooth-supporting tissues leading to immunopathology and alveolar bone destruction. This host-microbial interaction leads to altered metabolism, which contributes to sustained inflammation. **Purpose:** We aimed at identifying the metabolic signatures of human periodontitis. **Methods:** Diseased (inflamed) and control (healthy) gingival tissues were biopsied from periodontitis and healthy individuals, in the USC Advanced Periodontics Clinic. Clinical features of participants were analyzed. Biopsied gingival samples were extracted for metabolomic analysis using Q-Exactive Plus hybrid quadrupole-Orbitrap mass spectrometer in the USC Infection & Immunity. **Results:** Mean age of participants (n=5) in the healthy, control group is 49.6 years, with an average pocket depth (PD) of 2.8mm in the gingival biopsied sites. Mean age of participants (n=5) in the diseased group is 54.5 years, with an average pocket depth (PD) of 5.3mm in biopsied site. PD is significantly different between two groups. Initial metabolomic analysis indicated significant differences between healthy and diseased gingival samples in metabolic profiles. We are increasing the number of participants for the data validation. Future plans include comparing metabolomic data of periodontitis with other chronic inflammatory diseases. **Conclusion:** Our data suggest that metabolomic profiling may provide valuable insights into the biology of periodontal infection and inflammation and testable biomarkers for the atraumatic diagnosis of periodontitis.

## DENTISTRY & CCMB FACULTY

Poster #56

**Title**: Learner-centered Dental Admissions: 4. Implementation of an Asynchronous Multiple Mini-Interview for Advanced Standing International Dentists

**Authors**: Anita Tourah, Robin Fox, & Mahvash Navazesh

**Background**: The Dental Admissions Office uses the Multi Mini-Interview (MMI) to evaluate Advanced Standing International Dentists (ASPID) applicants on their empathy, integrity, ethical decision-making, communication, and leadership skills, and an OSCE to evaluate their knowledge in dentistry. Due to the COVID-19 pandemic, in-person interviews were not held for applicants evaluated during 2021-2022. Instead, a "virtual MMI", using the Kira Talent Platform©, was developed. **Purpose:** An asynchronous virtual MMI was initiated in October 2021 to evaluate applicants' empathy, integrity and ethical decision-making, as well as their dental knowledge and writing skills. **Methods:** Applicants were given a specific timeframe to access the platform. Once online, they received specific scenarios, questions to evaluate perceptual ability, an OSCE to evaluate dental knowledge, and a written essay to evaluate writing skills. Applicants were recorded answering questions about the scenarios and perceptual skills. Videos of their responses, and the essay, were reviewed by calibrated evaluators. **Results:** 4 faculty and 5 staff were calibrated as virtual MMI evaluators. Each applicant was given 5 case scenarios, 10 OSCE questions, and 1 essay question. One evaluator rated each response using a 1-5 scale. To minimize subjectivity, two evaluators scored all perceptual ability questions and one evaluator scored all essays. By early December 2021, 215 applicants were evaluated. **Conclusion:** The

virtual MMI was easily incorporated into the virtual interview, and was well-received by evaluators. Further comparison of virtual interviews with traditional in-person interviews will be undertaken.

## Poster #57

**Title**: Integrated National Board Dental Exam (INBDE) Item Development for Radiology

**Authors**: Arezou Shahbazi Moghaddam, Nasrin Bahari, & Mahvash Navazesh

**Background**: Oral and Maxillofacial Radiology (OMR) and interpretation of images to form a differential diagnosis are dentistry's cornerstone diagnostic tool. The Joint Commission on National Dental Examinations (JCNDE) that outlines the foundational knowledge (FK) in radiology, has implemented a new integrated examination (INDBE) approach that has replaced the traditional National Boards I and II. **Purpose:** To construct INBDE-formatted test questions that cross multiple disciplines to address FKs relevant to OMR per standards set by JCNDE. **Methods:** Several actions were initiated before writing test questions, 1. A comprehensive review of FK document, 2. Review of ADA guideline for INBDE item development, 3. Collection and rigorous study of radiographic images. Following the template that is developed at HOSD, two types of questions, Patient Box and Stand-alone (with or without accompanying images), were developed to address Anatomy, Techniques, Diagnosis & Treatment Plan, Radiation Biology and Radiation Safety concepts. **Results:** Over the course of nine months at 5 hours per week, a total of 62 new INBDE questions (42 Patient Box; 20 Stand-alone) were developed, categorized to relevant FKs, and approved to be utilized in the ExamSoft database and administered in 2022. All the questions were developed by one faculty member with expertise in radiology. **Conclusion:** The process for the development of INBDE formatted OMR test questions was successful. Further faculty recruitment and calibration for additional test questions development in OMR and other clinical disciplines are ongoing.

## Poster #58

**Title**: Salivary Diagnostics and Rapidly Evolving Information During COVID-19 Pandemic

**Authors**: Azadeh Ahmadieh, Sibel Dincer, & Mahvash Navazesh

**Background:** Many publications have focused on the role of saliva in health and diseases. The role of saliva in the detection and diagnosis of SARS-CoV-2 has been the area of focus for many studies in the recent months. Most of the evolving scientific information is presented in "original article" format that is peer reviewed. "Letter to editors" format under normal circumstances is often not peer reviewed and lacks significant and in-depth data analysis. It is unclear how much statistical data has been presented in letters to editors regarding the role of saliva in diagnosis of SARS-CoV-2 during these unprecedented times. **Purpose:** We evaluated the significance of presented data in "Letters to Editors" on diagnostic value of saliva in detection of SARS-CoV-2 during COVID-19 pandemic. **Methods:** Literature search performed from January 2020 to January 2022. **Results:** 60 "Letters to Editors" were identified. 8 were excluded because they were not focused on salivary diagnostics. 17 contained cross-sectional, 7 had cohorts data, 15 contained opinions, 6 presented the Randomized Clinical Trial proposals, 3 included reviews, 1 included RCT, 1 included Meta-Analysis data, 1 contained retrospective data and 1 discussed a single case report. The letters with significant statistical data had sample size ranging from 12 to 943 participants. **Conclusion:** Our review showed that 45% (27 out of 60) of "Letters to Editors" published during COVID-19 pandemic contain statistically significant data focused on the role of saliva in detection of SARS-CoV-2. This information can be used as a guide for researchers and future studies.

## Poster #59

**Title**: Pan-cancer analysis of CpG Islands reveals plasticity of Polycomb targets

**Authors**: Yueyuan Zheng, Guowei Huang, Tiago C. Silva, Qian Yang, Yan-Yi Jiang, H Phillip Koeffler, Benjamin P. Berman, & De-Chen Lin

**Background:** CpG Island promoter genes make up more than half of human genes, and a subset regulated by Polycomb-Repressive Complex 2 (PRC2+-CGI) become DNA hypermethylated and silenced in cancer. Here, we perform a systematic analysis of CGI genes across TCGA cancer types, finding that PRC2+-CGI genes are frequently prone to transcriptional upregulation as well. These upregulated PRC2+-CGI genes control important pathways such as Epithelial-Mesenchymal Transition (EMT) and TNFα-associated inflammatory response, and have greater cancer-type specificity than other CGI genes. Using publicly available chromatin datasets and genetic perturbations, we show that transcription factor binding sites (TFBSs) within distal enhancers underlie transcriptional activation of PRC2+-CGI genes, coinciding with loss of the PRC2-associated mark H3K27me3 at the linked promoter. In contrast, PRC2-free CGI genes are predominantly regulated by promoter TFBSs which are common to most cancer types. Surprisingly, a large subset of PRC2+-CGI genes that are upregulated in one cancer type are also hypermethylated/silenced in at least one other cancer type, underscoring the high degree of regulatory plasticity of these genes, likely derived from their complex regulatory control during normal development.

## Poster #60

**Title**: Interplay between SREBF1 and master transcription factors in squamous cancer

**Authors**: Li-Yan Li, Qian Yang, Yan-Yi Jiang, Wei Yang, Yuan Jiang, Xiang Li, Masaharu Hazawa, Bo Zhou, Guo-Wei Huang, Xiu-E Xu, Sigal Gery, Ying Zhang, Ling-Wen Ding, Allen S. Ho, Zachary S. Zumsteg, Ming-Rong Wang, Melissa J. Fullwood, Stephen J. Freedland, Stephen J. Meltzer, Li-Yan Xu, En-Min Li, H. Phillip Koeffler, & De-Chen Lin

**Background:** Squamous cell carcinomas (SCCs) comprise one of the most common histologic types of human cancer. Transcriptional dysregulation of SCC cells is orchestrated by tumor protein p63 (TP63), a master transcription factor (TF) and a well-researched SCC-specific oncogene. In the present study, both Gene Set Enrichment Analysis (GSEA) of SCC patient samples and in vitro loss-of-function assays establish fatty-acid metabolism as a key pathway downstream of TP63. Further studies identify sterol regulatory element binding transcription factor 1 (SREBF1) as a central mediator linking TP63 with fatty-acid metabolism, which regulates the biosynthesis of fatty-acids, sphingolipids (SL), and glycerophospholipids (GPL), as revealed by liquid chromatography tandem mass spectrometry (LC-MS/MS)-based lipidomics. Moreover, a feedback co-regulatory loop consisting of SREBF1/TP63/Kruppel like factor 5 (KLF5) is identified, which promotes overexpression of all three TFs in SCCs. Downstream of SREBF1, a non-canonical, SCC-specific function is elucidated: SREBF1 cooperates with TP63/KLF5 to regulate hundreds of cis-regulatory elements across the SCC epigenome, which converge on activating cancer-promoting pathways. Indeed, SREBF1 is essential for SCC viability and migration, and its overexpression is associated with poor survival in SCC patients. Taken together, these data shed light on mechanisms of transcriptional dysregulation in cancer, identify specific epigenetic regulators of lipid metabolism,

and uncover SREBF1 as a potential therapeutic target and prognostic marker in SCC.

## Poster #61

**Title**: Effect of paroxetine on guided bone regeneration in standardized rat calvarial bone defects: A randomized controlled trial using real-time in-vivo micro-computed tomography

**Authors**: Khalid AlHezaimi, Almutairi M, Sundar Ramalingam, & Nasser Nooh

**Background and objectives**: Selective serotonin reuptake inhibitors (SSRIs) reportedly inhibit bone metabolism. The aim of this real-time, in-vivo micro-computed tomographic (µCT) randomized controlled trial was to evaluate the effect of SSRI (paroxetine) on bone regeneration. Measurements of bone volume (BV) and bone mineral density (BMD) of the newly formed bone (NFB) in standardized calvarial defects (SCD) in a rat model were made.

Materials and methods: Fourteen female Wistar-albino rats (aged 6-9months; weighing 250-300grams) were randomly divided into tests (n=7; oral paroxetine administered for 8-weeks) and control groups (n = 7; placebo administered for 8-weeks). All animals underwent surgery under GA to prepare bilateral SCD (4.6mm diameter). SCD was filled with deproteinized particulate xenograft and covered by a resorbable collagen membrane (RCM). Real-time in-vivo µCT to evaluate BV-NFB and BMD-NFB was done immediately after surgery (baseline) and at 2, 4, 6, and 8-weeks postoperatively. **Results:** Gradual increase of the BMD-NFB and BV-NFB in both test and control groups. The BMD/BV mean at 6-weeks and 8-weeks in the control group was significantly higher ($p<0.01$) than the mean BMD/BV at 2-weeks. Test groups showed a significant increase from baseline in BMD & BV only at the eight weeks ($p<0.01$). **Conclusion:** Based on the present real-time in-vivo µCT results, administration of paroxetine (5mg/kg/day) over eight weeks resulted in a delayed increase and significantly lower BMD-NFB/BV-NFB.

## Poster #62

**Title**: Educational and Environmental Impacts of Hybrid Learning on Patient Assessment

**Authors**: Mahvash Navazesh, Xi Chen, & Narine Danielian

**Background**: Hybrid distance-learning replaced traditional in-person learning in many educational settings during the Covid-19 pandemic. Objective: This study compared in-person to hybrid synchronous instructional methods for the application of acquired fundamental knowledge on patient assessment in clinical settings by dental students at the Ostrow School of Dentistry of USC. **Methods:** Participants were coded by instructional methods (in-person vs. hybrid). Performances of 136 students (4 cohorts, 34 per cohort) enrolled in the Advanced Standing Program for International Dentists (ASPID) on their patient assessment competency exam were compared between the two instructional methods. The same comparisons were conducted for approximately 720 students enrolled in the Doctor of Dental Surgery (DDS) program (5 cohorts, approximately 144 per cohort). In addition to its focus on educational outcomes, this study uncovered the environmental benefits of hybrid learning. **Results:** ASPID students' success in the patient assessment competency exam was not significantly different between the two instructional methods. Passing rates of the competency exam were 100% and 99% for the hybrid and in-person methods, respectively. Data analysis of the competency exam for DDS cohorts is in progress. However, initial analysis based on 11 months of assessment revealed similar findings between the two instructional methods. Hybrid distance-learning of patient assessment at a minimum can lead to saving 576 pairs of single-use gowns, surgical masks, and gloves for each DDS cohort and 68 pairs for each ASPID cohort. **Conclusion:** The hybrid instructional method is effective for learning patient assessment and can lead to environmental benefits. Funding Support: None.

## Poster #63

**Title**: Peptide enabled nanocomposites offer biomimetic reconstruction of SDF-treated dental tissues.

**Authors**: Malcolm L. Snead, Sarah K. Woolfolk, Aya K. Cloyd, Qiang Ye, Kyle Boone, Paulette A. Spencer, & Candan Tamerler

**Background:** Caries is the most ubiquitous infectious disease of mankind and early childhood caries is the most prevalent chronic disease in children worldwide, with the resulting destruction of the teeth recognized as a global health crisis. Recent FDA approval for the use of silver diamine fluoride (SDF) in dentistry offers a safe, accessible, and inexpensive approach to arrest caries progression in children with ECC. However, the staining of dental tissue black has limited its wide-spread use due to the adverse impact that the stain has on esthetics, which can be socially stigmatizing. Targeting SDF silver-stained tooth surfaces, we developed a biohybrid calcium phosphate nanocomposite interface building upon the self-assembly of synthetic biomimetic peptides. Here, an engineered bifunctional peptide composed of a silver binding peptide (AgBP) that provides anchoring to the silver-stained tooth surface is covalently joined to an amelogenin derived peptide (ADP) to deliver the function of amelogenin protein to promote rapid formation of a calcium phosphate isomorph nanocomposite. Our results demonstrated that the bifunctional peptide was effective in remineralizing the biomineral destroyed by caries on slabs of SDF silver-stained tooth tissues. The proposed engineered peptide approach offers a biomimetic path for remineralization of the SDF-stained dental tissues producing a biomimetic calcium phosphate nanocomposite interface competent to be esthetically restored using commonly available adhesive dental composites, to restore mastication, improve health and reduce social stigma.

## Poster #64

**Title**: Effectiveness of Feedback on Improving Students' Performances on COMBOT Examinations.

**Authors**: Nasrin Bahari Chopiuk & Mahvash Navazesh

**Background**: Computer Based Objective Tests (COMBOT) assess students' knowledge in Biomedical Sciences are utilized in trimesters 1 through 6 at the Herman Ostrow School of Dentistry (HOSD). COMBOT tests are developed by calibrated faculty members who also review the outcomes, including the feedback given by the students in individual as well as group settings. The outcomes and feedback are used for timely interventions focused on under-performers and future test constructions. **Purpose:** To evaluate the effectiveness of the process at HOSD in improving students' learning and resultant successful attempt in achieving passing (score equal or higher than 70) and highest (scores in 90-100 range) in COMBOT assessments. **Methods:** The qualitative data included randomly selected and reviewed student feedback from 48 COMBOT examinations administered from 2017 to 2021. The quantitative data included evaluating the COMBOT exam performance of 864 students, six cohorts in trimesters 1-6, and reviewing the revised/improved exam questions for content, accuracy, or language clarity based on students' feedback. **Results:** Comparative data analysis of student performance across five years revealed a linear trend with a minimum of 2-fold decrease in the number of un-

successful exam-takers (below 70%) spanning the six trimesters, consistent throughout all six cohorts followed by an increase in scores of 70% or more. The average score for the high achievers remained between 92 to 93% for all cohorts. **Conclusion:** Our findings suggest that the comprehensive approach implemented at the HOSD in 2017 and continued through 2021 to improve learning and increase successful attempts in COMBOTs renders effective.

Poster #65

**Title**: Systematic Reviews: Does the same rule apply during a pandemic?

**Authors:** Sibel Dincer, Azadeh Ahmadieh, & Mahvash Navazesh

**Background**: Traditionally systematic reviews are inclusive of criteria-based studies with intention to assess highest quality of evidence and eliminate sources of bias. Letters to editors are often based on brief reports and are not suitable as standard research articles and aren't included in systematic reviews. In unprecedented times such as pandemics the urgent need for better understanding of the pathophysiology of diseases may lead to accumulation of fast-tracked letters to editors based on rapidly emerging scientific information. **Purpose:** Assessing the contribution of letters to editors in conducting systematic review of salivary literature during COVID-19 pandemic. **Methods:** A systematic review of the salivary literature, published from January 2020 to July 2021 was conducted to assess the role of saliva in detection of SARS-Cov-2. Search combination included: (COVID) OR (COVID-19) OR (SARS-CoV-2) AND (diagnosis) AND (saliva). **Results:** A total of 436 citations were found, 47 of those were letters to editors. 13 of the identified letters to editors included results of 8 cross sectional and 5 prospective cohort studies which were directly related to the research question. Five of those studies fulfilled all inclusion criteria used in the methods mentioned above. All studies were inclusive of comprehensive data and statistical analysis. **Conclusion:** Utilizing the search combination used above, salivary studies published in a format of letters to editors during COVID-19 pandemic may include critical findings and significantly contribute to identifying answers to important research questions. Those communications should be reviewed carefully and considered in systematic reviews.

## DENTISTRY & CCMB AFFLIATES

Poster #66

**Title**: Understanding the resistance aspects against public health measures

**Authors**: Chaeho Kim

**Faculty advisor:** Dr. Mina Habibian

**Background:** A portion of the United States population were not wearing masks during activities they engaged in even though masks became mandatory in the United States. Similar to this event, when seatbelts became mandatory in 1968, there was a massive uprising against them.

**Purpose:** This report aims to study why the public is resisting both public health measures and to draw the main conclusion as to why people are defiant against measures that can help them. **Methods:** Report will utilize a social media database and other media-related materials to gather information regarding public defiance against mask-wearing in the COVID-19 pandemic. For public defiance against seatbelt regulations back in 1968, literature reviews from scholarly articles will be utilized. Then, background information and the reasoning for the defiance will be compared, and the report will explore the conclusion behind the defiance. **Results:** Misinformation regarding COVID-19 has been linked to reduced COVID-19 risk perceptions and lower compliance with social distancing measures. Also, findings showed that people associated freedom limitation with seatbelt laws. The population of both parties took the liberty of focusing on the concept of "free society," where each individual must be left free to bring their own risks. **Conclusion:** Even though both events happened in different time frames, the social pattern and the norms surrounding both events are similar in that both health measures are perceived as uncomfortable actions that restrict their choice of freedom.

Poster #67

**Title**: Calvarial bone repair and remodeling in a murine model of craniosynostosis

**Authors**: Eloise Stanton, Janet Sanchez, Mark Urata, & Yang Chai

**Faculty advisor:** Yang Chai

**Background:** Craniosynostosis is a congenital craniofacial disorder that involves fusion of the sutures. *TWIST1* mutation leads to Seathre-Chotzen syndrome, in which reoperation rates are reported to reach 35-42%. Studies have shown that exposure to a selective serotonin reuptake inhibitor, citalopram, can cause craniosynostosis. **Purpose:** To investigate the genetic and environmental mechanisms underlying aberrant bone repair in a murine model of craniosynostosis. **Methods:** Twenty *Twist1*$^{+/-}$ mutant mice and wild-type (WT) mice with or without in utero citalopram exposure (20 mg/kg per day) were generated: WT (n=5), *Twist1*$^{+/-}$ (n=5), WT + citalopram (n=5), and *Twist1*$^{+/-}$ + citalopram (n=5). Each mouse underwent a calvarial surgery to generate bilateral 2mm critical-sized parietal bone defects. The defects were then analyzed up to 4-weeks postoperatively by microCT imaging and histology. **Results:** MicroCT analysis demonstrated that all *Twist1*$^{+/-}$ mice exposed to citalopram had a craniosynostosis phenotype and exhibited excessive and disorganized bone growth post-injury. Some *Twist1*$^{+/-}$ mice without citalopram treatment also developed craniosynostosis and exhibited a similar excessive bone growth pattern. All WT defects remained incompletely healed at 4-weeks postoperatively. In contrast, some *Twist1*$^{+/-}$ mice with citalopram exposure demonstrated full bone fill of the defect at 4-weeks. *Twist1*$^{+/-}$ mice without citalopram demonstrated more bone fill than WT, but the defect was not entirely filled. **Conclusion:** These preliminary findings following calvarial defect surgeries improve our understanding of bone repair in craniosynostosis. By continuing to investigate the mechanisms of bone injury and repair in craniosynostosis, we can better understand and prevent the factors implicated in re-synostosis following surgery.

Poster #68

**Title**: Runx2 is indispensable for bone tissue homeostasis in adult mice

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

**Faculty Advisor:** Yang Chai

**Background:** *Runx2* encodes a transcription factor that has an important role in regulating the differentiation of osteoprogenitors into mature osteoblasts. Furthermore, heterozygous mutations in *RUNX2* result in the rare human condition of Cleidocranial Dysplasia (CCD), which affects the development of bones and teeth. Runx2 is expressed in the osteogenic front in long bones of adult mice. Gli1+ cells have been identified as mesenchymal stem cells that can give rise to osteoprogenitors in bone formation. However, the functional significance of Runx2 in regulating the fate of osteoprogenitors in adults is still unknown. **Purpose:** To determine whether the loss of Runx2 in osteoprogenitors will lead to bone

defects in adult mice. **Methods:** Histology and microCT analysis were performed on adult *Gli1cre$^{ERT2}$;Runx2$^{fl/fl}$* and control mice, induced to knock out *Runx2* at 1 month old, to observe bone formation and bone tissue homeostasis. **Results:** Our preliminary data shows that when Runx2 is deleted in Gli1+ cells, there is an increase in cortical bone formation. Epiphyseal growth plate disturbance can be observed at 2 weeks post-induction and abnormal bone formation at 1 month. **Conclusion:** The cause of these bone tissue disturbances will be investigated further.

## Poster #69

**Title**: Design of educational resources for Oral Health Care

**Authors:** Sepideh Khosropahan, Mina Habibian, & Mariela Padilla

**Faculty Advisor:** Mariela Padilla

**Background:** Effective usage of health educational resources may help clinicians and patients to gain knowledge about health conditions. The purposes of learning resources are many, including encouragement of active learning, development of different skills, and adoption of desirable values and attitudes. **Purpose:** Report on the design of evidence-based educational materials for the provision of oral health care in patients with high blood pressure. **Methods:** In this proposed model, we used a literature review and interviews with experts to generate educational materials. A search was done in PubMed using the terms: "Oral care OR dental care" AND "Hypertension" "oral care" OR "dental care" OR "dental management" AND "Hypertension", to identify recommendations to be included in educational materials. Additionally, interviews were performed with two experts (one dentist and one physician), to create audio podcasts. Three healthcare providers (two physicians and a dentist) were presented with the materials and given the opportunity to answer questions, providing comments if pertinent. **Results:** The PubMed search led to 49 articles. The author selected 15 articles, which included recommendations and created educational resources. A survey with three providers indicated that the message was clear and useful and was willing to use this type of educational resource in their own practices. **Conclusion:** This model of using a literature review and interviews with experts to create educational materials can address the challenges providers face in finding practical, evidence-based information. This model needs to be further explored and evaluated.

## Poster #70

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

**Authors:** Thach-Vu Ho, Bridget Samuels, Yuan Yuan, Carl Kesselman, Robert Schuler, Alejandro Bugacov, Cristina Williams, & Yang Chai

**Faculty Advisor:** Yang Chai

**Background:** The major goal of the FaceBase Consortium is to advance research by creating a comprehensive repository of datasets on craniofacial development and dysmorphologies, and disseminating these datasets to the research community. **Purpose:** The FaceBase3 Data Management and Integration Hub builds on the existing and successful scientific and technical team that has led the development, deployment, operation and community engagement of the FaceBase2 data hub. Looking forward to the future impact of the FaceBase Consortium, we face major challenges that include (1) how to annotate large datasets to empower the biomedical research community; (2) how to improve data integration and facilitate data search and retrieval from the hub; (3) how to use the data from FaceBase to design studies and otherwise inform our future research; and (4) how to translate our knowledge from animal model studies to improve human craniofacial health. **Methods:** FaceBase provides innovative tools for the identification, retrieval, display, curation, and analysis of data on human and animal models of craniofacial development and disease. **Results:** FaceBase currently includes over 950 datasets from human, zebrafish, mouse, and chimpanzee. Alongside these models, chick and xenopus data represent priorities. We are also expanding our data repository to include morphological and functional data on tooth development. **Conclusion:** FaceBase seeks to provide a comprehensive, trustworthy data repository and educational resource on craniofacial development, through ensuring that contributed datasets are findable, accessible, interoperable, and reusable. FaceBase promotes multidisciplinary collaboration and research in craniofacial development, molecular genetics and genomics.

## Poster #71

**Title**: Craniosynostosis: Potential target genes involved in Twist1 mutation and environment

**Authors:** Eloise Stanton, Janet Sanchez, Mark Urata, Yang Chai

**Faculty Advisor:** Yang Chai

**Background:** Craniosynostosis is a congenital defect characterized by the premature fusion of calvarial sutures. Our recent study using a *Twist1$^{+/-}$* mouse model has shown that environmental factors, including in utero exposure to the selective serotonin reuptake inhibitor citalopram, can exacerbate this disease. **Purpose:** To perform RNA sequencing analysis at P7 to uncover the downstream target genes affected in the coronal suture prior to its fusion. **Methods:** Sixteen *Twist1$^{+/-}$* mutant mice and wild-type (WT) mice with or without in utero citalopram exposure were generated: WT (n=5), *Twist1$^{+/-}$* (n=4), WT + citalopram (n=3), and *Twist1$^{+/-}$* + citalopram (n=4). At P7, the coronal sutures were dissected and subjected to RNA extraction. Hitech sequencing was conducted and post-sequencing data analysis was performed using Partek Flow and Ingenuity Pathway Analysis. **Results:** *Twist1$^{+/-}$* mice exposed to citalopram demonstrated significant upregulation of genes involved in the pathophysiology of osteoarthritis [*S100a8*: 4.616; *S100a9*: 3.815] in comparison to *Twist1$^{+/-}$* mice without citalopram exposure. WT mice exposed to citalopram demonstrated a significant downregulation of genes in the Igf1 signaling pathway [*Igfbp4*: -1.476; *Igfbp5*: -1.447] compared to WT mice without citalopram exposure. Finally, *Twist1$^{+/-}$* mice with citalopram exposure had significant downregulation of growth factor receptors in the STAT3 pathway [*Fgfr3*: -1.262; *Igf1r*: -1.246; *Igf2r*: -1.306] in comparison to WT mice with citalopram exposure. **Conclusion:** RNA sequencing data provide valuable insights into the mechanisms involved immediately preceding suture fusion. By analyzing the interplay of the environment and genetics involved, we can better understand how to prevent and treat this devastating disease.

## Poster #72

**Title**: Novel Mutant Mouse Lines to Study Distinct Stages of Amelogenesis

**Authors:** Rucha Arun Bapat, Yanbin Ji, Yan Zhou, Albert W. Zhou, Joseph G. Hacia, & Michael L. Paine

**Faculty Advisor:** Michael Paine

Background and **Purpose:** Shortages in existing models of enamel formation and disease have hampered recent progress in enamel research. Establishing novel animal models are needed to accelerate research in the field. **Methods:** We developed two novel internal ribosome entry

site (IRES) Cre-recombinase mouse mutant lines to advance studies on amelogenesis. *Ambn-IRESCre* was developed to study secretory-stage amelogenesis, and *Odam-IRESCre* developed to study maturation-stage amelogenesis. We crossed the two novel mouse lines with the Rosa26R (R26R) mouse line to develop *Ambn-IRESCre$^{+}$/R26R$^{+}$* and *Odam-IRESCre$^{+}$/R26R$^{+}$* mutant lines to further investigate. Cre recombinase expression in each line, post-birth, was analyzed by β-galactosidase (LacZ) staining. **Results:** Breeding with the R26R mouse line to *Ambn-IRESCre$^{+}$/R26R$^{+}$* mice we show LacZ activity initiated in pre-secretory ameloblasts. Breeding with R26R to *Odam-IRESCre$^{+}$/R26R$^{+}$* mice show that LacZ activity initiated primarily in transition-stage ameloblasts. These data are consistent with prior immunolocalization studies for AMBN or ODAM respectively, thus establishing two novel mouse lines to study conditional gene silencing to better define events critical to enamel formation. **Conclusion:** Two novel Cre-recombinase expression mouse models, *Ambn-IRESCre* and *Odam-IRESCre*, have been developed to study secretory- or maturation-stage amelogenesis. These mouse models are available from the Mutant Mouse Resources & Research Centers (MMRRC).

## BIOKINESIOLOGY & PHYSICAL THERAPY

## PHD CANDIDATES & POST-DOCTORAL FELLOWS

Poster #73

**Title**: Associations Between Gut Health, Aerobic Fitness, and Parkinson's Disease Symptoms

**Authors:** Kaylie Zapanta & Beth E. Fisher

**Faculty Advisor:** Beth E. Fisher

While Parkinson's disease (PD) has traditionally been considered a central nervous system disease, groundbreaking research has transpired, arguing that PD is influenced by gut microbiota alterations (dysbiosis). People with PD suffer from dysbiosis, and gut symptoms characteristic of dysbiosis, like constipation and irritable bowel syndrome (IBS). Given this evidence, treatment strategies that improve gut health in PD are warranted. One possible strategy is exercise. In non-PD populations, fitness status is associated with gut health. Thus, exercise that improves fitness status can restore the gut. Exercise improves motor and cognitive symptoms in PD, but it is possible that the gut moderates these improvements. However, no study to date has taken the crucial first step to associate gut health and fitness status in PD. As a preliminary analysis of a future study, we explored relationships between gut symptoms characteristic of dysbiosis, fitness status, motor symptoms, and cognitive symptoms in two individuals with PD. We measured gut health (Constipation and IBS, ROME-IV survey), fitness status (estimated oxygen consumption, $VO_2$), motor symptoms (Unified Parkinson's Disease Rating Scale-III, UPDRS-III), and cognitive symptoms (Montreal Cognitive Assessment, MoCA) in people with PD (n=2). We observed significant correlations between: UPDRS-III and constipation (r=.996, p=.002), UPDRS-III and IBS (r=.999, p=.001), and MoCA and constipation (r=.943, p=.028). We also observed insignificant trends between: UPDRS-III and IBS (r=-.895, p=.053), $VO_2$ and constipation (r=-.825, p=.088), and $VO_2$ and IBS (r=-.891, p=.054). These findings suggest that improving fitness status may restore gut health and improve motor and cognitive symptoms in people with PD.

Poster #74

**Title**: Examining visual learning strategies during a contingency paradigm in infants

**Authors:** Marcelo R. Rosales, Weiyang Deng, Jose Carlo Pulido, Nina S. Bradley, Maja J. Matarić, & Beth A. Smith

**Faculty Advisor:** Beth A. Smith

**Background:** Infant contingency learning has been considered an implicit learning task. However, there is literature to suggest infants use cognitive strategies to learn contingency paradigms. In this study we examine how infants use visual behavior while learning a contingency paradigm. We hypothesize that there will be an association between the number of times infants visually anticipate (visual anticipation score, VAS), the duration of time spent looking (TSL) and time to produce a reinforcement (TPR). **Methods:** Data from 4 infants (6-9 months) were used. The contingency paradigm involved reinforcing the infant's right leg movement. Head-mounted eye-tracking was used to estimate the position of the infant's gaze. Trained personnel, performing a frame-by-frame video analyses, identified each robot activation. They then identified each infant gaze on the robot (onset and duration). Predictive gaze was defined as a gaze shift with a visual fixation on the robot 0-400ms prior to its activation. VAS was calculated using a moving window for 3 reinforcements where higher scores reflected more consecutive anticipatory gazes. We used Spearman correlation to measure associations between VAS, TSL, and TPR. **Results:** Three of the 4 infants had a positive correlation between TSL and VAS ($p<0.05$). Three of the 4 infants did not have a correlation between TPR and VAS. Discussion: Visual attention (i.e. TSL) seems to be related to how often visual anticipation occurs (i.e. VAS) and is potentially showing evidence of an important cognitive strategy for learning. We will continue to collect data and refine our assessment of infant visual behavior.

Poster #75

**Title**: Mindfulness program for stroke survivors and caregivers: a feasibility study

**Authors:** Marika Demers, Francesco Pagnini, Deborah Phillips, Brianna Chang, Ellen Langer, & Carolee Winstein

**Faculty Advisor:** Carolee Winstein

**Background:** Preliminary evidence supports mindfulness to improve quality of life and well-being of individuals with neurological disorders and their caregivers. The impact and relevance of a mindfulness program tailored to stroke survivors and caregivers remain to be investigated.

**Purpose:** To determine the usability and satisfaction towards an online mindfulness intervention for stroke survivors and caregivers, and the potential effectiveness on psychological well-being. Methods/Approach: This feasibility study used a mixed-methods parallel design. Stroke survivors and caregivers participated in a three-week online mindfulness intervention using the Desire2Learn platform. Qualitative data about the usability and the relevance of the program were gathered though a semi-structured interview. Transcribed verbatim responses were analyzed using thematic content analysis. Self-reported outcome measures were administered at pre, post and one-month follow-up: Stroke Impact Scale, Hospital Anxiety and Depression Scale, NIH perceived stress, and Single-item Sleep Quality. Changes were assessed with non-parametric Friedman tests. Results/Practical implications: Stroke survivors (n=11) and caregivers (n=3) were highly satisfied with the mindfulness program offered online during a global pandemic. However, the Desire2Learn platform was not perceived as user-friendly, especially for participants with limited familiarity with technology. None of the self-reported measures changed over time, with great variability between participants. Nevertheless, participants reported many benefits from the program. **Conclusion:** This study

provided evidence of feasibility and acceptability of an online mindfulness intervention in a new population (i.e., stroke survivors and their caregivers). The results will inform modifications to the program and the online platform, before testing its effectiveness in a larger planned intervention study.

Poster #76

**Title**: A Knee Bias Movement Strategy Increases Risk for ACL Re-injury

**Authors:** Rachel K. Straub & Christopher M. Powers

**Faculty Advisor:** Christopher Powers

**Background:** Females favor use of the knee extensors over the hip extensors during landing, which may increase risk of ACL injury. Landing with high knee extensor moments has been shown to predict ACL injury. **Purpose:** To determine if increased use of the knee extensors over the hip extensors during athletic tasks predicts re-injury in females who have undergone ACL reconstruction (ACLR). **Methods:** This retrospective case-control study included video data from 85 female athletes (11-26 years, 23 cases and 62 controls) post-ACLR who had performed 6 athletic tasks as part of return to sport testing. 2D images were analyzed at peak knee flexion for each task. Estimation of the use of the hip extensors relative to the knee extensors was quantified as the difference between sagittal plane trunk and tibia orientation (2D trunk-tibia angle). This method has been shown to be predictive of the hip/knee extensor moment ratio during athletic tasks. Cluster analysis was used to identify "high knee extensor bias" and "low knee extensor bias" subgroups. Logistic regression was performed to determine if the "high knee extensor bias" subgroup was at greater risk of ACL re-injury, adjusted for known confounders. **Results:** Females classified as exhibiting "high knee extensor bias" (n=39) were at increased risk of ACL re-injury compared to those with a "low knee extensor bias" (n=46) (adjusted OR = 6.4, 95% CI: 2.0, 20.1). **Conclusion:** Female athletes who favor the knee extensors relative to the hip extensors during athletic tasks are at greater risk of ACL re-injury.

Poster #77

**Title**: Leg movement control in infants during a contingency learning process

**Authors:** Weiyang Deng, Barbara Sargent, Douglas Vanderbilt, Kathryn Havens, Marcelo Rosales, Christine Mirzaian, Jose Carlos Pulido, Maja J. Matarić, & Beth A. Smith

**Faculty Advisor:** Beth A. Smith

Leg movement control during **Background:** infancy is related to walking development. To create appropriate interventions, we need to understand the difference of leg movement control strategies between infants with typical development (TD) and infants born preterm (PT). We compared the two groups during a contingency learning paradigm through 1) time needed to reach the performing criteria, 2) quantity of movements, 3) linear variability and nonlinear variability of leg movements during the contingency period. Twenty infants with TD and 10 infants born PT participated at 6 to 8 months of age. An infant-sized humanoid robot moved its legs and laughed when infants made right leg movements with acceleration above individualized contingency threshold. The study consisted of 2-min baseline (no reinforcement), 8-min contingency (with reinforcement) and 2-min extinction (no reinforcement). Infants were categorized as performers and non-performers. We compared the two groups using Welch t-test. Performers in the PT group took longer (311.74 ± 62.57 s) to perform the task than the TD group (160.24 ± 74.52 s), p=0.02. Performers in the TD group generated more movements above movement threshold (normalized: 1.71 ± 0.82) compared to the PT group (1.04 ± 0.15), p=0.04. No significant differences were found for leg movements between the two groups in linear (p=0.71) or nonlinear variability (p=0.07). Performers in the PT group took longer to perform the task and demonstrated fewer exploratory attempts during the learning process compared to the TD group. Future studies are needed to explore the strategies to encourage more exploratory attempts during motor development.

## BIOKINESIOLOGY & PHYSICAL THERAPY

### PHD & MS STUDENTS

Poster #78

**Title**: Trail Leg Hip Power: Influence On Elbow Varus Torque In Baseball Pitchers

**Authors:** Adam J. Barrack, Lori A. Michener, Kristen Nicholson, & Christopher M. Powers

**Faculty Advisor:** Christopher M. Powers & Lori A. Michener

**Background:** Although excessive elbow varus torque has been reported to underlie ulnar collateral ligament (UCL) injury in baseball pitchers, contributing factors remain relatively unknown. The lower extremities generate power that is transferred up through the kinetic chain in pitching. Specifically, the trailing hip generates triplanar power during the stride phase. Diminished trailing hip power generation during pitching may necessitate compensatory power generation at the trunk and shoulder, potentially impacting elbow torque. **Purpose:** To determine the relationship between hip power and elbow varus torque during pitching. **Methods:** Participants (n = 48) were high-school and collegiate baseball pitchers (17.6 ± 2.5 yrs, 1.85 ± 0.06 m, 84.7 ± 13.4 kg). Reflective markers were placed on the bilateral lower extremities (femoral condyles, malleoli, calcaneus, and distal foot), spine, scapulae and both upper extremities (acromia, humeral epicondyles, styloids of the wrist, and hand). Kinematics and kinetics (instrumented mound) were obtained from the trail limb during 3 maximal effort fastball pitches (36.9 ± 2.5 m/s). Ball velocity (m/s) was measured using an automated ball tracking system. Stride phase was defined as the time between peak stride knee height and stride foot contact. Elbow varus torque and hip power were quantified using inverse dynamics equations and normalized to body weight. Hip power was calculated as the resultant sum of X, Y and Z components expressed in the hip joint coordinate system. Linear regression was used to evaluate the relationship between peak elbow varus torque and hip power, using ball velocity as a covariate. Significance was set to 0.05. **Results:** Peak hip power was found to be negatively associated with peak elbow varus torque (B = -0.02, p = 0.003, $R^2$ = 11.2%). **Conclusion:** Lower hip power production is associated with higher elbow varus torque during the stride phase of pitching. Greater use of the trail hip during the stride phase may allow pitchers to decrease elbow torque while maintaining ball velocity. Future work should explore intermediate relationships in the pitching kinetic chain to establish a mechanism by which increased hip power may mitigate elbow varus torque in pitching.

Poster #79

**Title**: Hip Abduction Neuromuscular Capacity Influences Ball Velocity in Baseball Pitchers

**Authors:** Alissa M. Zeitelhack*, Kayla Y. Bucci*, Nicholas J. Lobb, & Lori A. Michener

**Faculty Advisor:** Lori A. Michener

**Background:** Pitch velocity depends on power transfer

through the kinetic chain. The hip abductors stabilize the base and generate power. Hip abduction strength and rate of force development (RFD) theoretically optimize the pitching kinetic chain and thus pitch velocity. **Purpose:** Determine the relationships between hip abduction strength, RFD, and pitch velocity. **Methods:** NCAA Division I baseball pitchers (n=79; 19.8±1.4 years) participated. Bilateral peak hip abduction isometric strength (N) was measured by handheld dynamometry and normalized to leg length (m). Ball velocity (mph) was measured by radar and averaged across five 100%-effort fastballs. RFD (N/s) was calculated over 200ms and normalized to leg length (m). Both hip abduction strength and RFD were analyzed for the lead leg, trail leg, trail to lead leg ratio, and the absolute difference between legs. Stepwise regression analyses examined the relationships between each hip variable and ball velocity while covarying for body mass (kg). **Results:** The bilateral absolute difference in hip abduction RFD negatively related to ball velocity ($R^2$=0.09, β=-0.01, p<0.05). No other hip variables significantly related to ball velocity. **Conclusion:** Pitchers with greater hip abduction RFD asymmetry will have a lower pitch velocity. However, hip abduction peak isometric strength does not relate to ball velocity. This suggests the ability to generate force quickly bilaterally may impact pitching performance more than peak strength capacity. The explained variance between hip abduction and ball velocity was relatively low, indicating that other factors explain the variation in pitch velocity.

## Poster #80

**Title**: Vertical Stiffness: A Modified Hop Test

**Authors:** Antonio Squillante, Paul Kim, Bailey McLagan, & E. Todd Schroeder

**Faculty Advisor:** Todd E.Schroeder

**Background:** Various tasks have been used to measure vertical stiffness ($k_{vert}$) including hoping and jumping. With the use of force plates, it is possible to measure kvert as the ratio between average peak vertical ground reaction force ($F_{avg}$) and average vertical displacement of the center of mass ($\Delta_{COM}$) over a series of consecutive jumps. **Purpose:** The purpose of this study was to investigate the validity of a modified hop test to measure $k_{vert}$. **Methods:** 15 participants performed two separate hop tests in a randomized order: a standard hop test consisting of 15 consecutive hops ($HOP_{15}$), and a modified test ($HOP_{mod}$), consisting of a drop jump followed by 10 consecutive hops. Dropping height was determined prior to the test based on the highest reactive strength index among three different drop jump conditions: 30cm, 45cm, and 60cm. $\Delta_{COM}$ was calculated using a mathematical model: $[F_{avg}(t_c)^2/m\pi^2]+g(t_c^2/8)$. **Results:** A strong positive correlation emerged between kvert as measured via $HOP_{15}$ and $k_{vert}$ as measured via $HOP_{mod}$ (r=0.94, df=14, p<0.05) and a two-tailed paired T-test revealed no difference between the means (p<0.05). Agreement between the two variables was established via a Bland–Altman plot. **Conclusion:** $HOP_{mod}$ appears to represent a valid alternative to a traditional hop test to measure $k_{vert}$. As per its design, $HOP_{mod}$ allows for a greater degree of individualization in testing, adjusting the demand of the hop test to match the level of plyometric ability of each subject.

## Poster #81

**Title**: Preterm Infant Enrollment and assessment completion during the COVID-19 pandemic

**Authors:** Arya Salgaonkar. Shaaron Brown, Ketaki Inamdar, Meagan Miller, Jodi Darring, Jennifer Burnsed, Mary Shall, SPEEDI Research Team (Richard Stevenson, Amy Harper, Karen Hendricks-Munoz), & Stacey Dusing

**Faculty Advisor:** Stacey Dusing

**Background:** The rate of preterm births decreased temporarily during the COVID pandemic. However, the pandemic combined with systemic racism affected research. **Purpose:** This study aims to identify barriers/facilitators to enrollment and assessment completion in a multisite rehabilitation clinical trial. **Methods:** A combination of neurological, developmental, and parent-child interaction assessments were completed on fifty-seven extremely preterm infants (< 29 weeks' gestation) at each of 5 visits over 24 months. Three measures could be completed via telemedicine, while the remaining measures were missed in this longitudinal study. Descriptive analysis was completed for this preliminary analysis. **Results:** Eligibility and enrollment were impacted by COVID with 48% and 60% of eligible infants enrolling pre-COVID decreasing to 33% and 46% during COVID. The proportion of infants that enrolled who were non-white decreased at an urban site, increased in a rural site. The rate of in-person assessments during COVID (59%) was lower than the pre-COVID (100%) or late-COVID (96%) period (p< 0.0001). **Conclusion:** Caregivers' engagement in NICU, quick adaptation of assessors to telehealth, standardized telehealth protocols, and persistence of study coordinators helped to maintain a high level of enrollment and assessment during the COVID period. NICU visitation restrictions, children at home, and role of essential workers who are more likely to be People of Color may have impacted enrollment in research during pandemic.

## Poster #82

**Title**: The Effect of BFR on Muscle Function During Explosive Training

**Authors:** Antonio Squillante, Bailey McLagan, & E. Todd Schroeder

**Faculty Advisor:** E. Todd Schroeder

**Background:** Evidence supports the use of blood-flow restriction (BFR) in combination with resistance training to increase strength and power among healthy individuals. However, no study has reported the effect of BFR-induced fatigue on muscle function during short bouts of explosive effort. **Purpose:** To compare muscle function during a single bout of explosive training under two different conditions: with BFR and without BFR. **Methods:** 15 participants performed a 30-second consecutive countermovement jump test under two different conditions in randomized order. Under the BFR condition, cuff pressure was set to 80% arterial occlusion pressure. Participants performed a series of repeated countermovement jumps for 30 seconds on force plates sampling at 1000 Hz. Muscle performance was assessed by measuring jumping height. **Results:** A paired t-test was used to assess differences between jump height at different time intervals: 0-5 seconds ($t_1$,), 15-20 seconds ($t_2$), and 25-30 seconds ($t_3$). α-level was set at p=0.05. For each time interval, the average jump height was calculated. At baseline ($t_1$), no significant difference emerged between conditions (p=0.082; p<0.05). No significant difference in the overall decline in muscle function was measured between conditions at $t_2$ (p=0.208; p<0.05) and $t_3$ (p=0.310; p<0.05). **Conclusion:** The use of BFR did not result in a greater decline in muscle function during a single bout of explosive training lasting 30 seconds or less.

## Poster #83

**Title**: Correlation Between LSI and Intra-Limb Eccentric Knee Flexor Strength Asymmetry

**Authors:** Antonio Squillante, Brady McCormick, Paul Kim, & E. Todd Schroeder

**Faculty Advisor:** E. Todd Schroeder

**Background:** The single-legged hop test is often used to measure between-limbs asymmetry in eccentric knee flexor strength, which is an independent risk factor contributing to the incidence of hamstring strain injury. **Purpose:** To investigate the relationship between limb symmetry index (LSI) measured via a single-legged triple hop test and eccentric hamstring strength. **Methods:** 20 male and female participants performed two tests in randomized order: eccentric Nordic curl and single-legged triple hop test for distance, using both left and right leg. Peak eccentric force and LSI were calculated over three consecutive trials. **Results:** Pearson correlation analysis revealed a moderate and positive correlation between LSI and intra-limb eccentric knee flexor strength asymmetry ($r=0.41$, $df=18$, $p<0.05$). For subjects who scored above the 50th percentile in the eccentric Nordic curl test (352 N) correlation between LSI and intra-limb eccentric knee flexor strength asymmetry was moderate ($r=0.37$, $df=9$, $p<0.05$). For subjects who scored below the 50th percentile a weak and positive correlation was found between variables ($r=0.16$, $df=8$, $p<0.05$). When the scoring system was attributed a positive or negative value to account for leg preference the Pearson product-moment correlation coefficient between the LSI and intra-limb eccentric knee flexor strength asymmetry failed to reach significance ($r=0.19$, $df=18$, $p<0.05$). **Conclusion:** LSI assessed via a single-legged triple hop test cannot effectively predict asymmetry in eccentric knee flexor strength between dominant and non-dominant limbs.

Poster #84

**Title**: Effects of Repetitive Loading on Supraspinatus Muscle-Tendon Properties: Pilot Study

**Authors:** Daniel Awokuse, Nick Lobb, & Lori Michener

**Faculty Advisor:** Lori Michener

Background/**Purpose:** Loading is essential for the maintenance of tendon homeostasis but can promote remodeling or degeneration. This can lead to altered tendon mechanical properties and tendon structure. The amount of load that induces degenerative pathologies vs healthy remodeling is not clear; however, sufficient time between loadings to allow a tendon to respond to load appears important. In this pilot study, I quantify the effects of repetitive loading on supraspinatus tendon thickness and supraspinatus muscle-tendon shear wave velocity (SWV) by comparing side-to-side differences between dominant and non-dominant arms in baseball pitchers. **Methods:** Supraspinatus muscle and tendon stiffness was evaluated in 4 Division 1 collegiate pitchers using shear-wave ultrasound elastography. Stiffness was collected bilaterally on the distal tendon and superior portion of the supraspinatus muscle. B-mode ultrasound images were used to measure cross-sectional distal supraspinatus tendon thickness.

**Results:** Supraspinatus tendon thickness in the dominant shoulder was 0.3mm greater than in the non-dominant shoulder, which is larger than the measurement error (MDC=0.2mm). Supraspinatus tendon SWV in the dominant shoulder was 0.45 m/s greater in the dominant shoulder compared to the non-dominant, which is greater than measurement error (MDC=0.06 m/s) from a similar study. **Conclusion:** Division 1 pitchers demonstrated greater tendon stiffness and thickness in their throwing shoulder. Higher stiffness and thickness measures indicate stronger and healthier tendons. These results support that mechanical properties and tendon structure improve due to repetitive loading. This data will inform future studies looking at changes in patients with pathology.

Poster #85

**Title**: Neuromuscular Control of the Ankle in Achilles Tendinosis: Case-Control Analysis

**Authors:** David Ortiz-Weissberg, Kornelia Kulig, & Jacquelin Perry

**Faculty Advisor:** Kornelia Kulig

**Background:** Persons with unilateral Achilles tendinosis demonstrate reduced recruitment of gastrocnemius and soleus muscles during hopping. It is unknown whether this reduced reliance is a persistent adaptation observed during tasks with fewer postural demands.

**Purpose:** To investigate whether persons with Achilles tendinosis demonstrate reduced reliance on primary plantar flexors during an ankle-only motor task. **Methods:** We recruited one person with unilateral Achilles tendinosis and one person without history of Achilles abnormalities. We collected surface EMG on the primary plantar flexors, peroneus longus, and one dorsiflexor during isokinetic (controlled velocity) ankle dynamometry. The isokinetic task consisted of three eccentric velocities: 30°/s, 45°/s, and 60°/s. Outcomes: contribution index [ratio of primary plantar flexor activity to total plantar flexor activity] and dorsiflexor co-activation [ratio of dorsiflexor activity to plantar flexor activity]. **Results:** The participant with Achilles tendinosis demonstrated greater contribution index on the non-involved limb relative to the involved limb at all velocities. In contrast, the control participant utilized a similar contribution index across limbs. The participant with tendinosis displayed reduced dorsiflexor co-activation in the involved limb during the 30°/s and 45°/s conditions. The co-activation ratio was similar across limbs for the control participant. **Conclusion:** The comparison indicates the participant with tendinosis prefers to offload the Achilles when given the opportunity. This offloading comes in the form of reduced recruitment of the primary plantar flexors and the opposing dorsiflexors. These results match previous findings during hopping, indicating the reduced involved limb reliance on the primary plantar flexors may be a persistent neuromuscular adaptation.

Poster #86

**Title**: Frontal Plane Lower Extremity Kinetics during Golf Equipment Transportation

**Authors:** Guanrong Cai, Jordan Cannon, Jared Moore, Noah Ogata, Yunsheng Zou, & George Salem

**Faculty Advisor:** George Salem

**Background:** Golf equipment (i.e. golf bags, clubs, balls, accessories, etc.) transportation (GET) is a regular task in the sport of golf, a popular activity with more than 66 million participants globally. Golf play requires large walking distances, therefore the influence of different methods GET on gait mechanics has important implications to performance and injury risks. Furthermore, frontal-plane lower extremity (LE) demands including knee abductor moment during activities may alter knee mechanics and contribute to pain and progression of osteoarthritis (OA). **Purpose:** To investigate the frontal-plane LE kinetics of GET via single-strap (SS) carry on the right shoulder and double-strap (DS) carry across both shoulders. **Methods:** Four experienced golfers participated in 3D motion capture of unloaded walking (UW), SS, and DS tasks. Frontal-plane kinetics were calculated for the LE during the three experimental conditions. **Results:** The left limb demonstrated 29.79% higher peak hip abductor (PHAM; SS: 1.22 ± 0.11 N/kg; Unloaded: 0.94 ± 0.07 N/kg) moments and 40.9% higher peak knee abductor moment (PKAM; SS: 0.62 ± 0.06 N/kg; Unloaded: 0.44 ± 0.1) during the SS condition compared to UW. The differences in moments were smaller when comparing the DS condition and UW. Ankle moments did not differ across conditions

and limbs. **Conclusion:** While PHAM is not associated with injury risks, higher PKAM is associated with knee disorders such as pain and OA. Preliminary results warrant further investigation in frontal plane LE loading during different methods of golf equipment transportation in a larger sample.

Poster #87

**Title**: Investigating visual attention during visual search in complex virtual environments

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

**Faculty Advisor:** James M. Finley

**Background:** Visual attention has been described in the literature as being controlled through either bottom-up or top-down mechanisms. The former emphasizes the automatic capture of attention by salient stimuli while the latter the influence of cognitive factors, such as task demands, in driving attention. As such, top-down cognitive control is needed to inhibit the automatic bottom-up attention capture and direct gaze towards relevant stimuli to achieve task goals. **Purpose:** Determine how aging-related changes in cognition affect visual attention during visual search in increasingly complex virtual environments. **Methods:** Young and older adults will perform a VR-based visual search task which involves selecting targets that alternate between letters and animals whose names start with those letters (e.g., A-Ant-B-Butterfly) in naturalistic virtual environments with increasing visual complexity. During gameplay, gaze data will be collected using eye-trackers built into the VR headset. Salience at fixations will be calculated using a previously described computational model of visual attention. Fixations will be classified based on their salience, task relevance, correctness, and location relative from the center and the duration of time spent on each target class will be calculated. **Results:** We expect to observe that older adults will increase the number of fixations on salient locations, increase time spent fixating salient task-irrelevant targets, and reduce time spent fixating less salient task-relevant targets. We also expect similar effects in virtual environments with high versus low visual complexity. **Conclusion:** The study will determine whether older adults are less capable of ignoring highly salient irrelevant distractors in naturalistic environments.

Poster #88

**Title**: Vertical Reaction Force During Treadmill and Cycling High-Intensity Interval Training

**Authors:** Jared Moore, Noah Ogata, Guanrong Cai, Alice Zayer, & George Salem

**Faculty Advisor:** George Salem

**Background:** High-intensity interval training (HIIT) has become a popular form of exercise due to its low time burden and easily customized protocols. To date, there has been no investigation into how lower extremity loading (i.e., vGRF) influences the physiologic response to HIIT. Also, little work has been done to compare HIIT protocols between different exercise modalities with the same participant pool. **Purpose:** The purpose of this pilot work was to examine the vertical reaction force (vRF) differences between treadmill running (TM) and stationary cycling (CE) to be applied to an analysis of the metabolic and inflammatory changes that occur after a 4x4 HIIT protocol. **Methods:** Six young, healthy participants (4M, 2F; 26 +/- 3y) completed a 4x4 HIIT protocol with four 4-minute active periods (AP) at 85-95% heart rate maximum (HRmax) followed by 3-minute recovery periods (RP) at 60-70% HRmax. The vRF was measured using Moticon 2 insoles and processed using MATLAB software. Peak vRF was averaged over the middle 30s of each period. Data are presented as mean +/- SD. **Results:** Treadmill running had the highest vRF during both the active periods and recovery periods compared to cycling. Cycling vRF averaged approximately 15-20% that found in running. **Conclusion:** These data show the feasibility of measuring vRF to assess lower extremity loading during exercise that will be used to compare metabolic, inflammatory, and muscle damage responses to HIIT exercise.

Poster #89

**Title**: Hip Compensation Strategies During Gait Following Anterior Cruciate Ligament Reconstruction

**Authors:** Jiaqi Wang, Whitney A. Marsh, Keegan Taylor, Taylor Montgomery, & Susan Sigward

**Faculty Advisor:** Susan Sigward

**Background:** Individuals post-anterior cruciate ligament reconstruction (ACLr) reduced sagittal plane knee loading during loading response (LR) of gait, limiting knee shock attenuation after initial contact. The hip often compensates for decreased sagittal plane knee loading; however, whether it compensates for reduced shock attenuation during gait remains unclear. **Purpose:** This study compared sagittal plane between-limb hip and knee mechanics in individuals post-ACLr to determine the hip compensation during gait. **Methods:** Ten individuals 3 months post-ACLr participated. Kinematic and kinetic data were collected during gait at self-selected speed over 10m. Knee and hip extensor moments (KEM, HEM), power absorption and generation were calculated in the surgical (Sx) and non-surgical (nSx) limbs. When the knee absorbed power during LR, knee and hip extensor moment impulse (KEI, HEI), and work negative (NW) and positive (PW) were calculated. Cohen's D effect sizes (ES) determined the magnitude of between-limb differences. **Results:** KEI, knee NW and hip NW were lower in the Sx vs nSx limb (ES: 0.70, 0.68, and 0.85, respectively). HEI and PW were greater in the Sx vs nSx limb (ES: 0.33 and 0.91, respectively). **Conclusion:** Lower KEI and NW in the Sx knee reflect altered shock attenuation during LR. While greater HEI was observed, the small ES combined with lower hip NW suggests the hip did not compensate for reduced knee absorption by increasing power absorption. However, greater hip PW with a large ES in the Sx limb suggests the hip may compensate by increasing body propulsion versus attenuating vertical impact forces.

Poster #90

**Title**: Human cortical alpha rhythm reflects activity of the salience network

**Authors:** Natalie McLain, Moheb Yani, & Jason Kutch

**Faculty Advisor:** Jason Kutch

**Background:** Several studies have found evidence of reduced resting-state peak alpha frequency (PAF) in populations with pain. However, the stability of PAF from different analytic pipelines used to study pain has not been determined and underlying neural correlates of PAF have not been validated in humans. **Purpose:** For the first time we compare analytic pipelines and the relationship of PAF to activity in the whole brain and thalamus, a hypothesized generator of PAF. **Methods:** We collected resting-state functional magnetic resonance imaging (rs-fMRI) data and subsequently 64 channel resting-state electroencephalographic (EEG) from 47 healthy men, controls from an ongoing study of chronic prostatitis (a pain condition affecting men). We identified important variations in EEG processing for PAF from a review of 17 papers investigating the relationship between pain and PAF. We previously showed common differences in pre-processing have minimal impact on PAF calculation. Now, we vary four post-processing variables (epoch length, alpha band, calculation method, and region-of-interest [ROI]) that were inconsistent

across the literature. **Results:** In our previous work, we found a single principal component, well-represented by the average PAF across all electrodes (grand-average PAF), explained > 95% of the variance across participants. We found that PAF is primarily impacted by calculation method and ROI. Across methods, interindividual differences in PAF were correlated with rs-fMRI-estimated activity in the thalamus, insula, cingulate, and sensory cortices. These results suggest PAF is a relatively stable marker with respect to common processing methods used in pain research and reflects interindividual differences in salience network function.

## Poster #91

**Title**: Muscle Activation During Barbell Back Squats at Different Velocities

**Authors:** Antonio Squillante, Noah Ogata, Willa Ma, & E. Todd Schroeder

**Faculty Advisor:** E. Todd Schroeder

**Background:** The aim of the proposed study is to compare the timing of muscle activation of the barbell back squat across four different muscle groups in the lower extremity under different loading conditions. Data will be grouped into two categories: barbell back squat with loads corresponding to high average vertical bar velocity (0.5-0.75 m□sec$^{-1}$) and barbell back squat with loads corresponding to low average vertical bar velocity (0.75-1.2 m□sec$^{-1}$). We hypothesize that there will be a significant difference between the timing of muscle activation in slow vs. fast barbell back squats. The protocol consists of two visits separated by one week of rest. Participants will begin each visit with a standardized warm-up; following this, they will be fitted with eight surface EMG sensors (left and right rectus femoris, biceps femoris, gluteus maximus, lateral gastrocnemius). During their first visit, participants will undergo both a countermovement jump test as well as a 1RM barbell back squat test. The second visit will involve completing sets of 3 barbell back squats under different loading conditions: 20-30-40% 1RM corresponding to an average vertical bar velocity of 0.75-1.2 m□sec$^{-1}$; 50-60-70% 1RM corresponding to an average vertical bar velocity of 0.5-0.75 m□sec$^{-1}$. Vertical bar velocity will be monitored using a wearable accelerometer placed on the barbell, while EMG data will be recorded as an average of the 3 reps for each set. A paired T-test will be used for subsequent statistical analyses.

## Poster #92

**Title**: Rate of Force Development and Symptom Improvement in Shoulder Pain

**Authors:** Oscar Vila Dieguez & Lori Michener

**Faculty Advisor:** Lori Michener

**Background:** Rotator cuff (RC) tendinopathy is the principal cause of shoulder pain. Exercise is beneficial, but there is poor understanding of the neuromuscular mechanisms associated with improvement. Isometric strength shows no clear relationship with improved symptoms. Exploring mechanisms that account for both neural and muscular components of muscle performance, such as rate of force development (RFD) are warranted. **Purpose:** Determine the effects of an exercise intervention on strength and RFD, and the relationship to patient-reported outcomes. **Methods:** Participants (n=7; age=26.8±5) diagnosed with RC tendinopathy underwent an exercise protocol for 2 weeks with pre and post-assessment. Pain and function were measured with the Penn Shoulder Score. Maximum isometric strength, and RFD for scaption and external rotation (ER) were measured with dynamometer. RFD was defined as the area under the force-time curve from 0 to 50, 100 and 200ms. Paired t-tests compared pre to post-intervention. Pearson's correlation defined the relationship between changes in strength and RFD with outcomes. **Results:** There were significant changes in pain [mean difference (MD)=-3.3; (95%CI: -0.32, -6.24); p=0.03], and function [MD=3.3 (95%CI: 0.05, 6.5); p=0.04] pre- to post-intervention. There was a significant high correlation between the change in pain and ER RFD at 50ms (r=0.81; p=0.02) and 100ms (r=0.74; p=0.05), but not with maximum isometric strength. **Conclusion:** Our results suggest that neural changes in force production may be more relevant to decrease pain with exercise. Exercises targeting RFD increases may be beneficial, but future research will determine if this potential mechanism also plays a role in long-term improvements.

## Poster #93

**Title**: Cerebellar inhibition to motor cortex varies during motor performance

**Authors:** Pooja Iyer, Maxfield Munk, & Beth Fisher

**Faculty Advisor:** Beth E. Fisher

**Background:** We engage several neurophysiological processes during motor practice to improve performance. Among these processes, cerebellar output to the motor cortex (M1), i.e., cerebellar inhibition (CBI), improves performance during the early phases of practice. Our long-term goal is to utilize CBI to understand cerebellar contributions to motor learning in people with Parkinson's Disease. Since the experimental efforts to capture CBI are preliminary, replicating the measurement process to explore CBI changes during a motor performance is warranted. **Method:** Design: We measured CBI in a single subject during a motor sequence task (120 trials): at rest, early (40 trials), and end (80 trials). Paired-Pulse Transcranial Magnetic Stimulation Paradigm: The Test Stimulus (TS) involved stimulation of the flexor dorsal interossei hotspot in M1. Ten trials at 53% Machine Stimulator Output (MSO) using a figure of eight coil produced motor evoked potentials (MEP) of 1mV. We applied a Conditioning Stimulus (CS) to the ipsilateral cerebellum (75% MSO) using a double cone coil. The interstimulus interval between the CS and TS was10ms. The CS activates putative pathways to M1 such that TS produces MEP with amplitude <1mV. Data analysis: CBI is indexed as an MEP<1mV indicates an inhibitory influence of cerebellum on M1. *CBI = (CS □ TS) / (TSonly)* **Results:** In contrast to the previous study, we observed a decrease in CBI from rest (0.53) to the early practice (0.72) that increased during the end of practice (0.35). **Conclusion:** These results challenge the reported direction of CBI, establishing the importance of testing more subjects.

## Poster #94

**Title**: Comparing biofeedback paradigms to reduce kinematic impairment post-stroke: Preliminary data

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

**Faculty Advisor:** Kristan Leech

**Background:** Kinematic impairments are common post-stroke, and are associated with increased metabolic cost and fall risk. One approach to address kinematic impairments post-stroke is biofeedback-based gait training, which has been shown to improve select gait kinematics. However, the most effective biofeedback paradigm to improve overall gait kinematics is unclear. **Purpose:** To determine the visual biofeedback paradigm that provides the largest reduction in interlimb asymmetry (our measure of gait asymmetry) in people post-stroke. We hypothesized that propulsion feedback will provide the greatest reduction in interlimb asymmetry.

**Methods:** Five participants post-stroke completed three days of biofeedback training. The three biofeedback paradigms were step length asymmetry, propulsion, and interlimb asymmetry. A single biofeedback paradigm was used each day, and the order was randomized. First, we collected kinematic and force data during a two-minute baseline trial. Then, each participant walked on the treadmill using biofeedback for four, five-minute trials. Our primary outcome measure was percent change in interlimb asymmetry relative to baseline, which was calculated during the final thirty clean paretic limb strides of the fourth feedback trial each day. **Results:** Four out of five participants had the greatest reduction in interlimb asymmetry using propulsion feedback, and one participant had the greatest reduction using step length asymmetry feedback. The average change in interlimb asymmetry was -25% using propulsion feedback, -16% using step length asymmetry feedback, and +11% using interlimb asymmetry feedback. **Conclusion:** Our preliminary data suggests that propulsion feedback may be the most effective feedback source to reduce interlimb asymmetry in people post-stroke.

## Poster #95

**Title**: Investigating Decision-Making While Walking in Risky Environments

**Authors:** Shreya Jain & James Finley

**Faculty Advisor:** James Finley

**Background:** Falls are a primary health concern in the United States, with an average of 9.9 million fall-related injuries occurring every year. Many fall risk factors have been identified and used to design interventions to reduce fall occurrence. While several clinical measures can be used to identify the presence of some fall risk factors, they do not assess how people make decisions regarding their walking behaviors in daily life and whether these decisions are appropriate given their ability and the environmental context. **Purpose:** To determine how people choose between walking conditions with varying levels of risk. **Methods:** We will use balance perturbations on a split-belt treadmill to create risky walking conditions that can cause forward and backward losses of balance. Participants will repeatedly choose between different perturbed walking conditions and their choices will allow us to determine how they perceive the riskiness in their experiences. Models of decision-making have been developed in the field of behavioral economics and we will apply these to investigate the processes and physiological and psychological factors underlying individuals' decisions between perturbed walking conditions. **Results:** Our preliminary data show large variability between subjects in their ability to perceive differences between perturbations. Additionally, some participants behave as if they have a higher aversion to backward and others to forward losses of balance. More data and further analysis are required and ongoing. **Conclusion:** This work will help us understand how well people perceive the risk in their walking experiences and whether their subsequent chosen behaviors are then appropriate.

## Poster #96

**Title**: ACL Reconstruction Affects Patellofemoral Joint Alignment and Contact Area

**Authors:** Thomas Demirjian & Christopher Powers

**Faculty Advisor:** Christopher Powers

**Background:** Reconstruction is the gold standard treatment approach for those who have experienced a tear of the anterior cruciate ligament. Persons who have undergone ACL reconstruction (ACLR) have been reported to exhibit early onset patellofemoral joint osteoarthritis. It is possible that reconstructive surgery that harvests part of the extensor mechanism may alter the patellar alignment thereby influencing patellofemoral joint mechanics. **Purpose:** To evaluate whether ACLR using a quadriceps tendon autograft influences patellar alignment and patellofemoral joint contact area. **Methods:** Magnetic resonance images from 19 females (18-36 years of age) who had undergone ACLR using a quadriceps tendon autograft were analyzed. Measures of lateral patellar tilt, lateral displacement, and patellofemoral joint contact area were obtained from MR images acquired before and after surgery. Paired-t tests were used to assess differences in measures pre-post surgery. **Results:**

Significant increases in lateral patellar displacement were found post-surgery (58% ± 6% of patella lateral to midline vs 78% ± 14% of patella lateral to midline, P=0.002). No changes in patellar tilt were observed. Patellofemoral joint contact area decreased from 128 $mm^2$ ± 63 $mm^2$ to 110 $mm^2$ ± 54 $mm^2$ post-surgery, P=0.001. **Conclusion:** ACLR using a quadriceps tendon autograft affects patellar alignment. The increase in lateral patellar displacement was consistent with the significant reduction in patellofemoral joint contact area post-surgery. A reduction in contact area would be expected to alter contact mechanics and may contribute to the higher incidence of patellofemoral joint osteoarthritis in this population.

## Poster #97

**Title**: Limb loading instruction does not restore knee loading post-ACL reconstruction

**Authors:** Willa Ma, Ming-Sheng Chan, & Susan Sigward

**Faculty Advisor:** Susan Sigward

**Background:** Loading strategies that shift mechanical demand away from the surgical knee persists post-anterior cruciate ligament reconstruction (ACLr). Previous work found that individuals can restore limb loading symmetry with instruction to equalize weight distribution between limbs during a squat; however, it is not known if this instruction improves knee extensor moment deficits. **Purpose:** To compare limb and knee loading strategies during a squat performed under natural and instructed conditions in individuals following ACLr and controls. **Methods:** Thirteen individuals post-ACLr (116 ± 17 days) and 19 controls participated. Kinematic and kinetic data were collected while participants performed squats naturally (N) and with instruction to equalize limb loading (IN). Vertical ground reaction force (vGRF), hip and knee extensor moment impulse, limb (LLS: vGRF) and knee (KLS: extensor moment impulse) loading symmetry, and hip-to-knee (H2K: extensor moment impulse) ratio were calculated. 2x2 ANOVAs assessed effects of group and condition on LLS, KLS, and H2K. **Results:** Significant interactions were found for LLS (P=0.001) and KLS (P=0.006). KLS was smaller in ACLr versus control: N (P<0.001) and IN (P =0.002). LLS (P=0.002) and KLS (P=0.008) increased from N to IN in the ACLr group. H2K was greater in the ACLr group. **Conclusion:** While instruction improved limb and knee loading symmetry in the ACLr group, they continued to exhibit surgical knee extensor moment deficits (36.2%). These data indicate that instruction to evenly distribute weight between limbs may not sufficiently restore knee extensor loading in early recovery following ACLr. Compensation with surgical limb hip extensors persisted.

## Poster #98

**Title**: Anticipatory muscle activation to counteract interaction torques in stroke survivors.

**Authors:** Yannick Darmon, Victor Barradas, Carolee Winstein, Emily Rosario, & Nicolas Schweighofer

**Faculty Advisor:** Nicolas Schweighofer

**Background:** Fast flexion and

extension of the elbow generate large interaction torques at the shoulder. To maintain accuracy and stability, it has been previously shown that the central nervous system learns to compensate for these torques by activating anticipatory shoulder muscles proportionally to the interaction torques. These feedforward motor commands are thought to be learned by the cerebellum. However, in stroke survivors, damage in the cerebro-cerebellum pathways may preclude stroke survivors from updating their feedforward controllers. **Purpose:** We test the hypotheses that shoulder muscular activity is not anticipatory and is not proportional to the interaction torques during single-joint elbow movements. **Methods:** We recruited 11 stroke survivors and we tested their more- and less-affected sides. During single-joint elbow extension, we explored the relationships between the generated interaction torques at the shoulder and the electromyographic (EMG) activity for the muscles responsible for maintaining the stability of the shoulder. **Results:** For both the more and the less affected sides, the muscle activity of the Posterior deltoid precedes the onset of the movement. However, the less-affected side shows a stronger relationship ($R^2$ = 0.41) than the more-affected side ($R^2$ = 0.11) between the estimated interaction torque at the shoulder and the Posterior Deltoid activity. **Conclusion:** Our results suggest that stroke survivors maintain the temporal strategy to counteract the interaction torques but lack the scaling component.

**OCCUPATIONAL SCIENCE & OCCUPATIONAL THERAPY DOCTORAL STUDENTS (PHD, OTD)**

## Poster #99

**Title**: Process evaluation of an app for individuals with cognitive impairments

**Authors:** Adam Strizich, Karen Tapper, & Stacey Schepens Niemiec

**Faculty Advisor:** Stacey Schepens Niemiec

**Background:** Sedentariness in older adults is linked to increased mortality risk. A physical activity app, Moving Up-A, was designed to improve physical activity patterns in older people with mild impairments in cognition. A two-phased feasibility study is underway to solicit feedback about the user experience. **Purpose:** Determine the initial process feasibility of implementing and evaluating Moving Up-A in older adults with mild impairments in cognition. **Methods:** Fifteen older adults with mildly impaired cognition and their study partners were oriented to Moving Up-A and tested the app for two weeks. One-week check-in calls were made to provide additional support. A user experience interview was conducted following the two-week trial. **Results:** Several process challenges, organized by theme, arose in phase-one feasibility testing. Recruitment/enrollment: participant recruitment was slow, necessitating removal of key eligibility requirements and formation of new recruitment partnerships. Cognitive Load: participants demonstrated signs of cognitive overload during some study activities. Protocol modifications were necessary (e.g., decreasing visit length, improving interview structure organization) to enhance participation. Training & Support: client-centered approaches and geragogy best practices (e.g., step-by-step guidance when troubleshooting app errors) became crucial in overcoming regular challenges and stressors related to user training and support. Eliciting User Feedback: some participants had difficulty articulating meaningful feedback about the app, warranting revisions to interview techniques (e.g., balancing open-ended and concrete questions). **Conclusion:** Drawing on lessons learned from a process feasibility evaluation, we offer recommendations for good practices that may be useful to broader health technology development efforts for special populations.

## Poster #100

**Title**: Facilitators and barriers impacting SENSE program implementation

**Authors:** Bethany A. Gruskin, Marinthea Richter, Polly Kellner, & Bobbi Pineda

**Faculty Advisor:** Bobbi Pineda

**Background:** The Supporting and Enhancing NICU Sensory Experiences (SENSE) is an evidence-based intervention optimizing the environment for infants in neonatal intensive care units (NICUs). **Purpose:** To identify facilitators and barriers to SENSE program implementation. **Method:** In May 2017, The SENSE program was made available to clinicians in the US and abroad by way of purchasing a license. In March 2021, a survey was distributed to 211 individuals, who had purchased the SENSE program license. Along with defining hospital characteristics, survey questions probed if implementation had occurred and barriers and facilitators to implementation. **Results:** 114 participants completed at least a portion of the survey (54% response rate). Of 107 respondents, 57 (50%) had implemented, 33 (29%) were in the process of implementing, and 17 (15%) had not implemented the SENSE program. From time of purchase, 64% (n=45) of respondents were able to implement the SENSE program in less than 3 months. From respondents without full implementation, identified barriers to implementation included the pandemic (19%, n=12), staffing and administrative challenges (44%, n=28), team buy-in (30%, n=19), and access to materials to aid implementation (6%, n=4). Activities identified to facilitate SENSE program implementation included providing education (72%, n=51), access to funding (8%, n=6), developing NICU policy (6%, n=4), and engaging in research on the implementation of the SENSE program (14%, n=10). **Conclusion:** Understanding facilitators and barriers to implementation of the SENSE program highlights opportunities for improvements to the SENSE materials and implementation recommendations.

## Poster #101

**Title**: Literature Review: Mitigating Barriers to Early Autism Identification and Diagnosis

**Authors:** Brittany Koenke, Emily Sopkin, & Grace T. Baranek

**Faculty Advisor:** Emily Sopkin & Grace T. Baranek

**Background:** For children showing early risk signs for Autism Spectrum Disorder (ASD), there is a temporal gap between when parents first raise concerns (~17.1 months; Locke et al., 2020) and when their child receives an ASD diagnosis (~4-5 years; Zwaigenbaum & Penner, 2018), resulting in a delay of important early intervention services. **Purpose:** To 1) understand the barriers to early ASD detection and diagnosis and the best practices to address these barriers, and to 2) determine future implications for occupational therapists in early intervention settings. **Methods:** First, a literature search was conducted using PubMed and Google Scholar databases to identify articles reflecting barriers to detecting and diagnosing ASD. Search terms included: ASD, early, detection, diagnosis, screen. 18 publications were reviewed. A second search was conducted using the same databases to identify interventions to mitigate the barriers which emerged. Search terms included: ASD, early signs, early intervention, therapist, occupational therapy. 17 articles were reviewed. **Results:** Barriers: 1) dismissal of parent concerns,

2) practitioners' awareness of ASD screening procedures and tools, 3) autism symptom severity, and 4) access disparities. Best practices to address these barriers: 1) including parents in the evaluation process, 2) implementing early screening and training on screening tools, 3) training professionals on early ASD risk signs, and 4) implementing screening programs and trainings in underserved areas and populations. **Conclusion:** Occupational therapists should seek training on early ASD risk signs and how/when to conduct screenings, support the parent role in evaluation, and implement routine screenings in underserved areas.

Poster #102

**Title**: Occupational exposure and musculoskeletal complaints among dental hygiene students

**Authors:** Buwen Yao

**Faculty Advisor:** Shawn C. Roll

**Background:** Dental hygiene (DH) students are exposed to musculoskeletal disorder risk factors of repetitive motions, forceful gripping, and prolonged awkward positions. However, little is understood about the relationships between the training of DH and the development of musculoskeletal discomfort. **Purpose:** To describe the trends of musculoskeletal symptoms and identify their relationships with DH training. **Methods:** Hand, shoulder, and neck pain was self-reported by 111 DH students at the beginning of their program and half-yearly for a total of five visits. The workload of DH training between each visit was retrieved, including numbers of patients treated and the difficulty level of each patient ranked by the required muscle workload (type 1 the easiest, 4 the hardest). Data analyses were conducted by building mixed-effect models. **Results:** The hand, shoulder, and neck pain peaked at the 18th month. Hand pain was associated with numbers of all patients ($p<0.01$), type 1 patients ($p=0.03$), and type 4 patients ($p=0.02$). Neck pain was associated with numbers of type 4 patients ($p<0.01$). Numbers of all patients and type 1 patients had the strongest associations at the start of the program ($p=0.01$, $p<0.01$), while numbers of type 4 patients had the strongest associations when students were first trained for type 4 patients (12th and 18th month, $p=0.02$, $p=0.01$). **Conclusion:** DH students are most prone to pain when first exposed to DH work and work that requires more muscle workload. Ergonomic prevention strategies may be most effective when students are exposed for the first time.

Poster #103

**Title**: Health services utilization among Florida autistic children and adults

**Authors:** Amber Angell, Susmita Datta, Xiwei Lou, Camille Parchment, Erica Shoemaker, & Tim Reistetter

**Faculty Advisor:** Amber Angell

**Background:** Autistic youth have high utilization of acute psychiatric healthcare, which is costly and may reflect a lack of sufficient lower-level care. Community-based therapeutic services may reduce the risk of future acute psychiatric care utilization, but as autistic individuals age, they appear to have less access to therapeutic services. There is a lack, however, of recent research investigating these trends. **Purpose:** The purpose of this study was to characterize contemporary age-related patterns of health services utilization for autistic children, youth, and adults. **Methods:** This retrospective observational study is a secondary analysis of the OneFlorida Data Trust, a PCORI-funded data research network. With age as the independent variable and therapeutic service utilization and acute psychiatric utilization as the dependent variables, we conducted ordinary least squares linear regressions using Python (version 3.10). We analyzed utilization for N=50,158 patients with any therapeutic encounter, and N=27,788 patients with any acute psychiatric encounter, in the measurement period (2012 to 2020). **Results:** Holding all other explanatory variables fixed, therapeutic service utilization decreased with age and acute psychiatric utilization increased with age. Behavior therapy and speech therapy were more frequently utilized, and occupational therapy and physical therapy were less frequently utilized. There were also significant differences in utilization by race, ethnicity, urbanicity, and sex. **Conclusion:** Among OneFlorida autistic patients, therapeutic service utilization decreased, and acute psychiatric utilization increased, with age. More research is needed to determine associations between therapeutic service and acute psychiatric utilization in autistic cohorts, particularly longitudinal studies that measure the impact over time.

## OCCUPATIONAL SCIENCE & OCCUPATIONAL THERAPY

## PROFESSIONAL STUDENTS (BS-MA, MA)

Poster #104

**Title**: Analysis of prefrontal cortex responses to chopstick usage

**Authors:** Stephan Manuel Acuña, Mayumi Wagatsuma, Christelli E. Carmona, Mai Narasaki-Jara, & Taeyou Jung

**Faculty Advisor:** Taeyou Jung

**Background:** Fine motor skills, such as manipulating utensils, are found to be associated with increased brain activation in the prefrontal cortex (PFC). Limited research has examined PFC activation during chopsticks usage. **Purpose:** This study investigated the cortical hemodynamic responses to chopsticks versus fork and hand use. Brain responses to chopsticks use were further analyzed based on three subgroups categorized by performance proficiency, usage frequency, and cultural background. **Methods:** 32 young adults (age 24.4 ± 2.36) participated in this study and were instructed to transfer beans from a source to a target plate at a comfortable pace. The participants completed the task using 3 separate conditions: chopsticks, fork, and hand in a randomized order. functional near-infrared spectroscopy was used to examine cortical hemodynamics by measuring oxyhemoglobin ($HbO_2$) in the PFC among the three modes of manipulation. **Results:** This study revealed a significant difference between chopsticks and hand usage ($p < 0.011$). Chopsticks use resulted in a 36% higher increase of $HbO_2$ than hand use. However, there was no statistically significant difference between chopsticks and fork use. Subgroup analysis reported a systematic trend of lower $\Delta HbO_2$ among participants who were proficient with chopsticks, frequently used chopsticks, and had a chopsticks-using cultural background. **Conclusion:** Our results suggest that the use of chopsticks can increase brain activity in the PFC compared to fork or hand use and that cortical hemodynamic responses to chopsticks use can also be influenced by other factors such as a level of proficiency, frequency of use, and cultural background.

Poster #105

**Title**: Oral Health Knowledge, Attitudes, and Practices of Black Caregivers

**Authors:** Dominique H. Como, Lucía I. Floríndez, Leah I. Stein Duker, & Sharon A. Cermak

**Faculty Advisor:** Sharon A. Cermak

**Background:** Pediatric populations from underserved minoritized groups (e.g., Black/African American [B/AA]) and

those with special health care needs (e.g., autism spectrum disorder [ASD]), are at greater risk for oral health disparities. Gaps in oral care knowledge, attitudes, and practices (KAP) may contribute to these disparities. **Purpose:** To identify the oral health KAP of B/AA caregivers of children with and without ASD. **Methods:** Participants included 125 B/AA or multiracial (including B/AA) caregivers of children 4-14 years with (n=65) or without (n=60)ASD. A culturally-tailored survey examined caregiver oral health KAP. **Results:** Knowledge: Parents correctly answered 67% of questions, wanted to increase oral health knowledge (80%), and learn to improve their child's oral health (88%). Attitudes: Caregivers indicated they (60%) and their child (57%) are fearful of dentists, although 90% trust their child's current dentist. Despite that, many (60%) believe their race/ethnicity negatively influences how their child is treated at the dentist. Practices: Brushing at least twice per day (caregiver, 62%; child, 59%) and regularly flossing (caregiver, 56%; child, 65%) were reported. However, caregivers reported neither they (60%) nor their child (42%) had a dental cleaning in the last year. **Conclusion:** B/AA caregivers have foundational knowledge about oral health and practices, but desire more. Due to experiences of dental fear and beliefs that race/ethnicity negatively impact care, patient-provider relationships should be strengthened. Creating culturally-tailored educational and behavioral interventions may help to improve oral health disparities for B/AA families. It is important to explore the intersection of culture and oral health.

## Poster #106

**Title**: Construct validity: Novel intentional communication coding scale for infant-caregiver interactions

**Authors:** Elizabeth Choi, Cristin Holland, Elizabeth Phelps, Stephen Morrison, Chloe Rey-Talley, Linda Watson, & Grace Baranek

**Faculty Advisor:** Grace Baranek

**Background:** Intentional communication (IC; directed vocalizations and/or gestures) is often difficult for infants at elevated likelihood for autism. Difficulty with IC potentially reduces caregiver responsiveness and therefore further development of communication skills. **Purpose:** We developed a coding scheme for our treatment study to measure IC in 11–16-month infants. To assess its construct validity, we tested its convergent validity (relatedness to measures of similar constructs) and divergent validity (dissimilarity to measures of unrelated constructs). **Methods:** We used Spearman's Rho with pairwise deletion to test associations among a) Time 1 (T1) and Time 2 (T2) IC rates, b) T1 MacArthur-Bates Communicative Development Inventory (M-CDI) Words and Gestures subscale sums, and c) T1 and T2 Mullen Scales of Early Learning (Mullen) subscale t-scores. We anticipated that IC categories would be moderately correlated with M-CDI subscales and Mullen Expressive (EL) and Receptive Language (RL) subscales. We expected less associations with Mullen Visual Reception or Fine Motor subscales. **Results:** Results of convergent and divergent validity tests were consistent with hypotheses. Surprisingly, T1 IC Gestures was not significantly correlated with any M-CDI subscales. IC Gestures may thus indicate less about gesture inventory and more about gesture production and use at this age. **Conclusion:** Findings provide preliminary support for the construct validity of our IC coding scale. Moreover, our coding scheme may be especially useful in this predominantly pre-verbal population as difficulties clearly directing communication are an early indicator of autism but are challenging to capture on current standardized measures of language.

## Poster #107

**Title**: Primary Healthcare Encounters for Autistic Adults and their Caregivers

**Authors:** Elizabeth Goodman & Leah Stein Duker

**Faculty Advisor:** Leah Stein Duker

Backgrond: Primary care is associated with greater access to healthcare services and improved health outcomes. However, autistic adults report challenges accessing and utilizing primary care, in addition to unmet healthcare needs. The need to minimize existing barriers and identify strategies to facilitate successful healthcare encounters is increasingly important as autistic adults represent a growing segment of society. Minimal research has examined primary healthcare encounters for this population. **Purpose:** To elucidate the barriers and facilitators to primary healthcare encounters for autistic adults and their caregivers. **Methods:** Thirty-two interviews of caregivers of autistic adults were conducted in Los Angeles and Philadelphia. Interviews lasted an average of 34 minutes, were transcribed verbatim, and analyzed using thematic analysis. This data represents a subset of a larger study which conducted interviews with autistic adults, caregivers, and primary care providers (PCPs). **Results:** Eight themes emerged from the interviews: (1) finding a PCP; (2) patient-provider communication; (3) anxiety due to unpredictability, an overstimulating sensory environment, and waiting time; (4) participation of consumers in the healthcare process; (5) stigma and assumptions about autism; (6) referrals to healthcare specialists; (7) burden experienced by caregivers; and (8) the impact of culture and ethnicity on care. All eight themes included barriers to care, suggestions to mitigate challenges, and/or successful strategies implemented during care encounters. **Conclusion:** Findings from this study have the potential to inform the development of, or improve existing, client-centered interventions to improve primary healthcare services for autistic adults.

## Poster #108

**Title**: The Impact of Multisensory Environments: A Systematic Review

**Authors:** Elizabeth Isralowitz, Caitlin Jolette, Molliane Grager, Sharon Cermak, & Leah Stein Duker

**Faculty Advisor:** Sharon Cermak

**Background:** Multisensory environments (MSE) manipulate sensory features of the environment. They are reported to lead to improved outcomes (e.g., attention, relaxation, engagement, reduction of stress and maladaptive behavior). However, questions exist regarding the research evidence for MSEs. **Purpose:** To systematically review the literature regarding the impact of MSEs on user, caregiver, and staff outcomes. **Methods:** Seven databases were searched using keywords "Snoezelen," "multisensory environment," and "multi-sensory environment." Studies published in English utilizing an MSE with clinical and non-clinical populations between 1990 and 2021 were included. Two independent researchers appraised methodological quality, as well as level of the evidence described by the Oxford Center for Evidence-Based Medicine. **Results:** Of the 1,572 articles screened, 250 were assessed for eligibility, and 98 were included in the review. MSEs were utilized most frequently with individuals with intellectual and developmental disabilities (38%), dementia (27%), and mental illness (12%). The most common outcomes targeted were relaxation, stress/agitation, mood, and adaptive behaviors. The majority of articles utilized multiple outcome measures. Approximately 25% of articles reported significant improvements in at least one outcome measure, while the majority found non-significant improvements or no change (69%). Preliminary results in-

dicate that most studies met low to moderate levels of evidence (59%) and/or had two or more serious methodological issues (62%). **Conclusion:** Despite MSE's increasing popularity with clinical and non-clinical populations, more evidence supporting the benefits of MSEs is needed.

Poster #109

**Title**: Student Occupations and Well-Being During COVID-19: Gender, Race, and Ethnicity

**Authors:** Elizabeth Isralowitz, Valerie Tapia, Nikki Nguyen, Kelly Deng, & Sharon Cermak

**Faculty Advisor:** Sharon Cermak

**Background:** The COVID-19 pandemic has disrupted the daily lives of college students. COVID-19 related stresses and concurrent rises in race-related bias may have a differential impact on various racial, ethnic and gender groups. **Purpose:** Examine the effects of students' gender, ethnicity, and race on occupational balance, social activities, mental-health, and COVID-related behaviors, beliefs, and experiences (CBBE) during the pandemic. **Methods:** Undergraduates (n=152) completed a survey on perceived occupational balance, activity participation, mental-health (anxiety, stress, fatigue, depression, loneliness), and CBBE. ANOVA and t-tests evaluated group differences. **Results:** Gender. Females reported more fatigue, anxiety, and stress. There were no gender differences for occupational or mental health measures. Females participated in more preventative actions and expressed more worry about COVID-19. Males showed a greater increase in drinking, smoking, and drug use (DSD). Ethnicity. Hispanic/LatinX participants reported greater occupational balance and satisfaction with participation in social activities than non-Hispanic/LatinX. There were no differences for mental-health or the CBBE. Race. Given the higher percentage of males in the Black/African-American group than other groups, we controlled for gender. Black/African-Americans reported significantly more occupational balance than Whites. There were no differences in satisfaction with social activities. Whites reported significantly more anxiety than Asians. There were no other between-group mental-health differences. Asians participated in the most COVID-related preventative actions. Whites reported a greater increase in DSD than Asians. Limitations: Small disproportionate sample size. **Conclusion:** COVID-19 has differential effects on self-perceived health and well-being related to gender and ethnicity/race. Understanding diverse experiences of students is important when providing support.

Poster #110

**Title**: Inter-Rater Reliability for Observation of Complex Infant and Toddler Behaviors

**Authors:** Emily Campi, John Sideris, Richard A. Faldowski, Claire Chen, Linda Watson, & Grace Baranek

**Faculty Advisor:** Grace Baranek

**Background:** Infant sensory cues can be ambiguous and measured observationally. Different interpretations contribute to poor inter-rater reliability (IRR), a component of measure validity. Sources of unreliability must be mitigated to yield reliable study results to inform research and clinical practice. **Purpose:** To illustrate the IRR process for rating complex behavior using the Sensory Processing Assessment (SPA) as an example. **Methods:** The SPA is an observational measure of sensory response patterns. Data were from an early intervention study. Participants were seventy-six 9-16-month-olds with elevated likelihood (n=42) and lower likelihood (n=34) of autism. IRR calculations included: (1) initial IRR (n=26), (2) double-coding from video (n=6), (3) adding observations (n=6) across rater pairs, and (4) adding variability (n=6) to the IRR sample (n=38 of 165 SPAs). Results/Discussion: We selected a two-way mixed effects, single-rater, absolute agreement intraclass correlation coefficient (ICC). ICCs were .63 (hyporesponsiveness) and .49 (hyperresponsiveness); absolute agreement was 87% (hyporesponsiveness) and 74% (hyperresponsiveness). These discrepancies triggered investigation into IRR. Primary raters scored observations live, and reliability raters scored from video, which conflated rater with rating method. ICCs from additional video raters were examined and were comparable to initial ICCs, suggesting that rating method did not affect IRR. Non-systematic pairing of raters muddled sources of variability in pairs who scored 1-2 observations, so ratings were added, yielding ICCs: .81 (hyporesponsiveness) and .58 (hyperresponsiveness). After the fourth step, ICCs were .85 (hyporesponsiveness) and .67 (hyperresponsiveness). **Conclusion:** When measuring complex behavior, IRR procedures must be planned to avoid pitfalls that may impact study validity.

Poster #111

**Title**: Creativity and Well-being in Emerging Adulthood

**Authors:** Hana Khan, Kimberly Morris, & Jo Ann Farver

**Faculty Advisor:** Jo Ann Farver

This study examines whether college students' engagement in creative activities is associated with their life satisfaction. Participants included 87 undergraduate students aged 18 through 29 who were selected through a convenience sample. Students were directed to thoughtfully respond to a brief 26-item survey assessing their current levels of well-being and life satisfaction, including general mood, energy levels, and feelings of stress using the Weekly Affect and Satisfaction Measure, General Health Questionnaire (GHQ-12), Subjective Vitality Scale (SVS), and creativity survey. A 2 X 2 mixed model ANOVA yielded results that neither supported nor contradicted the hypothesis that there is a significant relationship between engaging in creative occupations and well-being among emerging adults. Other factors, including gender, field of study, and ethnicity, were also observed as potential moderating variables among the variables of focus (creative activities and well-being), to examine whether or not greater consistency within the relationship exists among variables in the collected data. Study results did not provide evidence of an interaction effect to support that there was a difference between pre and post-test scores for level 1 (students consistently engaging in creative occupation) and level 2 (students not engaging in scheduled creative occupation) groups on any dependent variables of interest (general health, vitality, life satisfaction).

Poster #112

**Title**: Facilitating Engagement of Multiple Stakeholder Perspectives: Lessons Learned from TRUST

**Authors:** Julia Lisle, Mariamme Ibrahim, Emily Ochi, Erna Blanche, & Mary Lawlor

**Faculty Advisor:** Mary Lawlor

**Background:** Understanding the multiple perspectives of stakeholders within the autism community is key to eliciting more relevant and practical outcomes in autism research. Several studies have investigated research priorities of individual stakeholder groups (i.e., family, autistic self-advocates, clinicians, or researchers) within the ASD community. However, these ideas have not been considered collaboratively amongst stakeholders. Systemic barriers within research universities, bias and power differentials, access, and trust amongst stakeholders have contributed to the difficulty of engaging stakeholders. **Purpose:** The Transforming Research: Understanding Sensory Experiences in ASD, Stakeholders Working Together (TRUST) project aims to

build on existing relationships with stakeholders and community partners, to work towards a collective goal of improving outcomes for individuals with ASD and their families. This paper explores the processes and inherent complexities of engaging multiple stakeholders and highlights strategies to foster an inclusive space for collaborative stakeholder engagement. **Methods:** With guidance from the steering committee, the TRUST project administrative team implemented engagement strategies designed to capitalize on narrative expertise and multiple perspectives afforded diverse stakeholder groups. **Results:** The engagement strategies facilitated meaningful participation and trust amongst individuals involved in the project. Examples of these strategies include overcoming systemic barriers to hire stakeholders, using virtual meeting spaces to facilitate engagement for individuals with varying sensory and communication needs, providing leadership opportunities to stakeholders, and adhering to rules of engagement during every meeting. **Conclusion:** Future research may find implementation of strategies like those used in the TRUST project beneficial for engaging multiple stakeholders.

## Poster #113

**Title**: Musculoskeletal sonography supporting upper extremity therapeutic interventions: A scoping review

**Authors:** Katherine J. Loomis, Jiwon Shin, & Shawn C. Roll

**Faculty Advisor:** Shawn C. Roll

**Background:** As musculoskeletal sonography technology advances, point-of-care use for physical rehabilitation is becoming increasingly feasible to support day-to-day clinical care and decision-making. Due to the rapid growth of literature surrounding musculoskeletal sonography, it is now possible to investigate this topic specifically within upper extremity rehabilitation. **Purpose:** To evaluate the growth, range, extent, and composition of existing musculoskeletal sonography literature supporting physical rehabilitation for upper extremity conditions in order to identify trends and opportunities for further investigation. **Methods:** Five scholarly databases were searched using the general terms "sonography, ultrasound or ultrasonography," "musculoskeletal or musculoskeletal system," and "upper extremity." This produced 4,097 total articles which were then screened for eligibility. Two independent reviewers examined 421 eligible articles using the criteria of: involving an upper extremity musculoskeletal diagnosis typically treated in rehabilitation settings, use of sonographic imaging, and data-driven study design. Articles specifically pertaining to direct use for point-of-care sonography within upper extremity rehabilitation settings were identified for further in-depth exploration, while the remainder were categorized by general diagnosis type (e.g. acute vs. chronic) and study focus. **Results:** Analysis of full text articles is ongoing, however preliminary results indicate that though there is a fair amount of literature applicable to therapeutic settings, much of the literature focuses on grading of condition severity, preliminary validity and reliability of measurement techniques, and understanding underlying anatomical mechanisms of conditions. **Conclusion:** There are opportunities to further develop the body of knowledge for dynamically informing clinical decision-making, evaluating patient outcomes, and using sonographic imaging as a therapeutic intervention.

## Poster #114

**Title**: Physical activity impact on blood glucose among adults with T1D

**Authors:** Loree Pham, Ray Hernandez, & Elizabeth Pyatak

**Faculty Advisor:** Elizabeth Pyatak

**Background:** The benefits of engaging in physical activity (PA) on an individual's metabolic health are well established; however, short-term dynamic relationships between PA and blood glucose (BG) are unclear. **Purpose:** Drawing data from a larger longitudinal study of BG, function, and well-being in adults with type 1 diabetes (T1D), this study uses accelerometry and continuous glucose monitoring (CGM) to examine within- and between-subject effects of PA bouts on BG. **Methods:** All participants (103 adults with T1D) wore a blinded CGM device with BG values recorded every 15 minutes. PA was measured using accelerometers worn continuously for 14 days. Between- and within-person correlations between PA bouts and average BG were analyzed. **Results:** Within-person, more time in moderate or vigorous PA (MVPA) was associated with lower average BG ($p < 0.001$). More time sedentary was associated with higher average BG ($p < 0.001$). Increased MVPA was associated with greater glycemic variability ($p < 0.001$). Between-person, more time spent sedentary was associated with lower BG levels ($r = -0.21$, $p = 0.026$). **Conclusion:** As expected, PA was associated with lower BG both during and after activity on a within-person basis; unexpectedly, however, the results were reversed when analyzing across individuals. Sedentary time was associated with lower BG, while those who regularly engaged in MVPA had higher BG on average. Findings suggest those who are more sedentary may have lifestyles that allow for better control of BG compared to those whose lifestyles include more PA. Understanding how PA influences BG may enhance diabetes interventions.

## Poster #115

**Title**: Doppler Sonography for Detecting Intraneural Blood Flow within Median Nerve

**Authors:** Luming Yang, Buwen Yao, & Shawn C. Roll

**Faculty Advisor:** Shawn C. Roll

**Background:** Due to the complexity of intraneural blood flow (INBF) acquisition technology, researchers have not reached a consensus on the standards on blood flow acquisition and analysis processes. **Purpose:** To identify the existing methodology of Doppler sonography to detect INBF within the median nerve. **Methods:** PubMed and CINAHL were used to search for articles using Doppler sonography to assess INBF within the median nerve since the year 2000. Three reviewers independently finished the screening process. Articles without human subjects, firsthand data, or the examination of INBF were excluded. Data extraction was completed by one of the reviewers. Country, population, image acquisition, and analysis protocols were extracted from all the final included studies. **Results:** A total of 520 records of titles and abstracts were screened, and final review included 52 studies. They were mainly conducted in the US, India, Egypt, etc. 35 out of 52 articles included patients with carpal tunnel syndrome or clinically suspected carpal tunnel syndrome. Other common populations include diabetes, leprosy, and peripheral neuropathy. Sonography machines and modes used in the studies varied. Various analysis methods were adopted to measure INBF: 1) hypervascularity seen as a binary outcome; 2) blood flow signals counted or scored; 3) continuous outcomes, such as intensity of power doppler signals, peak systolic velocity of spectral doppler waveforms. **Conclusion:** This review demonstrated a strong need to develop a standardized sonography imaging protocol and documentation for examining INBF within the median nerve, and the clarification of nomenclature used to describe it as well.

## Poster #116

**Title**: Facilitating Community Participation for Individuals with Autism and their Families

**Authors:** Mariamme Ibrahim, Christal Haynes, Bryan Morales, Emily Ochi, Erna Blanche, & Mary Lawlor

**Faculty Advisor:** Dr. Mary Lawlor

**Background:** Individuals with autism spectrum disorder (ASD) face various challenges in community contexts impacting participation and inclusion in these settings. Compared to neurotypical peers, this population is less likely to participate in community activities (Cameron et al., 2021). Barriers and facilitators to community engagement span beyond an individual's interpersonal characteristics and extend to environmental and community factors. Within a community setting, prominent barriers were identified that may hinder participation, including social demands of activities, lack of programs and services, and peer relationships (Krieger et al., 2018). Understanding how these barriers and facilitators impact an individual's ability to participate within the community is important in designing effective interventions to improve outcomes for this population. This paper aims to contribute to the understanding of community participation for individuals with ASD by drawing on multiple narrative perspectives. This paper reports on narrative phenomenological and ethnographic studies to explore how individuals with ASD and their families participate in community contexts. Data examples from research with individuals with ASD, caregivers, and clinicians will be provided in order to highlight the complexities of community participation through personalized experiences. Data themes from a collection of interviews with participants reflect the importance of maintaining a sense of agency, supporting flexibility of individuals and systems within the community, and tailoring activities to individuals' interests to support participation. Addressing environmental barriers, including both physical and social environments, should be considered in future research to support community participation and inclusion for individuals with ASD and their families.

## Poster #117

**Title**: Impact of the Covid-19 pandemic on access to early intervention

**Authors:** Marinthea Richter & Roberta Pineda

**Faculty Advisor:** Roberta Pineda

**Background:** The Covid-19 pandemic and the resulting stay-at-home orders led to changes in healthcare service delivery. The impact of these changes on access to early intervention (EI) services for high-risk preterm infants after NICU discharge is uncertain.

**Purpose:** To identify differences in access to EI before and during the pandemic for preterm infants at 6-months corrected age. **Method:** This retrospective study investigated whether preterm infants (born ≤32 weeks estimated gestational age) who attended a 6-month follow-up appointment during 2019 and from March-November 2020 were receiving EI services. SPSS was used for chi-square analyses to evaluate differences in EI service utilization in 2019 and 2020.

**Results:** 165 infants were included [96 who attended their 6-month follow-up appointment in 2019 (before the Covid-19 pandemic) and 69 from March-November 2020 (during the pandemic)]. The 2019 group was more likely to be receiving some EI services by their 6-month appointment (n=55, 57%) as compared to the 2020 group (n=28, 41%; p=0.034). While developmental stimulation is one service provided under EI, more families of the 2019 cohort utilized child developmental stimulation services (n=32, 33%) as compared to the 2020 cohort (n=9, 13%); p=0.003. **Conclusion:** There was less EI service usage in 2020 as compared to 2019, highlighting that access to EI services for high-risk infants was likely impacted during the COVID-19 pandemic.

## Poster #118

**Title**: The Relationship between Dental Fear/Anxiety, Sensory Over-Responsivity, and Oral Health

**Authors:** Natasha Hikita, Molliane Grager, Willa Giffin, Jose Polido, & Leah Stein Duker

**Faculty Advisor:** Leah Stein Duker

**Background:** Oral health is integral to health. In individuals with special healthcare needs, sensory over-responsivity (SOR) has been linked to maladaptive oral health behaviors and outcomes (OHBO) as well as dental-related fear/anxiety (DFA). It is now understood that neurotypical individuals may also experience SOR; however, limited research has examined the relationship between SOR, DFA, and OHBO in neurotypical individuals. **Purpose:** To review literature examining the relationship between person-factors (e.g., DFA, SOR) and OHBO in neurotypical individuals. **Methods:** Two rounds of literature searches were performed using the PubMed database in an iterative manner. Included articles examined DFA, SOR, catastrophizing, and/or OHBO in neurotypical individuals across the lifespan. Relationships between constructs were recorded and organized into a visual model. **Results:** A total of 161 articles from 34 countries were included. Results supported relationships between DFA and all other constructs in the model [SOR (n=10), catastrophizing (n=7), poor oral health (n=79), irregular dental attendance (n=57), dental behavior management problems (DBMP) (n=28), and need for pharmacological methods (n=16)]. Additionally, SOR was associated with catastrophizing (n=2), DBMP (n=4), irregular attendance (n=1), and need for pharmacological methods (n=2); catastrophizing was linked to poor oral health (n=1). All OHBOs (poor oral health, irregular dental attendance, DBMPs and use of pharmacological methods) were associated with one another. **Conclusion:** Understanding the relationships between person-factors (e.g., DFA, SOR, catastrophizing) and OHBOs is valuable in order to highlight connections between constructs that may be targeted in the development of new interventions to improve OHBOs and the experience of DFA.

## Poster #119

**Title**: The Effect of Arts and Crafts Intervention on Executive (Dys)Function

**Authors:** Ruisheng Yun, Huanxia Zhou, & Julie McLaughlin Gray

**Faculty Advisor:** Julie McLaughlin Gray

**Background:** Executive function is an important determinant of independent living among stroke survivors. In addition, attendance and improvement of patients with post-stroke executive dysfunction were less, due to attention deficits and emotional problems. One way to improve executive function and engagement may be therapeutic use of Arts and Crafts. **Purpose:** The purpose of this study was to explore the effect of an occupational therapist-provided Arts and Crafts intervention on changes in executive function of stroke survivors. **Methods:** The study design was a randomized controlled trial (RCT) with two groups: an experimental intervention group with conventional rehabilitation training and Arts and Crafts intervention; and an active control group with conventional rehabilitation training only. Forty (40) post-stroke patients with difficulties completing complex activities were recruited. Arts and Crafts intervention consisted of 30-hour sessions spread over 4 weeks. Outcomes included Trail Making Test (TMT-a & b), Stroop Test (ST), Tower of Hanoi (TOH) and Lawton IADL and the two groups were compared at baseline and four weeks after the end of the training. **Results:** There were significant differences in both

the time of completing TMT-a (P<0.01), TMT-b (P<0.05), ST (P<0.05) and errors in TMT-b (P<0.05) between the experimental and the control group after four weeks. There were no significant differences in errors in TMT-a and ST, the time and steps of HOI, and Lawton IADL. **Conclusion:** Therapeutic use of Arts and Crafts could be an effective intervention to improve executive function for stroke survivors.

## Poster #120

**Title**: Ergonomic Management of Upper Extremity Arthritis: A Systematic Review

**Authors:** Samantha Yo & Shawn C. Roll

**Faculty Advisor:** Shawn C. Roll

**Background:** While non-pharmacological treatment may provide short-term relief for those with osteoarthritis, current treatment methods do not adequately address the complex needs of these individuals and the demand for long-term management. Ergonomic interventions may be a viable approach to address these limitations. **Purpose:** To identify existing literature surrounding the implementation of ergonomic interventions for those with upper extremity osteoarthritis. **Methods:** Variations of keywords related to osteoarthritis and ergonomics were searched across four databases (PubMed, CINAHL, PsycINFO, and Web of Science). All available literature before October 2021 was screened by two independent reviewers. **Results:** A total of 3377 abstracts were screened to identify articles that incorporated ergonomic principles applicable to patients with upper extremity osteoarthritis. The implementation of ergonomics was distinguishable into three categories: task-based, contextualized, and lifestyle interventions. Task-based interventions (i.e., general joint protection) were excluded from our analysis because they encompassed current clinical practice and addressed singular needs. Only 17 articles that discussed more complex implementation of ergonomics were included in the final review. Contextualized interventions (n=8) identified specific occupations that benefitted from environmental adjustments (i.e., workplace modifications). Lifestyle interventions (n=9) employed a broad approach that encouraged continued self-maintenance of symptoms and ensured that skills were applicable across multiple occupations. **Conclusion:** Ergonomic interventions expanding upon traditional methods to encompass contextual and environmental barriers, and cultivate a strong sense of self-efficacy, may allow for long-term impact for those living with arthritis. More research focused on the use of ergonomic interventions is necessary to better define and understand the long-term benefits.

## Poster #121

**Title**: Personality and Social Touch in Typically Developing and Autistic Children

**Authors:** Sofronia Ringold, Aditya Jayashankar, Emily Kilroy, Riley McGuire, Christiana Butera, & Lisa Aziz-Zadeh

**Faculty Advisor:** Lisa Aziz-Zadeh

**Background/Purpose:** Research indicates that many factors can impact the experience of social touch. However, one gap in our understanding is the relationship between personality traits and the experience of social touch. The big-five framework is a widely used classification of personality into five dimensions: extraversion, agreeableness, conscientiousness, emotional stability, and openness to experiences. Previous research on Autism Spectrum Disorder (ASD) has shown children with ASD have different personality trait levels compared to typically developing (TD) children which may explain their differences in thinking, feeling, behavior and social perception. **Methods:** 21 TD participants (ages 8-17, mean= 12.09) and 17 participants with ASD (ages 8-16, mean= 12.25) completed the Ten Item Personality Inventory (TIPI) and the Sensory Touch Questionnaire for Youths (STQY). Higher STQY scores indicate more unpleasant feelings towards social touch. Spearman's correlations were used to assess correlations between the measures. **Results:** The ASD group showed significantly lower scores on openness to experiences (p<.001) relative to TD. However, groups did not significantly differ in their experience of social touch. A significant negative correlation was found between openness to experiences and social touch for TD children (□=-.632, p<.01). No significant correlations were found for the ASD group. **Conclusion:** Consistent with previous research, different personality trait levels were seen between groups. In addition, less openness to experiences was correlated with more unpleasant ratings of social touch in TD but not ASD children. These results support the notion that personality traits, specifically openness to experiences, can impact subjective experiences differently in TD and ASD children.

## Poster #122

**Title**: Tailoring Lifestyle Redesign Occupational Therapy to Serve the LatinX Population

**Authors:** Valerie Tapia, Gabby Granados, Elissa Taylor, Daniel Padilla Vega, Elaina Rodriguez Garza, Jesus Diaz, & Beth Pyatak

**Faculty Advisor:** Beth Pyatak

**Background:** The Hispanic/LatinX population has historically higher prevalence and complications with diabetes than the represented majority. Fundamental Cause Theory posits that health disparities are attributed to social determinants.We aimed to better understand factors driving challenges for patients receiving Lifestyle Redesign Occupational Therapy (LR-OT) in a safety-net primary care setting. **Methods:** Pre-post surveys and clinical data from an ongoing LR-OT program were analyzed to examine differences in glycemic control (HbA1c), blood pressure, occupational performance and satisfaction (COPM), and self-reported overall health status (EQ-5D). Correlations were run on clinical outcomes and number of completed visits. **Results:** 75 patients completed the LR-OT program (53.7□11.1 yrs, 59.4% female, 83.3% Latinx, 71.7% Spanish Speaking, 18.2% home insecure, 32.1% food insecure). The 63 patients enrolled for elevated HbA1c on average decreased HbA1c value -1.36% (□2.42%), p<.001. Occupational performance (6.1 to 7.8) and satisfaction (6.2 to 7.9) significantly increased, p<.002 and improvements in performance were associated with more visits (r=0.39, p=0.03). LatinX patients showed marginally significant improvements in overall health status (Cohen's D=0.72, p=0.06), while improvements in SBP were associated with fewer OT visits (r=0.32, p=0.02). **Conclusion:** Among patients who completed our program, main expected outcomes were achieved. A study designed to explore how social determinants impact this population and is necessary to determine in what systematic ways the LR-OT program can be modified to tailor services.

## Poster #123

**Title**: Exmaining occupational competence and temporality in dental hygiene students

**Authors:** Yiyang Fang & Shawn C. Roll

**Faculty Advisor:** Shawn C. Roll

**Background:** Dental hygienists are at high risk of developing work-related injuries. Investigations in hygienists' early working life are important to inform injury prevention. **Purpose:** We aim to examine the development of competence and temporality among dental hygiene students through an occupational

science perspective. **Methods:** This study used data collected from a longitudinal cohort study that followed 108 dental hygiene students for 2 years. At 6-month intervals, participants completed a self-reported survey regarding their perceived competence and comfort level with certain treatment techniques and dental equipment. Additionally, we obtained participants' clinical performance grades on a scale of 0 to 5. Descriptive data analysis was conducted using SPSS® software. **Results:** Particpants' average clinical performance grade increased from 3.0 to 3.6 over their 2-year trainings. The percentage of participants practiced outside of school decreased from 87.0% at 6 months to 25.0% at 24 months. By the end of the study, over 85% of participants reported that they were comfortable most of the time or almost all of the time when performing fulcrum finger and indirect vision. However, 33.3% participants reported that they sometimes caught themselves forgetting to use a fulcrum finger at 24 month and the 5 most common reasons for this included 1) hard-to-reach area, 2) time pressure, 3) fatigue, 4) difficult task or patient, and 5) distraction. **Conclusion:** Despite a steady improvement in competence, dental hygiene students experienced a lack of control over temporality during clinical practice, which interfered with their ability to apply protective techniques.

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Poster #124

**Title**: Establishing a typology of office worker behaviors: A pilot study

**Authors:** Yoko E. Fukumura, Melanie T. Kijel, Gale Lucas, Burcin Becerik-Gerber, & Shawn C. Roll

**Faculty Advisor:** Shawn C. Roll

**Background:** While workers are encouraged to engage in healthy workplace behaviors to avoid risk of occupation-related disorders, effecting long term behavior change is difficult. Understanding how office workers engage in their work is necessary to identify targets for effective behavior change. **Purpose:** Establish a typology of worker behaviors in an office setting. **Methods:** Twenty healthy adults were video recorded while working at a computer for one hour. Using Observer XT (Noldus, Inc), a multi-step coding scheme was used to characterize four behaviors. Body movement was captured as duration of sedentary/dynamic behaviors and shifts in posture. Body positioning within the workspace was coded to contextualize body segment movement. Common behaviors across all participants (i.e., stretching, fidgeting) as well as work and nonwork tasks were coded to understand workspace engagement. **Results:** Time spent in sedentary and dynamic movement ranged from 1-268 seconds (median 7; IQR 3-16 secs) and 1-280 seconds (median 3; IQR 2-5 secs), respectively. The proportion of time spent as sedentary or dynamic was significantly different between participants ($p<0.05$). Across all participants, the upper extremities shifted more often than the trunk or neck. Participants spent the majority of the session with eyes on the workstation and hands on the computer mouse or keyboard. Additionally, participants were observed using their phones, socializing, and reading printed documents. **Conclusion:** This study is the first to characterize office work behavior through observational coding and can provide a foundation for tailoring intervention based on individual behavioral characteristics to facilitate positive behavior change in the workplace.

# FROM THE EDITORS

To our fellow students, faculty, and staff:

It is our honor and privilege to present to you the Fourteenth Edition of *The Explorer* Journal of USC Student Research. In this edition, our talented student authors have brought you to the forefront of some of the innovative and game-changing research being conducted within the numerous programs 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 wonderful discoveries of all our fellow classmates and faculty that are engaged in research and those who continue to make meaningful breakthroughs for our profession. Despite the limitations imposed by the COVID-19 pandemic, we want to recognize the hard work and dedication that our classmates, faculty, and staff demonstrated during this time. Our keynote speakers truly showcase the efforts our community is making towards 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– whether it may be from restorative dentistry to occupational therapy or biokinesiology to name a few, we hope the projects presented in this journal will spark curiosity and interest in pursuing research.

Lastly, we would like 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 curtains in order to host Research day in person and make today a succes. We are also very fortunate to have an amazing group of writers, photographers and leaders in 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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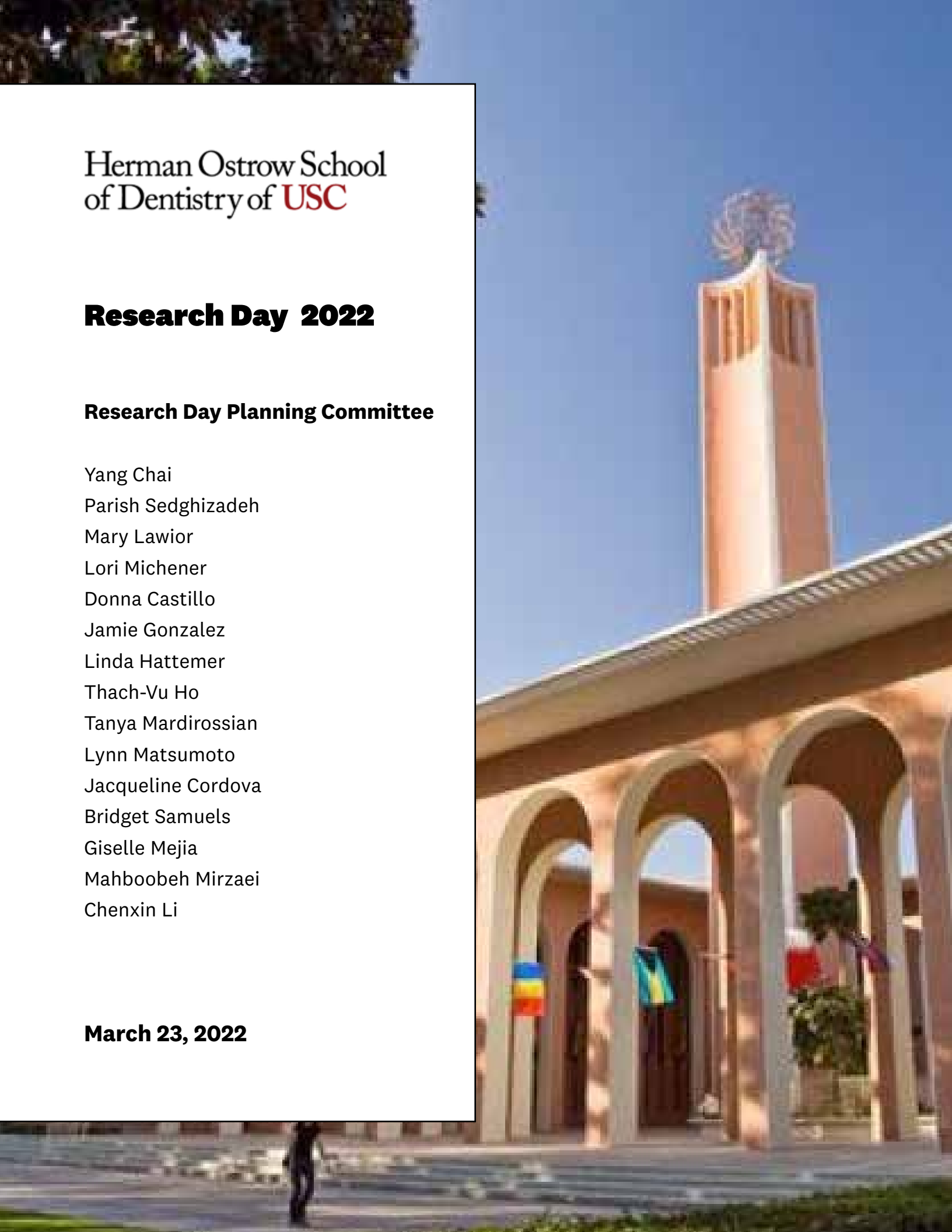

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# Research Day 2022

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