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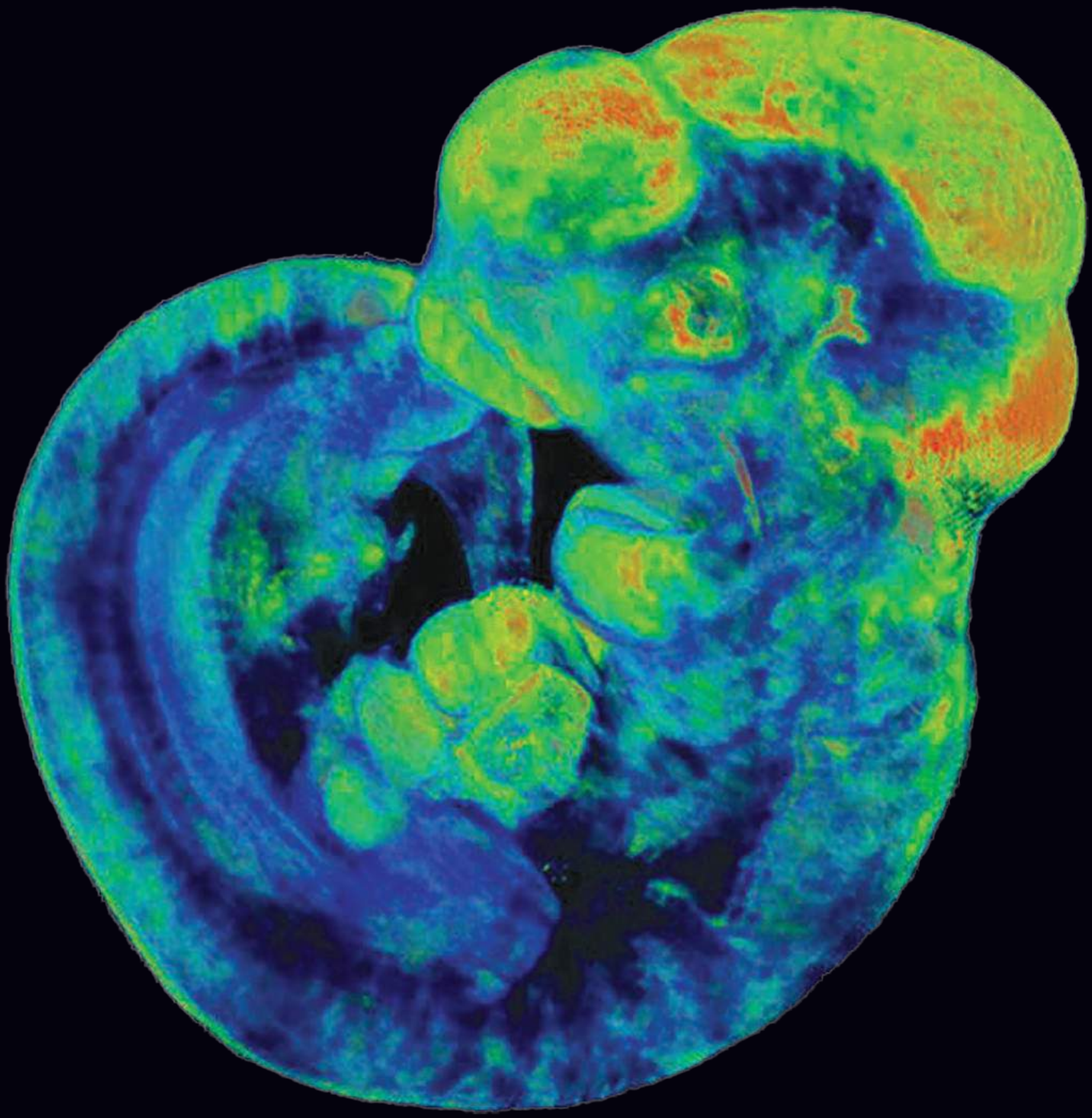

Herman Ostrow School of Dentistry of USC

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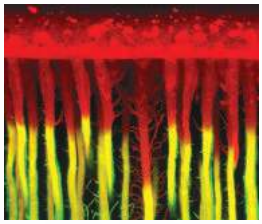
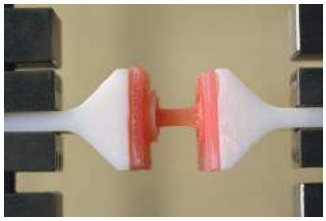

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FROM THE **DEAN**

Dear students and colleagues,

Welcome to Research Day 2018, one of the university's only days devoted exclusively to faculty and student inquiry and discovery.

The importance of conducting research cannot be overstated. Research is the fuel for our profession, launching us into ever-exciting and sometimes unexpected directions. Being successful in our profession will require in you an insatiable thirst for new knowledge. You must constantly consume new research, understand new technologies and be willing to evolve in the way you practice. Participating in Research Day prepares you to do just that and, better still, to be savvy scientific investigators while doing it.

As part of a research-intensive university, we at the Herman Ostrow School of Dentistry of USC take scientific inquiry and discovery very seriously. As many of you might know, Ostrow has consistently been one of the nation's top funded private dental schools by the National Institute of Dental and Craniofacial Research. There's perhaps no greater compliment than to have this national organization, which aims to improve oral, dental and craniofacial health through research, believe so strongly in the work that our researchers do every day.

This commitment to research doesn't stop with dentistry. Our colleagues at both the USC Chan Division of Occupational Science and Occupational Therapy and the USC Division of Biokinesiology and Physical Therapy are also among their professions' top thought leaders. USC Chan is currently home to one of occupational therapy's largest research programs — as determined by federal research dollars — with nearly $10 million in active grants. And this past year, the USC Division of Biokinesiology and Physical Therapy, which has been a No. 1-ranked physical therapy program since 2004 by the U.S. News & World Report, earned more than $4 million in new grant funds to conduct research.

Today, I encourage each of you to not only spend time looking at your colleagues' posters but also spend some time looking at the other professions' research as well. Try to understand what challenges they face and the ways in which they hope to overcome them. This will give you the ultimate leg-up in your careers as health care professions continue their push toward integrated, team-based care. I hope that you walk away from today having learned something new. I know I always do.

Finally, I would like to take a moment to congratulate all our faculty and student researchers. I am incredibly proud of your hard work, dedication and your scientific curiosity. Your ideas today could be tomorrow's next great breakthrough, and that is truly exciting.

Fight On!

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

INTRODUCTION TO RESEARCH DAY

Dear Colleagues,

Welcome to Research Day 2018! This is truly my favorite event of the year, when our entire Herman Ostrow School of Dentistry community comes together, including the students, staff, and faculty in Dentistry, Occupational Science, Occupational Therapy, Biokinesiology, and Physical Therapy.

Excellence in research is one of the University of Southern California's top priorities, and one in which we take the most pride. At the Ostrow School in particular, our students work closely with expert clinical faculty and also have the opportunity to conduct cutting edge laboratory research, which few universities are able to offer in these fields. On Research Day we applaud the students who have taken advantage of this unique benefit, which will serve them well as they become tomorrow's leaders in health science and patient care.

This year we are honored to have Dr. Martha Somerman, DDS, PhD, the Director of the National Institute of Dental and Craniofacial Research (NIDCR), join us for this celebration of research. Much of our research in dentistry and craniofacial biology, as well as our T90/R90 training program for students and postdoctoral scholars, is supported by the NIDCR. The NIDCR is one of the oldest and most venerable of the National Institutes of Health, and has long recognized the importance that oral health care has on a person's overall well-being, and vice versa. USC consistently ranks among the top US research institutions in NIDCR funding, which enriches our academic environment and makes our cutting-edge discoveries possible.

Please join me in congratulating our Ostrow colleagues on their tremendous successes on Research Day. It is clear from all the groundbreaking work being conducted by our students that the future of our professions is bright, and that our tradition of excellence in the health sciences will be well represented by the USC-trained clinicians, researchers, and educators of tomorrow.

Fight on!

FIRST YEAR FORTUNES

NIH Award and Multi-Site Symposium Cap a Prolific Year for Grace Baranek

Mike McNulty, OTD, OTR/L

The past year at the USC Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy was the first for its newly appointed Associate Dean and Chair, Grace Baranek.

Baranek came to USC in early 2017 from the University of North Carolina at Chapel Hill, where she had been a faculty member for 20 years. There she was most recently the Associate Chair for Research in UNC's Department of Allied Health Sciences and a Professor in the Division of Occupational Science and Occupational Therapy.

At USC Chan she succeeds Florence Clark, who served as the Division's administrative leader since 1989, prior to embarking on her retirement in early 2018.

Autism expertise

Baranek is a nationally and internationally recognized expert in the field of autism spectrum disorder (ASD) and related neurodevelopmental disorders — a key area of scholarship for USC Chan. Her research concentrations include the early identification of and intervention for children with ASD, as well as understanding the impact of sensory experiences upon the lived experiences of individuals with ASD. She earned her Bachelor's degree in Occupational Therapy from the University of Illinois at the Medical Center and her Master's and PhD degrees in Psychology from the University of Illinois at Chicago.

In addition to publishing numerous research articles on autism — including one that won the American Occupational Therapy Association's Cordelia Myers American Journal of Occupational Therapy Best Article Award and another that earned her the American Journal of Speech-Language Pathology 2013 Editor's Award — Baranek continues to advance the science behind autism with her interdisciplinary research.

She is co-founder of the Program for Early Autism: Research, Leadership and Service, an interdisciplinary and intermural project between USC Chan and UNC Chapel Hill aiming to develop early assessment and intervention tools for infants at risk for a later diagnosis of ASD. She also served as the principal investigator of the Sensory Experiences Project, a 10-year research grant studying sensory features among children with autism spectrum disorder.

Baranek has been an American Occupational Therapy Association (AOTA) Fellow since 2005, a member of the American Occupational Therapy Foundation's (AOTF) Academy of Research since 2008 and maintains active memberships with the AOTA, the International Society for Autism Research and the International Society for Occupational Science. In 2012 she received the AOTF's A. Jean Ayres Award — one of the profession's premier awards recognizing scholarship in sensory integration and sensory processing — named in honor of the late USC alumna and former faculty member A. Jean Ayres BS '45, MA '54.

Welcome to Troy

To say that Baranek's first year at the helm of the USC Chan Division has been a busy one would be an understatement.

During 2017, she met with the division's many internal and external stakeholders including Dean Avishai Sadan and the senior leaders of the Herman Ostrow School of Dentistry of USC, finalized the following year's budget, and presided over her first commencement and white coat ceremonies. She also traveled to China with the USC Chan China Initiative team and liaised with domestic and international students and guests. She even made it up on the jumbotron screen at the L.A. Coliseum as a "faculty spotlight" during a Trojan football game.

Yet as busy as Baranek's first year at USC has been, it has been just as academically productive. One of the profession's premier experts on the sensory features of children with autism and its impact upon families' everyday life experiences, Baranek's scholarly projects and research agenda have not skipped a beat during her transition to Troy.

In August, the National Institutes of Health (NIH) awarded Baranek a new grant in the role of Principal Investigator, alongside Professor Linda Watson from the University of North Carolina at Chapel Hill's Division of Speech and Hearing Sciences. Officially titled "Evaluation of a Novel Intervention for Infants at Risk for Neurodevelopmental Disorders," the two-year R21 award, totaling more than $400,000, is funded by the NIH Eunice Kennedy Shriver National Institute of Child Health and Human Development. The project will develop and test a new model designed to help parents improve their responsiveness to their infants ages 11-15 months who are at-risk for a later diagnosis of ASD.

In what is known as the "Parents and Infants Engaged" or "PIE" model, a trained coach facilitates parents' observations and interpretations of their child's behaviors, specifically reactions to sensory stimuli and pre-linguistic communication, features of which are typically correlated with ASD. The coach will also collaborate with parents to explore alternative responses and to reflect upon whether or not different responses helped the infants better engage with their environment and with their parents.

The risk of ASD in infants, without known familial risk, cannot be easily detected through biomarker screening. This study will help clarify whether parent responsiveness to infants' sensory regulation and social-communicative development is effective at preventing the cascading effects of atypical neurodevelopment on later adaptive outcomes.

In November, USC Chan hosted the first of what is expected to become an annual meeting of PEARLS experts who are researching early identification of, and interventions for, infants at-risk for a future diagnosis of ASD. At the table were faculty members hailing from USC Chan, the USC Division of Biokinesiology

Photo Courtesy of Nate Jensen.
Grace Baranek, PhD, OTR/L, FAOTA
Associate Dean, Chair and Professor

and Physical Therapy, the USC Viterbi School of Engineering, UNC Chapel Hill and Vanderbilt University, representing the fields of occupational science and occupational therapy, physical therapy and movement science, engineering and computer science, speech and hearing sciences and psychology.

The invited participants convened at USC Chan to discuss their cutting-edge research, potential collaborations and translational projects. Additional experts even video-conferenced into the symposium from destinations as far away as Europe, and because one goal of PEARLS is student training and mentoring, a dozen graduate students from USC and UNC joined the day's discussions.

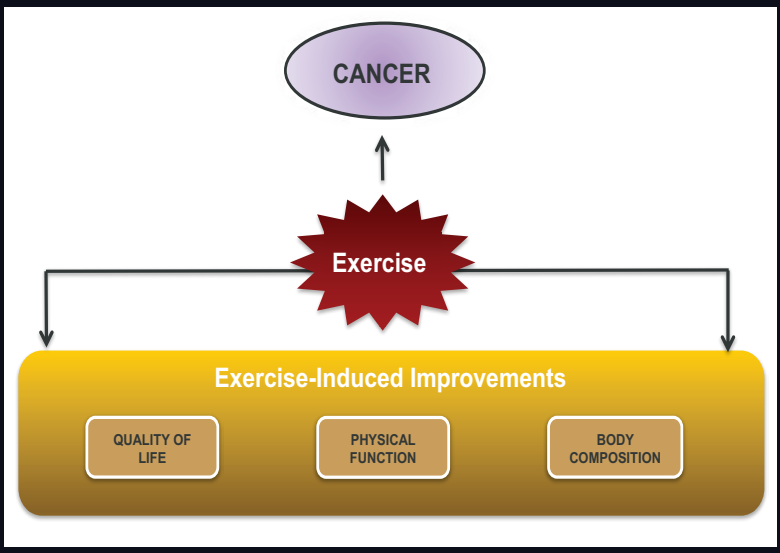
For Baranek, it's all in a day's work, many more of which lie ahead for one of the newest members of the Trojan family.

Exercise Oncology: Progressing Cancer Care with Movement Science

Christina M. Dieli-Conwright, PhD, MPH, FACSM

Exercise physiology often draws attention for its ability to enhance physical performance in recreational and high-level athletes; to rehabilitate cardiovascular, neurologic, or musculoskeletal impairments; and most recently to integrate technology for analyzing human movement. However, the last 20 years has brought a new target on board: cancer, and a specialty now often referred to as exercise oncology. Exercise oncology has emerged as a critical component of cancer care and, in the hopes of many exercise scientists, a fundamental modality in the cancer rehabilitation trajectory. However, to one day establish exercise oncology as a standard of cancer care component, additional research-based evidence is required to support this notion and prove that the benefits of exercise can profoundly improve patient outcomes. The Integrative Center for Oncology Research in Exercise (ICORE), directed by Christina Dieli-Conwright, seeks to support this notion with a mission to conduct innovative research to develop and implement novel exercise intervention approaches to prevent cancer risk, recurrence, and mortality in the support of healthy living for those affected by cancer.

Early on during her pre-doctoral training, Dr. Dieli-Conwright was inspired to utilize her education in clinical exercise physiology to better the lives of those affected by cancer. While her doctoral studies were centered on skeletal muscle physiology and hypertrophic signaling in postmenopausal women, she was exposed to cancer cell experimentation and the impact hormonal treatments can have on those cells. She expanded on this training with a postdoctoral fellowship at the City of Hope where she focused on 1) examining the benefits of exercise on cancer risk using a large epidemiologic patient cohort study and 2) observing the impact of chemotherapy on body composition and cardiometabolic dysregulation in patients with breast cancer. Ultimately her work during the fellowship invigorated her motivation to conduct clinical exercise oncology trials, as her published findings reported women who participated in a lifetime of physical activity were less likely to get certain forms of cancer, and women who had undergone chemotherapy were gaining weight, losing muscle, and developing metabolic syndrome, predisposing them to diabetes and cardiovascular disease.



Exercise-Induced Improvements in Cancer Survivors.
Image courtesy of Christina Dieli-Conwright.

Over the last 25 years, numerous publications support the integration of exercise into daily life for cancer survivors, supporting the notion that exercise is medicine. In fact, the benefits of exercise in cancer survivors are similar to those without a cancer diagnosis. Exercise improves a multitude of physical, psychosocial, and mental health outcomes. These outcomes have been reported in exercise trials for cancer survivors ranging from weeks to months in duration, conducted in supervised and unsupervised settings, community-, home-, clinic-based environments, with varying exercise prescriptions. However, research questions remain to be elucidated that comprise the mission of the USC ICORE research program: Can exercise reduce the comorbid conditions that are often fatal in cancer survivors? Can exercise prevent cancer recurrences in patients at risk for disease mortality?

In recent months, the ICORE has completed a large randomized clinical trial focused on addressing these research questions. With funding from the National Cancer Institute, Dieli-Conwright's team conducted a 16-week supervised aerobic and resistance exercise intervention to attenuate metabolic syndrome among one hundred ethnically-diverse, sedentary, overweight or obese breast cancer survivors who completed cancer treatments within the previous six months. The findings were published in the Journal of Clinical Oncology, one of the most

prestigious cancer journals, and this is the first study to significantly improve all components of metabolic syndrome (visceral adiposity, hyperglycemia, low serum high-density lipoprotein cholesterol, hypertriglyceridemia, and hypertension) with a structured exercise intervention in cancer survivors. Additionally, the intervention attenuated sarcopenic obesity and circulating biomarkers related to insulin resistance. Importantly, this work demonstrates the impact of exercise on cardiometabolic risk factors in a diverse population and supports the implementation of a structured exercise intervention early in the survivorship continuum.

Obese breast cancer survivors have twice the mortality of non-obese breast cancer survivors. Various biologic mechanisms, such as adipose tissue inflammation, linking obesity and cancer prognosis have been proposed to explain this association. Therefore, Dr. Dieli-Conwright's team used a translational science approach in collaboration with the laboratory of Steven D. Mittelman, MD, PhD (Division of Pediatric Endocrinology, Mattel Children's Hospital, UCLA) to examine the effects of exercise on adipose tissue biomarkers related to cancer prognosis, a substudy to the aforementioned exercise trial, funded by the SC-CTSI pilot award program. Recently published in *Breast Cancer Research and Treatment*, they found that a combined aerobic and resistance exercise intervention improved adipose tissue inflammation noted by reductions in adipocyte secretion of pro-inflammatory biomarkers, reductions in M1 insulin resistant macrophages, and increases in M2 insulin sensitive macrophages. Our results demonstrated for the first time that an exercise intervention can alter adipose tissue macrophage profile and release of inflammatory cytokines in adipose tissue in cancer survivors.

The future of ICORE holds much promise for the maturity of the field of exercise oncology research. Namely, the ICORE team will strive to continue to target comorbid conditions and biomarkers of cancer prognosis with exercise alongside collaborations with basic, translational, and clinical researchers both here at USC, at the Norris Comprehensive Cancer Center, nationally, and internationally. ICORE is currently conducting clinical trials targeting cardiometabolic dysregulation in breast, prostate, endometrial, and colorectal cancer survivors, focusing research efforts on eliminating the burden of cardiotoxic chemotherapy on the cardiovascular system with a high-intensity interval aerobic exercise training intervention. This study is being led by Kyuwan Lee (doctoral candidate in the Division of Biokinesiology and Physical Therapy) and funded by the SC-CTSI pilot award program. In addition, ICORE initiated the CARE trial for breast and prostate cancer survivors in Fall 2017, led by Kyuwan Lee, Christina Chow (2017-18 USC Provost's Undergraduate Research Fellowship awardee), Nathalie Sami (Keck medical student), and Kaylie Zapanta (Biokinesiology M.S. student). The CARE study seeks to examine the effects of a novel circuit-based exercise program on cardiometabolic dysregulation. Finally, Dr. Dieli-Conwright hopes to secure funding to execute large clinical trials to examine the effects of exercise on adipose tissue biology linked to poor cancer outcomes in obese cancer survivors and to examine the potential subsequent impact this may have on survival.

Dr. Christina Dieli-Conwright

Exercise oncology research will continue to derive beneficial findings on health outcomes for cancer survivors, building a case for exercise as a standard-of-care rehabilitation modality in the future. The ICORE will utilize existing and new exercise design paradigms to target comorbid conditions and prognostic biomarkers that will not only improve physical fitness but may also prolong survival in cancer survivors. The research team will strive to educate, inform, investigate, and support exercise as medicine for cancer survivors, those at risk for cancer, and all those involved in the cancer healthcare team, making movement science a permanent fixture in the cancer survivorship trajectory to improve survival.

Paving the Path in Craniofacial Research

Neha Desai and Karthika Basireddy

Jianfu Chen, PhD, Assistant Professor at the Center for Craniofacial Molecular Biology

Dr. Jianfu "Jeff" Chen is an Assistant Professor at USC's Center for Craniofacial Molecular Biology (CCMB) within the Herman Ostrow School of Dentistry. He is heavily involved in research related to pediatric brain disorders and neurodegeneration. Dr. Chen has a Bachelor's degree in Microbiology from China Agricultural University. Following that he moved to Kansas to further his studies in plant pathology. However, he faced some challenges when his Principal Investigator moved back to China from Kansas. He still managed to complete his Master's degree in plant pathology. While in Kansas, he did a lot of research in different areas of the field. He was always fascinated by interactions of microorganisms and plants and considered such interactions "cool." Dr. Chen then enrolled in a PhD program at the University of North Carolina at Chapel Hill (UNC). While at UNC, he had the opportunity to work on cardiovascular research involving muscle mechanisms of the heart and associated conditions like cardiomyopathy and hypertrophy. He enjoyed this research and was planning to stay in the cardiovascular field, but his PhD committee advised him to work in neuroscience. He followed the committee's recommendation and it proved very fruitful. After completing his PhD in cell and developmental biology, Dr. Chen moved to University of Georgia for his post-doctoral studies. He continued his work in neuroscience, developmental disorders, and craniofacial birth defects. Dr. Chen was always intrigued by the fact that many neural disorders, including those in pediatric patients, are associated with bone problems like fragility and weakness. He continued pursuing the question of why these problems co-occur while finishing his studies.

Dr. Chen was recently recruited to join the faculty at USC and brought a team of researchers with him from Georgia. He mentioned that CCMB has a very strong reputation in the research field and things work differently here than they do at many other places. His current research is related to craniofacial and skeletal biology. He happily noted that there is a strong environment for this kind of research at USC, and therefore there is a lot of potential to collaborate and accomplish things. His lab currently has four post doctoral scholars and two graduate students. The primary source of funding for his research at USC is through the National Institutes of Health (NIH). Dr. Chen feels that applying for funding is challenging. Funding and grants these days have become competitive. However, he understands its importance and constantly applies with strong applications for funding. Dr. Chen explained the challenges researchers face while obtaining grants:

> NIH grants are high-profile and based on your previous research work, success of your past projects, literature available about your work, and many different factors. Once you submit your proposal, experts from the field at the grant governing body assess it and decide whether you are eligible to receive the grant.

According to Dr. Chen, collaboration is very important. The biomedical field is vast and there are many different things to know. There are many experts with different skill sets and therefore it is virtually impossible for one person to know everything about a given topic. Thus, it becomes important to collaborate with others with different areas of expertise that are complementary. Currently, he collaborates with researchers from the University of Georgia, University of Miami, Georgetown University in Washington, and many other premier institutes.

For Dr. Chen, research is very near and dear to his heart. He feels happy to do something that has never been done before by anyone. For him, research should be novel. He also enjoys working with different individuals and teaching students. He believes in guiding students and letting them do things on their own, since he is of the opinion that students who do things on their own learn better. He stresses rational reasoning and critical thinking, and firmly believes that good research skills can be useful not only in academic and research fields, but also in marketing and business. Dr. Chen always wants his students to grow and become respected scientists.

He sometimes finds it challenging to create a work-life balance, but he makes sure he comes to work early so he can be home with his three- and seven-year-old daughters and wife for dinner. Dr. Chen tries to avoid taking work assignments home. He isn't fond of cell phones and sometimes forgets to check emails while focusing on his work. The important reason behind this, he says, is his demanding research. He emphasizes that in research, you need to be 100% focused, which may keep you away from other things.

Dr. Chen's regular day is pretty well-planned with fixed daily objectives. He always has his planning done in advance so that he can start working as soon as he enters his lab in the morning. This helps him stay on top of the deadlines that are inherent to presenting at scientific conferences and publishing work in peer-reviewed journals.

Dr. Chen has a great armamentarium for his research and his lab is well-equipped with many high-tech devices and many different instruments, in addition to the shared resources available to all the investigators at CCMB. His research makes use of a wide range of techniques for studying different aspects of the developing brain and bone, used capably by his highly trained staff.

Currently, Dr. Chen is enjoying his new tenure-track position at USC. He has past experience teaching undergraduate students at the University of Georgia and looks forward to teaching at USC as well. In the next five years, he wants to further develop research into pediatric neurological disorders. His team is trying to understand intellectual disability and the reason why a smaller brain can lead to this problem, wich may also shed light on neurodegenerative conditions such as amyotrophic lateral sclerosis (ALS or Lou Gehrig's disease) and frontotemporal dementia, which are two related diseases on which he has published. One vein of this research focuses on microcephaly associated with exposure to Zika virus *in utero*. Dr. Chen is interested in working with undergraduate and graduate students, and encourages those who are interested to email him concering the availability of positions in his lab. Dr. Chen is conducting groundbreaking research in the field of craniofacial biology and hopes to create a significant impact on society through his ongoing work.

Forging Ahead in The Biomedical Sciences

Lomesh Popat and Sara Kahng

Dr. Jian Xu is an Assistant Professor in the USC Division of Biomedical Sciences and USC Center for Craniofacial Molecular Biology at the Herman Ostrow School of Dentistry. Dr. Xu's enthusiasm for research first started at Peking University, where she completed her undergraduate degree in Pharmacology. She started looking at the anticancer effect of chemicals that were extracted from natural compounds. After that she pursued her PhD at Cincinnati Children's Hospital in Ohio, focusing on heart failure and the molecular mechanisms that regulate heart function. This research led to her interest in the TGF-β and BMP pathways, which became central topics of much of her future studies. After receiving her Ph.D, she joined a lab at UCSF for her post-doctoral research.

Dr. Xu is involved with numerous research projects emphasizing the TGF-β and BMP pathways, which involve a large family of growth factors that induce signaling, but the signaling effects are very different in different cell types. Her research includes studies of the regulation of development and injury repair, in both the craniofacial and cardiac fields. While these two areas may seem disparate, they develop from largely the same tissue types and rely on overlapping arrays of signaling molecules. In addition, her research studies immune responses involving the interaction of different cell types and the regulation of the progression or resolution of inflammation.

Orthodontics

Another exciting topic examines the TGF-β and BMP signaling pathways and their roles in tooth movement as well as in response to infrared laser light, which is one of the methods used to expedite tooth movement. Her lab developed mouse models to mimic human orthodontic treatment with braces and brackets to move teeth. However, Dr. Xu admits there are a few challenges with this model as they are still in the process of optimizing the surgical procedures.

While still in clinical trials, infrared lasers have shown to move teeth 20-50% faster during orthodontic treatment. Expedited movement is also very beneficial for patients who suffer from alveolar bone loss due to disease or trauma, since treatment is difficult when there is a lack of sufficient tissue to support the desired tooth movement. During her research, it was discovered that controlling certain signaling pathways can be used to dramatically enhance tooth movement at a compression site. By utilizing inhibitors and activators of the pathway, Dr. Xu and her team are trying to manipulate the movement of teeth. To further her research, Dr. Xu is currently investigating whether the infrared laser light induces a stress response, leading to promotion of bone movement, as well as signaling activation in the periodontal cell types to promote the deposition of new bone. Essentially, the goal of the project is to ensure bone quality while enhancing the speed of the tooth movement process.

Arginine Methylation

In addition, Dr. Xu is studying arginine methylation and the regulation of cell fate decisions in periodontal inflammation. Prmt1 is the predominant enzyme that performs arginine methylation in mammalian cells and it regulates the TGF-β and BMP pathways. TGF-β has been shown to exert a significant effect on periodontitis. Dr. Xu found that deleting the Prmt1 enzyme shuts down the anti-inflammatory pathway while promoting the pro-inflammatory pathway, ultimately exacerbating the periodontitis. When asked about future research applications, Dr. Xu states, "we want to embed either the enzyme or methylated substrate in hydrogel and test whether these loaded hydrogels can ameliorate periodontitis; and of course, eventually generate a reagent that can be applied to human patients to help periodontitis treatment."

Craniofacial Development

Dr. Xu's research on Prmt1 also has implications for our understanding of craniofacial development. Dr. Xu's group deleted Prmt1 in all the neural crest-derived cells, which are cells that contribute to the majority of the craniofacial skeleton, including the facial bones and anterior skull. Dr. Xu states:

When we deleted Prmt1, we saw phenotypes in two parts: one is the cleft palate–complete cleft palate in all of the mice that lost Prmt1. When we looked into this further, we found that it regulates multiple signaling pathways, including predominantly the BMP pathway. It dramatically reduces the BMP downstream signaling so that it decreases the palatal mesenchymal cell proliferation. During palate development, the palate has to grow forward to reach the midline, then the midline disappears and the palate seals to become the palate. But the mutated cells do not proliferate to grow enough and never reach the midline. These baby mice have a complete cleft palate and they are unable to suckle milk, so they die on the first day. If you look at their stomachs, there is no milk. That is one of the phenotypes. Also, the maxilla and frontal bone are all derived from the neural crest cells. We found very specific defects in these bones. In some bones like the pre-maxilla there are minor defects. But in the frontal bones the sutures become super wide. The mandible and maxilla shorten. This is similar to one of the BMP downstream factor mutations. That also suggests it is mainly going through the BMP pathway. These are two aspects of craniofacial development we studied.

Expanding upon her research on Prmt1, Dr. Xu and her lab address how genes regulate susceptibility to environmental stress. It was discovered that mice with only one functional copy of the *Prmt1* gene had a greater occurrence of cleft palate under such conditions, while normal control mice were protected from the environment pollutant-induced cleft palate. However, mice with complete loss of the protein uniformly developed cleft palate, even without any environmental stimulus. This finding suggests that partial loss of the *Prmt1* gene results in greater sensitivity to cleft palate from environmental stress. When asked about her the implications of this study, Dr. Xu explained:

> This is relevant in human populations because it is also known that people from different genetic backgrounds have different susceptibility to environmental stress, smoking, alcohol consumption or environmental pollutants. Especially in the Central California region there is a part heavily influenced by pollution.

Future Research

When asked about the direction of her future research, Dr. Xu stated:

> When I started, the question was mainly derived from the mechanism point of view. I wanted to understand how signaling—BMP signaling or arginine methylation—regulate cell fate decision: whether cells decide to proliferate or die; whether epithelial cells decide to become mesenchymal or remain epithelial. After three years, the questions now focus on how periodontal disease occurs, how does it resolve, and how can we manipulate it to stop an occurrence or help resolving it. Also, for the orthodontic movement, how can we understand it better so we can help it to go faster without compromising the bone quality? I think the future goal of my group is disease-oriented. At Peking University, I was trained in the medical school environment, so I appreciate the clinical significance of medical research early on. Now I want to bring my attention back to the clinical significance, so our findings can benefit patients and clinical practices faster.

Jian Xu, PhD, Assistant Professor in the USC Center for Craniofacial Molecular Biology.

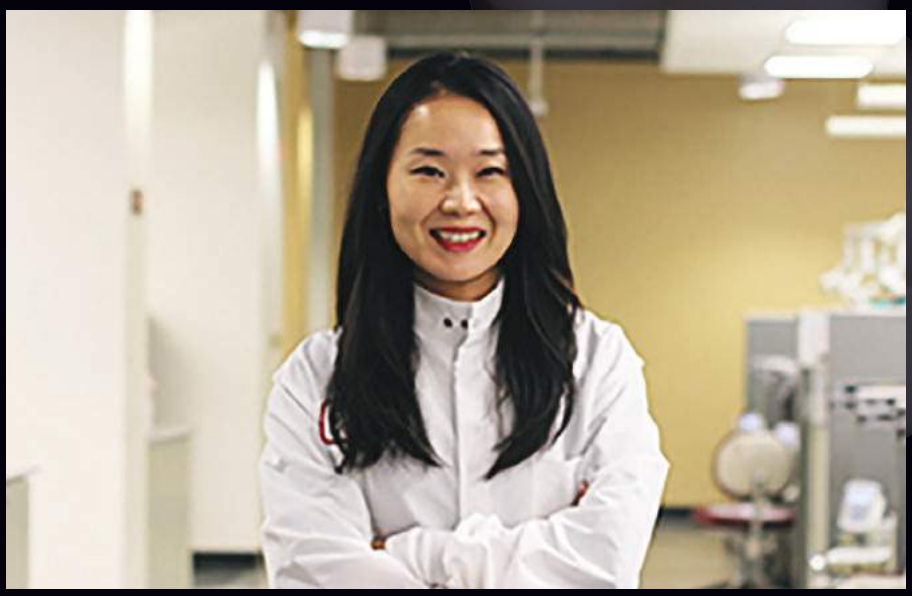
The *Art & Science* of *Dental Materials*

Paulomi Salvi and Tarang Patel

Dr. Cheryl Park earned a B.A. degree in Biological and Biomedical Sciences with a minor in Business at the University of Southern California before pursuing a dental degree in 2013 at the Herman Ostrow School of Dentistry of USC. Her motivation to become a dentist came through observing at an oral surgeon's and a general practitioner's dental office. She enjoyed the patient relationship factor and realized that unlike in medicine, in dentistry she can treat a patient in one session, starting from data collection through diagnosis, treatment, and seeing the final outcome. Following completion of her DDS, she completed her residency in the Department of Prosthodontics at USC in 2016. Dr. Park always wanted to teach and pursue a career in academics as well as work in private practice. As an Assistant Professor, she teaches pre-clinical curriculum to students in the Advanced Standing Program for International Dentists (ASPID) in the summer and to the DDS class for the rest of the year. On the clinic floor she enjoys working with students on everything in prosthodontics, including implants and fixed and removable work. She is now part of the new digital denture workflow and the in-house milling system for zirconia restorations.

Dr. Park's biggest draw to research has been her curiosity. "If there was a fact, I was questioning how that fact came to be. If you want to question something," she suggests, "find the references and the original study that tested it. It is interesting in that, to test the hypothesis or fact, you have to simplify the method of research, and no research is truly testing out the reality. Research needs to be simplified first to isolate the problem, which made me think about the importance of design of the study." Dr. Park's interest in research grew through first-hand experience at the Center for Craniofacial Molecular Biology at USC (CCMB) and during her DDS program. She recommends that students visit CCMB to further their research interests in biomedical sciences. During the 2009 Summer Research Fellowship Program at CCMB, she was part of Dr. Anh Le's lab team conducting a study on oral mucositis. Oral mucositis is a serious side effect of the radiation and chemotherapy the cancer patients undergo. Thus, they experimented with inducing oral mucositis in mice and giving them stem cell therapy to see if it could mitigate the disease. During that summer, she also learned laboratory techniques including genotyping, Western blotting, how to work with animals, and different types of tissue staining.

As Dr. Park stepped into dentistry and her subsequent residency, her interest in dental materials developed and she worked on two projects with Dr. Winston Chee, her guide from her prosthodontics residency. The first study was designed to evaluate the resistance to fracture of different thicknesses of zirconia luted to implant components. At the time, there was a lack of information regarding the optimal wall thickness of zirconia surrounding implant components. Few controlled laboratory studies had taken this specific factor into account. Considering the average human bite force, this study suggested keeping a thickness of 0.5 mm to 1 mm of this particular type of zirconia around the implant cylinder to avoid fracture due to stress. Dr. Park's research work with Dr. Phark and Dr. Chee, "Evaluation of Fracture Resistance of Varying Thicknesses of Zirconia Around Implant Abutment Cylinders" was



Dr. Cheryl Park, DDS, Assistant Professor of Clinical Dentistry.

Photo Courtesy of Dr. Cheryl Park.

published in the *Journal of Oral Implantology*.

As a result of this study, Dr. Park is comfortable using zirconia on implants but warns that its use also depends on varying factors, since all zirconia materials that have been tested are opaque and monolithic. While multilayered materials lead to improved aesthetics, they have not been as widely tested for their fracture strength as compared to fully opaque zirconia.

In another collaboration with Dr. Chee, Dr. Park evaluated the adhesion strength of soft liner materials to a 3D-printed denture base material. Soft liner adhesion to conventional heat-polymerized denture materials has been well researched in the past. However, the adhesion of soft liners to new 3D-printed denture materials is still largely unknown. The aim of this study was to therefore evaluate the adhesion strength of liners. Results of this study confirmed that silicone and acrylate soft liner materials seems to have comparable adhesion strength to the conventional PMMA and 3D-printed material. Of the two companies currently producing soft liners for 3D-printed dentures, Dentca and Pala from Kluzer, Dr. Park has been working exclusively on the material made available by Dentca.

Dr. Park also worked with Dr. Tae Kim to assess the efficacy of 3D tooth arrangement software as an educational tool. In the rapidly developing field of digital dentistry, CAD/CAM systems have been implemented in removable prosthodontics. Recently, novel CAD software allowing digital tooth arrangement has been developed by Dentca. The aim of this study was to assess the efficacy of this software as an educational tool. CAD toth arrangement software has the potential to be used as an educational tool by students to learn how to successfully arrange denture teeth in the correct positions.

Dr. Park's primary area of research currently includes a project with prosthodontic resident, Dr. Jihey (Jennifer) Jeong, Dr. Jin-Ho Phark, and Dr. Winston Chee. In this study, they artificially age zirconia and test its resistance to fracture in order to determine whether the aging process affects the zirconia implant restoration. Dr. Park gave insights into how they simulate wear on restorations in the lab to resemble aged zirconia. This is done mainly by autoclaving the restorations at different pressures for variable time periods. The results of this study will affect fabrication and handling of zirconia restorations in the lab and give rise to the possibility of testing whether grinding of zirconia restorations by dentists affects the strength of the zirconia. Clinical guidelines can then be formulated based on the results of this study.

Among the challenges Dr. Park has faced in research, she feels the biggest obstacles are obtaining funding and being able to devote sufficient time to research. Though research has posed its fair share of challenges, she finds that answering scientific questions and working with others while bringing their expertise to the fore are the most rewarding aspects of research. Regarding feedback she received on her research, she notes that zirconia is being used with increasing frequency, and specifically since it's being used increasingly on implants, she has reeived support from all quarters, and there has been no criticism so farregarding the results of the study. Unlike the proverbial researcher who shouts "Eureka!"at the moment of discovery, she doesn't recollect having an "aha" moment in the lab, as most of the projects she has been working on were carefully developed from a well-supported hypothesis to produce results. But the one moment that does stand out for her occurred in Dr. Phark's lab for while testing the fracture resistance of different samples of zirconia, when machines failed to break the thicker zirconia.

Dr. Park is grateful to have worked with outstanding mentors and colleagues. She encourages students who are interested in research to start early and talk to faculty to find a mentor. She also advises students to get in touch with faculty at both the Herman Ostrow School of Dentistry and CCMB to learn more about research opportunities in biotechnology as well as material sciences. She is eager to help students interested in pursuing research in biomaterial sciences and emphasizes that students should build a good resume to further their research career. She signed off by saying she found great research mentors at USC, which provides the perfect culture for cultivating a successful career in research.

The Science of Bonding

Amrita Chakraborty and Amro Albaghdadi

William Channing famously said, "No power in society, no hardship in your condition can depress you, keep you down, in knowledge, power, influence, but by your own consent." Dr. Neimar Sartori's life is a testament to overcoming hardships and achieving success in spite of adversity. He was born in the small Brazilian city of São José de Cedro, near the Argentinian border, and at the age of two he moved with his family to the forests of the Amazon. Living without the comforts of electricity or running water in the middle of the forest, and without any formal education, Dr. Sartori learned to live off the land at an early age. Coming from a family of farmers, it was quite unprecedented and yet highly appreciated when Dr. Sartori showed an inclination towards the health sciences. His parents wanted him to get a higher education and he entered school formally at the age of nine when his family moved back to the city.

As a child, Dr. Sartori spent hours developing his hand skills through drawing and helping his mother with tailoring. He always enjoyed the practical aspects of kinaesthetic learning. His life away from regular civilization with poor access to healthcare made him appreciate the importance of accessible healthcare for all. With his desire to be involved in the field of healthcare and his excellent hand skills, it was not surprising that he decided to make dentistry his profession.

During his years as a dental student in Brazil, he was interested in both the clinical aspects and the potential of research to developing biomaterials for dentistry. Dr. Sartori thoroughly enjoyed his five years at dental school learning the art of dentistry. However, he always felt his knowledge was lacking, with emphasis only on theoretical and practical dentistry. To further improve his knowledge in the field of research, he spent six years studying biomaterial science and its application in the field of dentistry.

Bonding has been a recurring theme of many of Dr. Sartori's research papers. His thesis, presented for the completion of his MS degree in Restorative Sciences, was titled "Clinical effectiveness of a potassium oxalate-based desensitizing agent used in association with two single-bottle etch-and-rinse adhesives on clinical performance and post-operative sensitivity in non-carious Class V restorations. " This study was one of his first forays into the field of bonding agents and specifically investigating bonding to enamel as well as dentin. The research explored the effect of desensitizing agents on the efficacy of bonding with single-bottle etch and rinse adhesives. His PhD thesis, "Long-term efficacy of ethanol-wet bonding under simulated pulpal pressure," also involved understanding and optimizing bonding to hydrophilic surfaces like dentin. The philosophy behind this study was to replace water in the dentin with ethanol. Drying of dentin causes the collapse of the collagen fibrils, thus preventing bonding. Ethanol, if used to replace the lost water, will prevent collapse of the collagen fibrils while also causing their shrinkage. This shrinkage helps to increase the inter-fibrillar space, thus improving the flow of the bonding agent. Better flow of the bonding agent improves bonding, and ensures longer retention of the restorative material.

Dentinal enzymatic activity has long been understood to hinder good bonding, and Dr. Sartori recently worked on new approaches to inhibiting the enzymatic activity using EDC or Carbodimide. The results of the study, published recently in the *Journal of Dental Research*, are promising: the use of EDC for both self-etch as well as etch-and-rinse approaches resulted in the reduction of matrix-bound collagenolytic enzymatic activities.

Clinical translation of his research into bonding has always been a primary focus for Dr. Sartori. With zirconia becoming one of the ground-breaking materials now being used in our field, he is currently working on improving the bonding of zirconia to dentin and enamel. The aim of his research is to enable the minimal reduction of tooth structure while ensuring that a zirconia restoration can withstand masticatory forces. The only way to make this possible is to ensure there is a strong bond between the zirconia and the remaining tooth structure. With improved bonding, the use of either monolithic or layered zirconia as a veneer with minimal tooth reduction is a possibility.

The strongest motivation for Dr. Sartori to complete his PhD was his love

for teaching. He strongly believes in spreading his love for research and restorative dentistry to young dentists. Towards this end, he was an Associate Professor at his alma mater, the University of Southern Santa Catarina at Tubarão, SC, Brazil, in the Department of Restorative Dentistry, Division of Operative Dentistry. He has continued to educate budding dentists in the US as Associate Professor in Restorative Sciences at the Herman Ostrow School of Dentistry of USC.

One of the biggest challenges Dr. Sartori faced both academically and personally was his decision to move to the US in order to complete part of his PhD. Though he was a visiting scholar at the Herman Ostrow School of Dentistry of USC, and the School of Dental Medicine at Case Western Reserve University in Cleveland, his permanent move to the US was difficult. However, the city of Los Angeles is now home to Dr. Sartori and his wife, who is also a practicing dentist.

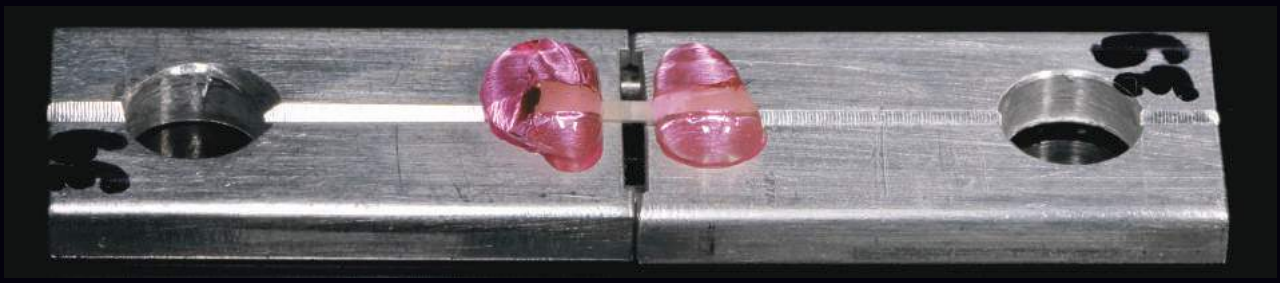
Having always been interested in expanding the horizons of his education, Dr. Sartori invested his time training with CEREC, which has been at the forefront of dentistry's steps in CAD-CAM engineering. He has also learned histological techniques for research and teaching activities, as well undergoing training in electron microscopy in Brazil.

Dr. Sartori maintains collaborations with researchers from all over the world. In light of his international stature, Dr. Sartori was named Associate Editor of the *Brazilian Journal of Health Research* and *Quintessence of Dental Technology*. He is also a scientific reviewer for the *Journal of Dentistry, Journal of California Dental Association, Acta Biomaterialia Odontologica Scandinavica, European Journal of Dentistry* and many other high-impact journals.

Dr. Neimar Sartori, DDS, PhD, Associate Clinical Professor

Dr. Sartori strongly believes the future of dentistry is not just about better biomaterials, which restore tooth structure along with aesthetics, but in better understanding the genetic aspects of tooth development and eruption. Stem cells have been making waves in dentistry, with the regenerative potential of the pulp being studied extensively worldwide. Biomimetic dentistry, bioregenerative dentistry, and aesthetic dentistry working together would be an ideal future for the dental world.

Great educators motivate and ignite imagination while instilling a love for learning. Dr. Sartori hopes to achieve this by inspiring greater development in the future of dentistry, both through his teaching and his research into the complexities of biomaterials.



Microtensile bonding strength testing device. It is used for testing the micro-tensile bonding strength between the restorative materials and the hard dental tissues. Image courtesy of Dr. Neimar Sartori.

Community Oral Health Training and the *Professional Pipeline Connector Program*

Susan Park and Romina Sadreshkevary

The term "community health" refers to a branch of clinical science that focuses on the maintenance, protection, and improvement of the health status of a group or community. It encompasses a wide range of social and medical disciplines, taking into account a number of factors, including socio-economic status, environmental factors, and health/clinical aspects of individuals in a community. Through integrating this wide range of genres, the purpose of community health programs is to improve communication and even the infrastructure of a community in order to improve access to basic health services including dental care. As such, a critical element in promoting community health involves training healthcare professionals in efficient communication and implementation of programs in a community.

To learn more about community oral health efforts being pioneered at USC, we interviewed Herman Ostrow School of Dentistry Professors Mariela Padilla and Joyce Sumi, who are on the faculty of the Department of Oral Pathology and the Dental Hygiene program, respectively. They are two of the key faculty members in developing a multi-disciplinary program called the Community Oral Health Training and Professional Pipeline Connector. During the interview, we had opportunities to learn more about community health programs in Los Angeles and USC's role in improving access to healthcare in local communities, as well as the professors' paths to where they are today.

Since 1965, USC has been involved in various community programs that promote public health. While there have been many programs that teach the basic principles of community health to students, until recently there had yet to be a multi-disciplinary program allowing students and professors from various disciplines to develop and implement oral healthcare programs. In order to address such needs, the Community Oral Health Training and Professional Pipeline Connector Program was initially proposed by Dr. Roseann Mulligan, Associate Dean of Community Health Programs and Hospital Affairs at the Herman Ostrow School of Dentistry of USC. The Pipeline Connector is an interdisciplinary program designed with the objective of reducing oral disease and advancing overall health through increasing access to health care and improving the prevention and management of oral disease across the lifespan.

In further developing the Pipeline Connector Program, faculty members and professionals from various healthcare programs, including social work, dentistry, and dental hygiene, were invited to develop multi-disciplinary programs. Professor Mariela Padilla and Professor Joyce Sumi were asked to join these efforts due to their years of experience educating students, conducting various research studies on oral health improvements, and implementing various oral health programs in their professional fields. Currently, the Pipeline Connector Program is still in the developmental phases. During the interview, however, we had an opportunity to learn more about the objectives and general structure of the program.

In order to maximize the students' learning experience in this program, the Pipeline Connector Program has three strategies, which include: (i) establishing and developing partnerships with community health organizations serving vulnerable populations, which can provide students with practicum opportunities and post-graduation service placements; (ii) providing a toolkit of resources that will assist current students and dental providers in caring for the oral health of patients in underserved areas; and (iii) creating a virtual/online learning environment to promote communication, problem-solving skills ,and values development with applicability to real world situations.

Traditionally, in many health professional programs, students spend the majority of their time on developing their clinical skills through interacting with their patients. Due to an increasing diversity in the age, cultural, and socio-economic profiles of people in many communities across North America, there is an increasing emphasis in many educational institutions on multidisciplinary healthcare practice. As such, there is an increasing awareness by many healthcare professional students of the growing need for interprofessional communication; however, students often lack sufficient exposure to such opportunities. For this reason, the Pipeline Connector Program encourages students to engage in interprofessional collaboration through developing and implementing interactive community projects. During their involvement in various community projects, students can learn more about the scope and expertise of each others' professions and about the health-related challenges that members of the community face on a daily basis; a better understanding of the community allows students to empathize with other healthcare professionals as well as with vulnerable and underserved community members, which can significantly help the students in establishing long-term relationships with the partnering communities as well as with each other.

Furthermore, the online component of the Pipeline Connector Program confers many advantages to students. According to Professor Padilla and Professor Sumi, the online lecture and 10 fully developed interactive case-based webinars encourage students to become proficient in the theoretical aspects of community healthcare as well as in the application of the theory. The online component was designed to provide more flexibility to the students' schedule and maximize the time spent on achieving hands-on skills. With this great flexibility, the online program also allows people from a wide range of professional backgrounds with interest in developing a career in community health (as providers, educators, or administrators) to participate at their own pace. In order to encourage more student and professional participation, the Pipeline Connector Program aims to provide a robust and dynamic online portal to provide up-to-date placement opportunities at clinics with loan repayment/forgiveness eligibility.

Fortunately for USC students, Los Angeles provides a diverse student body and so-

cio-culturally diverse communities in the vicinity. By providing the opportunity to engage with the local community through collaboration with other healthcare professionals, the program aims to enrich the educational experiences for students during their time at USC.

During our interview with Professor Padilla and Professor Sumi on their latest in-progress project, the Community Oral Health Training and Professional Pipeline Connector, we also had opportunities to learn more about their career paths, philosophies, and experiences as faculty members at the Herman Ostrow School of Dentistry of USC. While there were some overlaps in their general philosophies and teaching styles, their approaches to promoting success to students reflect their unique career paths.

Professor Mariela Padilla currently serves as Assistant Professor of Clinical Dentistry and Assistant Director of Distance Education Programs on the faculty of Orofacial Pain and Oral Medicine. Professor Joyce Sumi is Assistant Professor of Clinical Dentistry on the faculty of Dental Hygiene, and graduated from the University of Southern California with a Bachelor of Science in Dental Hygiene. After graduation, she worked in private practice for 10 years until she completed a Master of Science in Dental Hygiene program at the University of California San Francisco. Professor Sumi published several research articles that investigated the impact of pathogenic viruses on the immune response of children. Currently, Professor Sumi splits her time between teaching advanced classes and supervising students in Dental Hygiene at USC and in private practice.

When it comes to their teaching philosophies, both professors mentioned that their main objective as an instructor involves guiding students to master the course materials and develop a more comprehensive understanding of their profession. However, their approaches to helping students succeed slightly differ. Professor Padilla, who has years of experience in academia and in administration, emphasizes that every student learns differently. In order to help students master course content, she introduces various learning resources, including textbooks, hands-on clinical experiences, and online lectures that incorporate theory and interactive cases. By doing so, Professor Padilla hopes that students can identify with the learning method that best resonates with them and internalize the material through repeated exposure.

Professor Sumi, who has years of experience in academia and in clinic, understands that there are often discrepancies between theory and clinical practice. In order to bridge the gap between the two areas and encourage students to succeed, Professor Sumi encourages students to pursue as many opportunities as they can during their time in school. At the same time, Professor Sumi encourages students to learn from various challenges that they encounter and incorporate their experiences into their future practice. Overall, the professors' teaching philosophies and teaching styles provided a better understanding of why they are so enthusiastic about creating the Pipeline Connector Program.

When it comes to their favorite parts of their jobs and those they find to be the most challenging, their responses reflected experiences with their students. Both professors mentioned that the best part about their jobs involves when they are able to inspire, guide, and motivate students towards achieving their goals. Both professors agreed that fulfilling moments involve when students persist in the learning process, actively communicate with the professors, and fully master the course contents. To quote Professor Sumi, "the best part about being an instructor is when students have the 'aha' moment."

For both professors, challenging moments involve students losing confidence in their abilities. When students face challenges in the clinic or in class, some become too intimidated to explore and overcome obstacles due to fear of failure. As instructors, both professors recognize that they can make a big difference to students' experiences in their class. In order to encourage students, both instructors provide lots of constructive feedback, share their life experiences, and encourage students not to fear challenges until students gain more confidence. Thanks to their support through the years, they have fostered many students who went on to become active leaders in their communities.

Dental school can be a life-changing experience for many students. As future healthcare professionals, students are exposed to hours of rigorous lectures and clinical work. While students eventually achieve mastery of the course materials and gain big-picture understanding of their professions, students also encounter many challenges that could undermine their confidence during the course of their training. Fortunately for students at the Herman Ostrow School of Dentistry, there are amazing faculty members like Professor Padilla and Professor Sumi, who continue to motivate and encourage students to achieve their goals by sharing their expertise. With their contributions to the Pipeline Connector Program, students can look forward to a more enriching experience here at the University of Southern California.

Professors Mariela Padilla and Joyce Sumi, faculty of the Department of Oral Pathology and the Dental Hygiene program, respectively.

Improving Oral Diagnoses through "DDS Detective"

Susan Park

Dr. Mariela Padilla

Assistant Professor of Clinical Dentistry and Assistant Director of Distance Education Programs on the faculty of Orofacial Pain and Oral Medicine (OFPOM), graduated with a DDS from the University of Costa Rica (UCR) in 1989. In 1990, she became a full-time professor in Diagnostic Sciences and Orofacial Pain at UCR and at Latina Universidad. She completed her residency program in Orofacial Pain at UCLA in 1998 and obtained her Master's degree in Education and Curriculum Design in 2005. From 2005 until 2016, she served as Dean of the Latin American University of Science and Technology's School of Dentistry and was part of the Academic Board.

Oral medicine involves the diagnosis and management of medical conditions that affect the oral and maxillofacial region. At the Herman Ostrow School of Dentistry, the faculty of OFPOM provide evidence-based, comprehensive education, and treatment of oral disease and oral pain, such as chronic headaches, tooth grinding, jaw disorders, breathing issues, and oral diseases. Since joining the Ostrow School in 2016, Dr. Padilla has been involved in various activities from treating patients, to conducting scholarly research, to developing a 37-month Online Master's program in OFPOM and a 12.5-month Certificate in Orofacial Pain. During the didactic online curriculum, students are trained to recognize the pathology, treatment, and clinical applications of systemic disorders including masticatory musculoskeletal pain, neurogenic orofacial pain, temporomandibular disorders, headaches, and orofacial motor disorders including orofacial dystonias and bruxism. In order to further facilitate the students' learning, Dr. Padilla incorporates live webinar sessions with faculty and residents to provide students with collaborative learning experiences. By integrating various modes of learning into the academic programs offered by OFPOM, Dr. Padilla envisions that the Herman Ostrow School of Dentistry will pioneer the development of didactic and collaborative programs in the field of oral medicine.

Dr. Padilla has conducted various clinical research projects during her time on the faculty of OFPOM. One of her most recent research projects involved evaluating the efficacy of current treatments for chronic orofacial pain. In her clinical research, she examined common causes of chronic pain in the orofacial region—neuropathic pain, chronic daily headaches, myofascial pain, and osteoarthritis. After further analyzing various types of drugs used in treating each type of pain, her study suggested several treatments that provide an optimal therapeutic solution while minimizing long-term side effects. Further stemming from this research, some of her current clinical projects involve exploring a more comprehensive combination of therapies for orofacial pain management, which combines pharmacological, surgical, and lifestyle modifications.

As the Assistant Director of Distance Education Programs, Dr. Padilla pioneered the development of a software program, DDS Detective, which is designed to improve students' understanding of diagnosis and treatment of orofacial disorders. DDS Detective was launched in 2010. It provides students with clinical scenarios and helps them seek clinically significant information. The DDS Detective software is valuable for novice students in dentistry and other fields of health care, helping them to learn and apply their knowledge; however, students' responses showed significant variability in the diagnostic tests and medications they proposed. In improving the existing virtual patient learning program, Dr. Padilla improved the graphics to 3D, increased the number of clinical scenarios by eight times, and updated each case with the most current evidence-based information. Most DDS students who utilized this updated program had positive experiences. Many students noted that the breadth and layout of the software allowed them to effectively internalize the information while having fun. OFPOM, being located in the metropolis of Los Angeles, attracts a highly diverse group of patients from a population pool of 22 million people. Fortunately, dental students and residents at USC have various opportunities to interact with and treat patients with a variety of unique medical conditions. Thanks to the strong research environment, emphasis on evidence-based patient treatments, and collaborative learning environment, Dr. Padilla envisions that students at the Herman Ostrow School of Dentistry will play an integral role in advancing the field of oral medicine.

Transforming DENTAL CARE IN THE DENTAL DESERT

Sinead Benyaminov and Davita Danesh

The Dental Transformation Initiative-Local Dental Pilot Project (DTI-LDPP) is a novel California state-funded program that aims to promote the dental health of children in the Los Angeles community. The principal objectives are prevention and improving access to and utilization of dental care services. Specifically, it has been shown through research that establishing a dental home and focusing on prevention are key factors when it comes to children's dental health. Dr. Mouhammad Hazem Seirawan and Dr. Natalia Slusky placed utmost importance on these key objectives when their team designed their proposal and successfully applied for funding from the state to initiate the DTI-LDDP project in collaboration with California State University, Los Angeles (CSULA). This project was conceptualized in the Division of Dental Public Health and Pediatric Dentistry at the Herman Ostrow School of Dentistry of USC by a team of investigators including Dr. Mina Habibian, Dr. Christine Edwards, and Assistant Professor Kristine Parungao under the leadership of Associate Dean Dr. Roseann Mulligan.

Dr. Mouhammad Hazem Seirawan received his Doctorate of Dental Surgery degree in Damascus, Syria, in 1993. He has always been passionate about public health. Upon moving to the United States, he earned his Master's degree in Public Health from Wichita State University in 2001, followed by a Master's of Science in Biostatistics from the Keck School of Medicine of USC in 2004. In 2012, he then earned his Certificate of Specialization in Pediatric Dentistry from NOVA Southeastern University. Dr. Seirawan participated in a multitude of dental public health research projects at USC. His prior research includes topics in developmental disabilities and special care dentistry. He combined his passion for pediatric dentistry with his commitment to helping underserved populations in his role as Section Chair of Public Health Projects in the Division of Dental Public Health and Pediatric Dentistry at the Herman Ostrow School of Dentistry of USC.

Dr. Natalia Slusky received her Doctorate of Dental Surgery degree from the School of Dentistry at Perm State Medical Institute in Russia, followed by a PhD degree in Medical Sciences from Moscow State University of Medicine and Dentistry in Russia. Once she moved to the United States, she earned a Master's degree in Healthcare Management from California State University, Los Angeles. Dr. Slusky has been practicing general dentistry in private practice since 1999. She is currently an Associate Professor of Clinical Dentistry in the Division of Dental Public Health and Pediatric Dentistry at the Herman Ostrow School of Dentistry of USC. Her research interests include geriatric dentistry, behavioral dentistry, and the business aspects of oral health care delivery.

Together with their team, Dr. Seirawan and Dr. Slusky developed their new project based on the successful model of a previous project called the Children's Health and Maintenance Program (CHAMP). CHAMP is a multidisciplinary, community-based oral health promotion program for children (0-5 years old) that began in 2012 and was granted $18.4 million over five years by First 5 Los Angeles. Specifically, the program targets underserved populations lacking adequate access to dental care in the low-income communities surrounding USC and Los Angeles County. The program has multiple components including community development, outreach activities, case management, anesthesia, and technology. Prior studies conducted by Dr. Mulligan and Dr. Seirawan observed that 73% of Los Angeles' underprivileged children had untreated caries, of which 29% were only white spot lesions that could be arrested with proper care. Moreover, 81% of children were in need of dental care, which was negatively impacting their academic performance (Mulligan, 2011 & Seirawan, 2012), thus further prompting Dr. Seirawan and Dr. Slusky to take action. CHAMP highlighted the dearth of adequate dental services for young children in the epicenter of Los Angeles. Thus, their mission became identifying underserved children (0-5 years old) living in specific Service Planning Areas (SPAs) in Los Angeles and connecting them with appropriate dental homes to receive oral health care. One of the achievements of CHAMP was creating a network of dental home partners consisting of community and private dental clinics. These clinics are vetted to ensure they are adequately equipped and have the capacity to handle the needs of this marginalized population. The underprivileged children are identified through community outreach activities performed by several teams of Ostrow faculty and staff, led by Assistant Professor Kristine Parungao. The children that are enrolled in CHAMP receive educational services, dental screenings, and preventive services directly at community sites. They are then linked to dental home partners where they receive continuing dental care throughout their childhood and adolescent years. Additionally, under the same grant, Dr. Roseann Mulligan created a pediatric dental home—the Pediatric Dental Clinic (PDC) at Los Angeles County and USC Medical Center's Medical Village–for a specific niche of the underserved community, foster children. The PDC opened in 2016 and is thriving under the leadership of Dr. Thanh Tam Ton, providing dental care to hundreds of foster children in need. Being a part of the largest medical center in Los Angeles, the PDC serves as an ideal site where medical doctors and USC pediatric dental residents offer optimal, inter-professional, comprehensive care.

CHAMP also emphasizes education on multiple levels, resulting in well-informed parents, teachers, community workers, and healthcare professionals

who can help care for and serve children in the Los Angeles area. Over 2,500 health professionals have been trained to provide care and properly educate children served by the four approved SPAs through an educational curriculum developed by Dr. Mina Habibian. Another key team member, Dr. Christine Edwards, led the community development efforts that resulted in a network of 24 dental homes and 304 recruitment sites, where 37,816 children have been screened and their parents have received oral hygiene education. The study concluded that this model has promoted and improved access to oral health care among underserved children. It was thus determined that the model can be adopted in its entirety or through deployment of selected components in other health programs. This success encouraged Dr. Seirawan's team to affect and equip an even larger population with similar care, education, and tools to improve the health of thousands of children.

Dr. Mouhammad Hazem Seirawan and Dr. Natalia Slusky.

Development of the DTI-LDDP (Dental Transformation – Local Dental Demonstration Project) application and its successful funding was truly a team effort that resulted in an award of more than $7 million over four years to continue and expand the previous CHAMP model. The new program has diversified and expanded, extending the age of the targeted children from 0-20-year-olds of Los Angeles County. This has extended care to children and youths who are outside the reach of the four previously approved SPAs and also specifically includes Native American communities. Through a personalized approach, the trained professionals will provide oral health screenings and education, and also refer these individuals to dental homes appropriate for their needs, ensuring comfort and facilitating establishment of a continuous and trusted relationship between a participating family or individual and a dentist. For many participants, interaction with outreach teams is their very first exposure to dental care. Providing simple yet important preventive services, such as tooth brushing demonstrations and fluoride varnish applications, in a non-threatening environment and in a friendly and supportive manner, aims to provide a positive experience to establish an auspicious relationship between a child or teen and his or her oral health providers.

The foremost objective of oral health education will continue to lie in teaching and training children, parents, community lay people, and health care professionals. The multidisciplinary nature of CHAMP will also be continued through DTI-LDPP. USC dental hygiene students as well as students from five other disciplines (child development, family and children's services, nursing, nutrition, and public health) from CSULA will participate in oral health outreach activities to provide a holistic care approach to each child and family. The ongoing inter-professional collaboration between dental professionals and social workers was successful in CHAMP in helping with the case management of thousands of families (Parungao, 2017). It is this collaboration with the USC School of Social Work that laid the foundation for the new multidisciplinary program. One of the lessons learned from CHAMP was the huge need for other basic resources (e.g., food, housing, safety, etc.) in the community, the lack of which impedes utilization of dental care.

A major goal of DTI-LDPP is to educate children and their families on oral health, while simultaneously connecting them to dental homes, thus creating long-standing relationships between them and dental professionals. Through these dental homes, families will continuously be instilled with positive and healthy habits, their dental ailments will be treated, and prevention will be emphasized as the optimal objective. Dr. Seirawan, Dr. Slusky, and their colleagues, a talented and caring team of faculty from the Herman Ostrow School of Dentistry of USC's Division of Dental Public Health and Pediatric Dentistry, aim to continue improving the oral health of thousands of children in the Los Angeles area. If their prior work is any indication, they are bound to be widely successful.

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*Shaping the **Endodontic Curriculum** for **Millennials***

Azzah Widatalla and Teresa Nguyen

Utilizing new research to fuel the endodontics specialty, Dr. Yaara Berdan, Assistant Professor of Clinical Endodontics at the Herman Ostrow School of Dentistry of USC, strives to provide her students with the tools necessary to achieve excellence in endodontic care. Born and raised in the Los Angeles area, Dr. Berdan always had an interest in the healthcare field, however not necessarily in the field of dentistry. She recalls her routine visits to the dentist as a young child being nothing but great experiences. For Dr. Berdan, the "smell of eugenol" and the "taste of topical" were a few of her favorite sensations whenever she visited her dentist. Later on as a young adult and with her mother's advice, Dr. Berdan pursued her passion towards a career in dentistry, seeing how a dental profession suited her well. The great experiences she had as a child in the chair would soon allow her to deliver the same type of care to others. Little did Dr. Berdan know that she would become an Assistant Professor of Clinical Endodontics.

After receiving her doctoral degree in dental surgery from the University of California, San Francisco, Dr. Berdan knew she wanted to further her dental education. She completed her pediatric dentistry residency program at Boston Children's Hospital. Following her residency, Dr. Berdan practiced for a couple of years just north of Boston. It was then when she realized that pediatrics might not be her final specialization as she previously thought. She often found herself enthralled with traumatic cases during practice in which pediatric patients would require endodontic treatment. These challenging cases, coupled with her established affiliation with the endodontics department at the Children's Hospital, inspired Dr. Berdan to pursue another specialty certificate. This time around, Dr. Berdan completed her endodontic residency program at the University of Illinois, Chicago. What stood out to Dr. Berdan about endodontics was its scientific foundation: she desired a setting that was scientifically based, and that emphasized research, science, and healing, where she would be able to follow through with each case from start to finish. After completing her residency, she moved back to Los Angeles and practiced for seven years as an endodontist.

Still, after years as a practicing endodontist, Dr. Berdan had a burning desire to become even more involved within dentistry. She started volunteering at the Herman Ostrow School of Dentistry of USC once a week to quench her thirst for involvement and eventually increased her contributions to twice a week. Over time, her volunteering experience sparked her interest in teaching, in which she worked closely with students during the supplemental endodontic experiences and supervised the endodontic procedures performed in student clinic on the second floor. Dr. Berdan frequently volunteered her expertise by providing students further insight and assistance to uncover the realm of endodontics to supplement the endodontic experiences of her students who wanted to gain a better understanding and appreciation for endodontics. After noticing how enthusiastic Dr. Berdan was to her students as a mentor, the school offered her a part-time position as a faculty member in the endodontic department in 2009. Starting off with small seminars, further progressing into lectures, and ultimately serving as the endodontic course director, Dr. Berdan found her initial experiences nerve-wracking, but she found them very rewarding over time.

Although she had never anticipated becoming a faculty member prior to attending both the pediatric and endodontic residency programs and practicing in her community, Dr. Berdan is extremely invested in and enthusiastic about the education of millennial students. In 2010, she was involved with the American Dental Education Association (ADEA) as a representative on the Counsel of Faculties, which meets with faculty members from other dental schools to further the evolu-

tion of dental education and curriculum for new millennial students. Dr. Berdan recalls that she was blown away by the organization and its goals just within the first meeting. The ADEA's mission to lead "individuals in the dental education community to address contemporary issues influencing education, research and the delivery of oral health care" aligned with her own values, specifically introducing students to research and stressing how important and relevant it is to endodontics. Dr. Berdan accomplishes this by utilizing relevant research articles throughout the courses she teaches. This teaching approach guides her students to obtain more foundational knowledge, improving their understanding of how and why certain techniques are performed in the field. By promoting students to stay current in evidence-based literature, Dr. Berdan hopes to provoke students to generate new ideas and look further into additional research that could be done, which could ultimately progress the endodontic field and dentistry overall. Another goal that she has to further progress dental education for millennial students is to transition away from traditional lecture-based learning. In her endodontics course, Dr. Berdan adopts an interactive, problem-based format in hopes to maximize student engagement and learning during lectures and simulation lab. Her strong advocacy and appreciation for peer learning is evident when her students can explain to their classmates during group discussions about the significance of topics discussed during the lecture and their applications in a clinical setting.

After participating in research opportunities during her residency, Dr. Berdan now enjoys learning more about the new and innovative research within the field through published literature, especially articles of a clinical nature. Diverging from an interest in laboratory research towards clinical research, she recently joined the National Dental Practice-Based Research Network, which seeks to improve the efficiency and effectiveness of dental care by conducting dental practice-based research in the "real world," as Dr. Berdan puts it. Currently, the organization and Dr. Berdan are studying whether extractions of compromised permanent first molars have an effect on the vitality of second or third molars in children between the ages of seven and nine years old. Another research project Dr. Berdan is working on with the research network concentrates on follow-ups after vital pulp therapy. She hopes to further investigate how to preserve the vitality of the primary teeth to ensure successful tooth development and eruption in children. As a lifelong learner, she continues to not only incorporate new research into practice, but also technological advances. Hence, she is a strong advocate for the use of endoscopes in the classroom and in the clinic. As Dr. Berdan puts it, "If you can see it [roots] clearly on a larger scale through the microscope, it will make more sense. You can see the difference better than looking in plain sight when you are first learning about endodontics." Dentistry is constantly evolving. With her continuous efforts to adapt new ideas, techniques and equipment into the curriculum, she believes students will not only gain a better understanding of endodontic procedures, but they will also be well-equipped to treat their own patients in their communities in the near future.

In the future, Dr. Berdan strives to further contribute more to research in her field of endodontics. She hopes to incorporate new findings into the endodontic curriculum at USC in order for students to be confident enough in their technical skills and have a stronger appreciation for the specialty. She also plans to continuously update the endodontic curriculum by incorporating new techniques and materials, such as new sealants coming onto the market, in conjunction with the traditional, pioneered techniques. Dr. Berdan gears the course towards students who will become the next generation of dental practitioners, so that they are able to thrive in various endodontic settings—hospitals, corporations, private practice, and community clinics. Dr. Berdan aims to guide students to familiarize themselves with endodontics by understanding the various techniques and instruments used during each procedure. For example, students will be able to explain what an endodontic rotary file does, its limitations, and what size they're opening with each file. In addition, she aims to promote students to think critically and adapt to different scenarios. It is the only way to truly excel in not just endodontics itself, but to become a well-rounded healthcare professional in one's community.

Dr. Yaara Berdan is an esteemed professor with a passion for educating the next generation of healthcare providers and leaders in the community. Dr. Berdan continuously strives to put her best foot forward when she is sharing her immense knowledge with her students. She plays an active role in the dental community, not only as an educator and mentor to her students, but also as a speaker during continued education courses, lectures, and hands-on workshops in endodontics. Her dedication to the betterment of the educational system is evident through her involvement with the innovative research that she uses as a foundation for the endodontic curriculum, and ultimately within the endodontics department at USC, to the great benefit of both students and colleagues.

"Dr. Berdan adopts an interactive, problem-based format in hopes to maximize student engagement and learning during lectures and simulation lab."

A Path to Education

Daniel Kohanchi and Jay Patel

Dr. Nam S. Cho is the young, vibrant Program Director of the Oral and Maxillofacial Surgery (OMFS) Residency Program at the Herman Ostrow School of Dentistry of USC. In fact, Dr. Cho is one of the youngest OMFS residency program directors in the country. Yet in speaking with him, you quickly get the sense he may also be one of the humblest. "I am fortunate to be here," he says earnestly. It's a self-effacing statement that only adds to the inspiration he offers trainees, including early achievements in clinical dentistry, research, publication, and education.

Dr. Cho was asked to lead the OMFS residency in 2013 by a world renowned visionary who also happened to be his mentor, Dr. Mark M. Urata. Dr. Urata is the Audrey Skirball-Kenis Chair and Chief of the Division of Plastic and Reconstructive Surgery at the Keck School of Medicine of USC. He is also Head of the Division of Plastic and Maxillofacial Surgery at Children's Hospital Los Angeles and Director of Craniomaxillofacial Surgery at Cedars-Sinai Medical Center. Together, he and Dr. Cho have developed a remarkable oral and maxillofacial surgery program. USC's residents are now among the best-trained in the field thanks to an increase in both didactic as well as clinical experiences.

Dr. Cho's passion for oral and maxillofacial surgery is evident in his clinical work and teaching. He helped create an amazing environment where residents are able to incorporate the newest techniques in treating each patient. For his commitment, he received the USC OMS Golden Sucker of Excellence in Resident Education Award.

Born in South Korea, Dr. Cho was raised by hard-working parents who immigrated to the United States to make a better life for their family when he was just four years of age. His deep admiration and profound respect for his parents is apparent as he describes his childhood. He attributes his success to his parents' core values: persistence, hard work, and focusing on one's education. These are now values Dr. Cho instills in his residents.

> "Always strive for excellence, and judge success as achieving your goals and nothing less."

Dr. Cho grew up in Southern California. His family moved from the Boyle Heights area to Diamond Bar, where he spent most of his teenage years and schooling. He graduated from the University of California, Los Angeles with a degree in microbiology in 2001, and went on to receive his dental degree from the USC School of Dentistry in 2005 and his medical degree from the Keck School of Medicine in 2008. He received his specialty certificate in 2011.

However, his entry into the field of dentistry was unsual. Dr. Cho has no dentists in his family, nor, he says, did anyone ever try to convince him to become one. The only exposure he had to a dentist growing up was sitting in the chair during his routine visits. Dentistry appealed to him for practical reasons—it's a rewarding profession that enables you to help people, have a reasonable lifestyle, and raise a family.

It was during dental school that Dr. Cho first realized his unique interest in oral surgery. The director of the Predoctoral Oral Surgery Department at the time, Dr. Walter Siegel, taught in a unique way that inspired Dr. Cho, by conveying a sense of compassion for patients and students alike. According to Dr. Cho, Dr. Sie-

Dr. Nam S. Cho, DDS, MD, Director of the Oral and Maxillofacial Surgery Residency Program at the Herman Ostrow School of Dentistry of USC.

"Never accept in success what you would not accept in failure"

gel was a true educator by every definition of the word. This admiration inspired Dr. Cho to continue his education in oral and maxillofacial surgery and solidified his desire to educate the next generation of oral surgeons, the way he was taught by the likes of Drs. Siegel and Urata. Dr. Cho continued on as a faculty member in 2011.

"Never accept in success what you would not accept in failure" is a mantra Dr. Cho lives by. "Always strive for excellence, and judge success as achieving your goals and nothing less."

Dr. Cho also felt a calling to research during his residency and feels he owes a lot of his methodology as a clinician to USC's promotion of inquisitive minds. Cultivating and maintaining a researcher's mindset helps clinicians resolve problems. Clinical research similarly plays an integral role in advancing the field of oral and maxillofacial surgery. In order to solve difficult problems, one must stay curious and study a variety of therapies to improve patient care and outcomes.

Dr. Cho also believes that planning and execution are keys to success in the field of surgery. Related advancements in technology like the availability of CT scans have opened the gates for virtual surgery. In corrective jaw and reconstructive surgeries, for example, an oral surgeon can now save time using virtual models to prepare. The accuracy of this approach allows for better outcomes for patients. Customized plates and splints are also more accurate and cheap, which reduces operation time and costs, allowing for the more efficient and efficacious treatment of patients.

No doubt Dr. Cho's future will be molded by his passion for excellence, education, research, and innovation. A sincerely humble individual who is also at the top of his craft, he is someone to admire and root for. All of us at USC are extremely excited to see even more great accomplishments by Dr. Cho throughout his career.

PhD Takes on Implant Dentistry's Greatest Obstacles

Christie Tu and Nina Bubalo

Since the age of 11, Dr. Neema Bakhshalian knew he wanted to become a dentist. One morning he woke up with terrible tooth pain that lingered for two consecutive days. His number 14 tooth had deep caries that had worked its way into the pulp, requiring a root canal. Of course at the time, he did not know this. All he knew was that the endodontist his parents took him to cured him of his pain in a mere hour. He says this was the moment he saw the positive outcomes of dentistry and "wanted to become an endodontist, to get people out of pain."

As a dental student, Dr. Bakhshalian started spending his free time in the research lab and his interest quickly shifted to periodontology. He and his colleagues led a study on rabbits that demonstrated the advantage of using demineralized dentin grafting materials to promote bone regeneration. This was a small yet successful project that launched Dr. Bakhshalian into a lifelong research career. He decided to pursue the somewhat unconventional path of pursuing a Ph.D. after dental school in order to further investigate bone regeneration. He attended Florida State University where he elaborated on his earlier research using more advanced technologies. He developed a protocol for freezing demineralized dentin to be used as grafting material. His protocol was later adopted by a couple of companies for commercialization, and is now FDA approved. These companies utilize a machine that takes the dentin from an extracted, non-restorable tooth to produce graft material within 15 minutes. Instead of animal- or cadaver-derived bone grafting material, the patient can then produce their own autogenous grafting material.

Preservation of bone tissue is a leading topic of research in the periodontal community. After extraction, the thin buccal plate of the alveolar bone can recede without the root of a tooth holding it in place. This leads to a thin ridge which can cause issues with esthetics and rejection of implants. Bone grafts, stem cells, and growth factors are some of the ways researchers are combating this loss. However, preserving bone was not always a hot button topic for research. Dr. Bakhshalian remembers in his early days as a dental student, being told to apply pressure to the socket during an extraction in order to flatten the alveolar bone! In those days, the majority of extractions were followed by treatments with either dentures or bridges, so a smooth ridge was considered advantageous. Nowadays, implants are considered the gold standard and bone is integral to osseointegration and implant success.

After Dr. Bakhshalian completed his Ph.D., he started his periodontology residency at the Herman Ostrow School of Dentistry of USC. He found himself staying here for three more years as a research associate, and ultimately teaching. Working directly with all of the 12 periodontology residents, Dr. Bakhshalian's research now ranges from retrospective analyses to clinical trials. "At the moment, we have a little over 10 research projects that are going on," he notes. Dr. Bakhshalian has been instrumental in orchestrating the integration of various subcategories of expertise within the Periodontology Department. Collaborating with Dr. Jianfu Chen in his microbiology-focused laboratory, Dr. Bakhshalian is now mainly studying peri-implantitis. Peri-implantitis, as described by Dr. Bakhshalian, is a process in which "the same way we can lose bone around teeth, we can also lose bone around implants." The critical difference is that bone loss around teeth has a long history and has been well studied, whereas implants are a more modern technology. "So realistically," Dr. Bakhshalian explains, "no one knows how to fix it. People have different ideas but none of them have been tested. One of the biggest problems and reasons why we don't know how to fix it is that we don't have a working model for it." Dr. Bakhshalian intends to tackle this dilemma by providing the research community with a standardized and consistent model of peri-implantitis. He and his research group have designed six different prototypes of scaled-down implants for rats, each one being better than previous prototypes. After these implants are in place, a biofilm is developed on the abutment, and placed on the implant. The resulting peri-implantitis observed in the rat very closely mirrors those cases that are seen in patients in clinic. Becoming the first in the world to successfully create a consistent model of peri-implantitis was not always a straightforward task. On working for seven years to design the implant components, protocol, and surgeries, Dr. Bakhshalian recalls, "Initially everything was failing, but now we've finally got to a point where our implants are working really well."

Another study in which Dr. Bakhshalian has been instrumental is investigating bone grafts that are conjugated with antibiotics. In collaboration with Dr. Parish Sedghizadeh, the team is investigating antibiotic treatment modalities for osteonecrosis of the jaw. With traditional oral or injected antibiotic therapy, the con-

centration that reaches the target site of necrosis in the jaw is relatively low. To improve the efficacy of treatment, the team is investigating a bone graft with antibiotics that will slowly release antibiotics in the area.

Dr. Bakhshalian recently published another study in The International Journal of Periodontics & Restorative Dentistry (January 2018). The article was a retrospective study on the effects of bovine bone grafts in human subjects. Some scientists hypothesized that bovine grafts, although deproteinated, might inhibit the natural wound healing process, leading to sockets containing mainly bovine bone. However, the retrospective study showed that when dissected, the sockets typically contained 40% human bone tissue and only 12% bovine, with the remainder being soft tissues, bone marrow, etc. Dr. Bakhshalian explains, "what we do is when the extraction is done, [is] we put bovine graft inside the socket. At the time of the implant placement, we take a bone sample. We can drill the bone or we can just take a bone sample to look at it histologically in order to see how it heals." They also take a CT scan in order to determine how much of the bone is from the graft and how much is new bone. "We have grafts that we've put in there and cases that have gone up to 13-16 years and doing fine," he says.

With a January publication, and additional manuscripts out for peer review, Dr. Bakhshalian is doing well by any researcher's standards. He has received multiple awards in the past for his research and involvement. When asked what award he is the most proud of, he mentions an academic leadership award he received during his time at Florida State. "Most awards you are awarded for something very specific, but this award considered everything: publications, research, community service, teaching, etc. So that was good," he says with a smile.

With an immense breadth of research on bone engineering and implants under his belt, Dr. Bakhshalian is indisputably shaping the future of periodontology. With the advent of implants and their widely popular and accepted use today, Dr. Bakhshalian anticipates more monumental science breakthroughs. "Implants are a great therapy that we didn't have before. But I think that it is just a phase into more advanced treatment. I think that stem cell, and tissue engineering and regeneration, are really the future. Right now, they're really in the early stages, but I think in time there is going to be a time where you can use stem cells to develop a new tooth instead of an implant," he speculates. Dr. Bakhshalian recognizes the immense possibilities that the future of dentistry holds, and he has the dedication and ambition that will continue to revolutionize the field of periodontology.

Dr. Neema Bakhshalian, DDS, MS, PhD.

The Researching Clinician

Maretta Oganesyan

JOAN BELENO-SANCHEZ

Professor Joan Beleno, a clinical faculty member and research coordinator in the Division of Dental Hygiene at the Herman Ostrow School of Dentistry of USC, has been an active member in the dental hygiene community since she entered the school in 2009. As a star student in her dental hygiene program, she received multiple leadership awards. As the previous president and now mentor of the Student American Dental Hygienists Association, Professor Beleno is a strong advocate for being involved in the dental community and for research in the field.

Professor Beleno knew early on that she wanted to pursue a career in the dental field, and during her time as an undergraduate at the University of California, Irvine, she volunteered at one of the few free dental clinics in Orange County. It was there where she first assisted a dental hygienist. "Seeing what she was doing—it seemed like surgery to me. It was later on when I realized that she wasn't the dentist." Inspired by the clinic and the work they offered to the community, she was driven to apply to a dental hygiene program.

As a dental hygiene student, Professor Beleno was elected to serve on the American Dental Hygiene Association's Student Advisory Board, becoming one of four advisory board members on the Committee on Student Relations. As a member of the program, she attended meetings and conference calls with dental hygienists all across the US. "They really wanted to know the students' opinions and wanted to know that what the students wanted to see change in the field as well."

When asked if she thought it was important for dental hygiene and DDS students to be involved in national associations, she replied, "I'm a bit of a proponent of that, since when I was a student, I was the president of the student members of our professional organization and now I'm their mentor. I do my best to translate how the professional organization, both national and local, can help both students and professionals." She gave the example of how in different states, dental hygienists cannot give anesthesia. "The reason why it is legal in California goes back to the lobbyists approaching the governor and stating that we want to put it in our scope of practice. These are just dental hygienists that are involved and pushing for change."

Upon receiving her dental hygiene degree from USC, she was immediately offered a position as a junior faculty member and she began teaching the sophomore Periodontology module. Her initial plan was to work temporarily as she applied to DDS programs, but found herself more involved than she initially anticipated: "I was supposed to apply to dental school but after teaching for six

months and being in that practice, I decided I didn't want to be DDS anymore and that I loved hygiene and prevention. I felt a different calling, so I cancelled all my interviews and withdrew my application. To this day I still believe that it was the best decision."

Coming from a research background from her undergraduate school, UC Irvine, she also accepted a position in research projects offered to her by her mentor, Professor Diane Melrose.

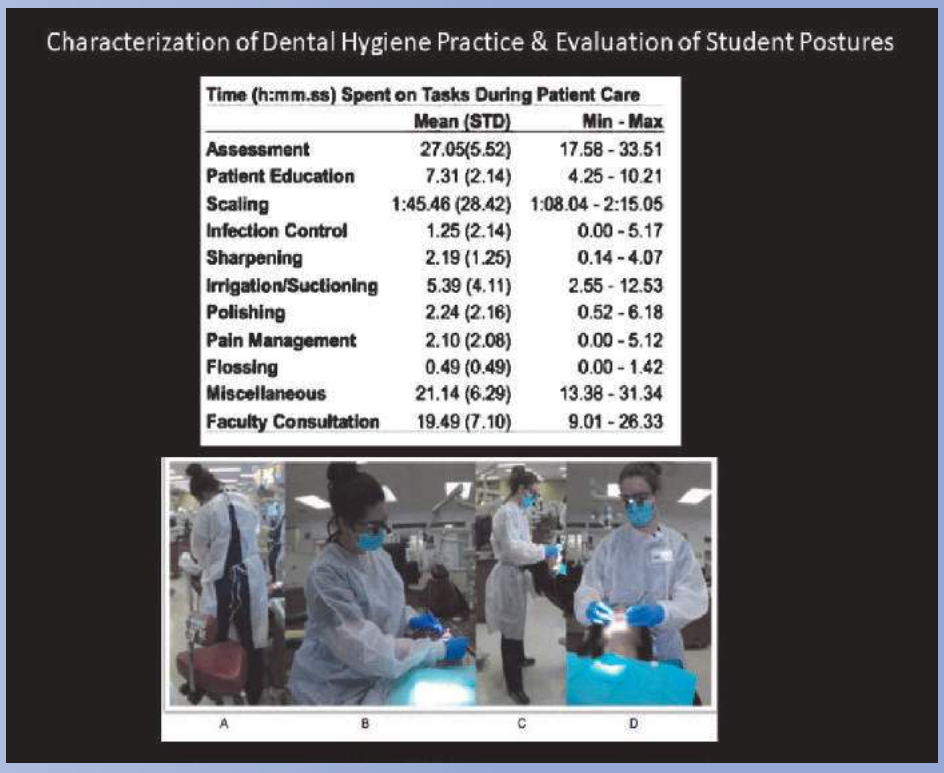
Professor Beleno is currently working on her master's degree at George Washington University in clinical and translational research, which came about through the NIH's decision to begin doing pilot studies in order to improve global health. It places translational research in the continuum of T0 to T4 research, with T0 being basic biostatistics and T4 being retrospective studies. The purpose of this is to teach clinician-researchers how to move from one phase to another and to allow them to reach a stage where they're utilizing community health and global health data. Professor Beleno is currently the only dental professional in her cohort, surrounded mostly by anesthesiologists, surgeons and other MDs. Since the program consists of many discussions and group projects, she finds that her position allows her to see how translational research can be effective and applied to dentistry itself.

Her current research is interdisciplinary, and she is collaborating with researchers in both occupational therapy and microbiology. In one of her current studies, "Metagenomic Signatures of Subgingival Plaque," a periodontal endoscope is used in order to probe the pocket of the gingiva to collect samples in a three-phase trial. It follows the patient from non-surgical periodontal treatment (such as scaling or root planing) to their second periodontal maintenance appointment. The study then tracks them afterwards to see if there is any change in their metagenomic makeup and to see if there are any trends in the specific types of bacteria in the diseased sites. The purpose of the research is to understand why some sites break down while other sites are healthy, and whether this is related to differences in the bacteria that are present. She finds that her clinical background helps with the research in that she is able to write the protocol, control the trials, and make changes when it is evident that the trial won't work on patients.

Another study that Professor Beleno is currently working on, and which directly pertains to her own profession, is the study of the "Musculoskeletal Health of the Upper Extremity in Emerging Health Professionals." Hygiene students learn to perform a lot of new movements that may cause pain or discomfort during the program. Her goal is to understand why they are feeling the pain, if it's something being taught, or if it's something relating to what they do with the patients. Using an ultrasound and sonograph, the study tracks the carpel tunnel over time and tries to relate it to possible risks in the wrist and shoulders. "We're seeing many changes being geared towards what we're using, such as loupes, ergonomic hand pieces, and less weight, versus how it's being used."

What does this all mean for Professor Beleno in the future?

> "I was asked by one of my professors recently if I was planning on getting a PhD and I said, 'probably,' which is ironic because it seems that I should have applied to that instead of getting my master's - but at that point in my life I didn't realize how much I would enjoy research. I still currently want to work and teach, and being a PhD student is a full-time job."

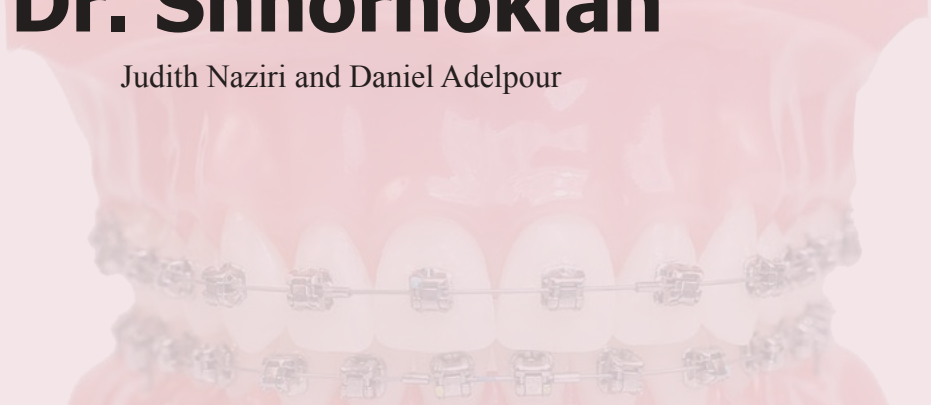


Characterization of Dental Hygiene Practice and Evaluation of Student Postures. Image Courtesy of Joan Beleno

The Past, Present, and Future of

Dr. Shnorhokian

Judith Naziri and Daniel Adelpour



History

Dr. Hovhanness I. Shnorhokian was born in Beirut, Lebanon, where he completed his bachelor's degree in Biology and subsequently his DDS degree. He then completed his Orthodontic Residency at the University of Pittsburgh in Pennsylvania. Dr. Shnorhokian's passion for both teaching and learning led him to pursue a degree in Higher Education at the University of Pittsburgh. After graduating, he continued in academia as an Assistant Professor, Associate Professor, and finally Chair of the Department of Orthodontics in the School of Dental Medicine at the University of Pittsburgh.

In 2008, Dr. Shnorhokian moved from Pittsburgh to Los Angeles, where he is now Acting Chairman in the Department of Orthodontics, celebrating his 10th anniversary working at the Herman Ostrow School of Dentistry of USC. In addition to being a member of the clinical faculty in the graduate orthodontic clinic, Dr. Shnorhokian is also the Co-Director of the undergraduate orthodontics course, director of the "Ortho Selective" program for 4th year DDS students, and one of the two orthodontists who run the Orthodontics Department at the USC Faculty Practice Clinic.

Research Experience

During his time in Pittsburgh, Dr. Shnorhokian became involved in several research projects. One in particular studied the influence of perennial allergic rhinitis on facial type. This study aimed to determine if allergy management would change the course of facial growth. This was done by following a group of children aged from five to ten years with perennial allergic rhinitis and comparing them to a control sample of children without perennial allergic rhinitis. It was found that the children with rhinitis had much larger palatomandibular angles and a lower anterior facial height. Furthermore, when looking at transverse cephalometric measurements it was found that those children showed significantly narrower bilateral orbital breadth, bizygomatic and binaural dimensions, meaning they had more narrow faces.

After finding these discoveries and differences amongst the children, the test group was then followed for two years through treatment for their allergic rhinitis to determine if this treatment subsequently changed their facial structure. This study aimed to pinpoint which facial changes had an effect on the symptoms. However, the observed facial differences did not seem to decrease with treatment. Therefore, it was concluded in this study that treating the allergy did not have an effect on the facial structure.

Dr. Shnorhokian's most recent publication studied the effectiveness of treatment for Class II, Division 1 malocclusion. This was a retrospective study that aimed to evaluate the effectiveness of orthodontic treatment. Two hundred and fifty patients with Class II, Division 1 malocclusions were studied through two variables: percentage change in occlusal index, and Peer Assessment Rating (PAR) score. The variables significantly associated with the duration of treatment were (1) the pretreatment PAR score, (2) the number of treatment stages, (3) the percentage of appointments attended, (4) the number of appliance repairs, and (5) whether the patient was treated with or without extractions. The only variable that influenced the percentage change in PAR was the pretreatment PAR score.

The Future of Orthodontic Research

In an interview, Dr. Shnorhokian expressed concerns with the changes that are coming forth in the world of orthodontics. With Invisalign and many other different types of removable retainers, Dr. Shnorhokian is worried about patient compliance, particularly as it applies to younger patients. He noted that as of right now, we have fixed appliances that younger individuals are unable to remove, increasing their compliance as well as their progress. With appliances such as Invisalign comes an opportunity to remove orthodontic trays, increasing the time of treatment and regressing movement.

When asked where Dr. Shnorhokian sees the future of research in the orthodontic field, he noted that it will require a multidisciplinary approach. Dr. Shnorhokian has noted that even today, it can take two years to fix minor crowding, and in order to find better and faster solutions for this issue, we need to work with all different fields of dentistry to take a more holistic, comprehensive approach.

Dr. Hovhanness I. Shnorhokian, DMD, PhD, Clinical Associate Professor

Leading with Excellence in *General Practice Residency*

Arian Barooty and Ana Zapata Caceres

Dr. Richard S. Green is the Director of the USC General Practice Residency (GPR) Program, Chairman of the Department of Dentistry at Los Angeles County+USC Medical Center, and Associate Professor in the Herman Ostrow School of USC Dental Hygiene program. After graduating from the USC School of Dentistry in 1979, Dr. Green went on to pursue postgraduate dental training through a general practice residency at Olive View. The duration of the program was one year and it endowed him with enough experience and confidence to start his own practice.

After practicing for nearly two decades, Dr. Green returned to the USC School of Dentistry in 1997 to spend one day a week teaching dental students. Realizing how much fun he was having, he eventually increased his commitment to three days a week. Subsequently, wanting to pursue a full-time academic career, he returned to school and completed a master's degree in Education at USC. In 2005, he was selected to be the Program Director for the GPR, a position he has held ever since.

Dr. Green's clinical experiences and background in education helped him shape the GPR into the great program it is today. The twelve-month residency provides participants with a broad range of experiences as they rotate through oral surgery, emergency medicine, anesthesia, care for the disabled, and other disciplines. Residents train under the supervision of the faculties of the Herman Ostrow School of Dentistry and the Keck School of Medicine of USC, primarily at the Los Angeles County+USC Medical Center and Veterans Administration (VA) Los Angeles Ambulatory Care facility. Some training is also conducted at Rancho Los Amigos National Rehabilitation Center and the Herman Ostrow School of Dentistry.

LAC+USC Medical Center is a world-class, Level-I trauma center and hub in the county-run healthcare system, serving ten million residents. The four residents that get selected for the twelve-month GPR program have the opportunity to work six months in the LAC+USC Dental Clinic and six months at the VA in downtown Los Angeles, where they treat medically compromised patients suffering from systemic diseases as well as traumatic injuries to the head and neck.

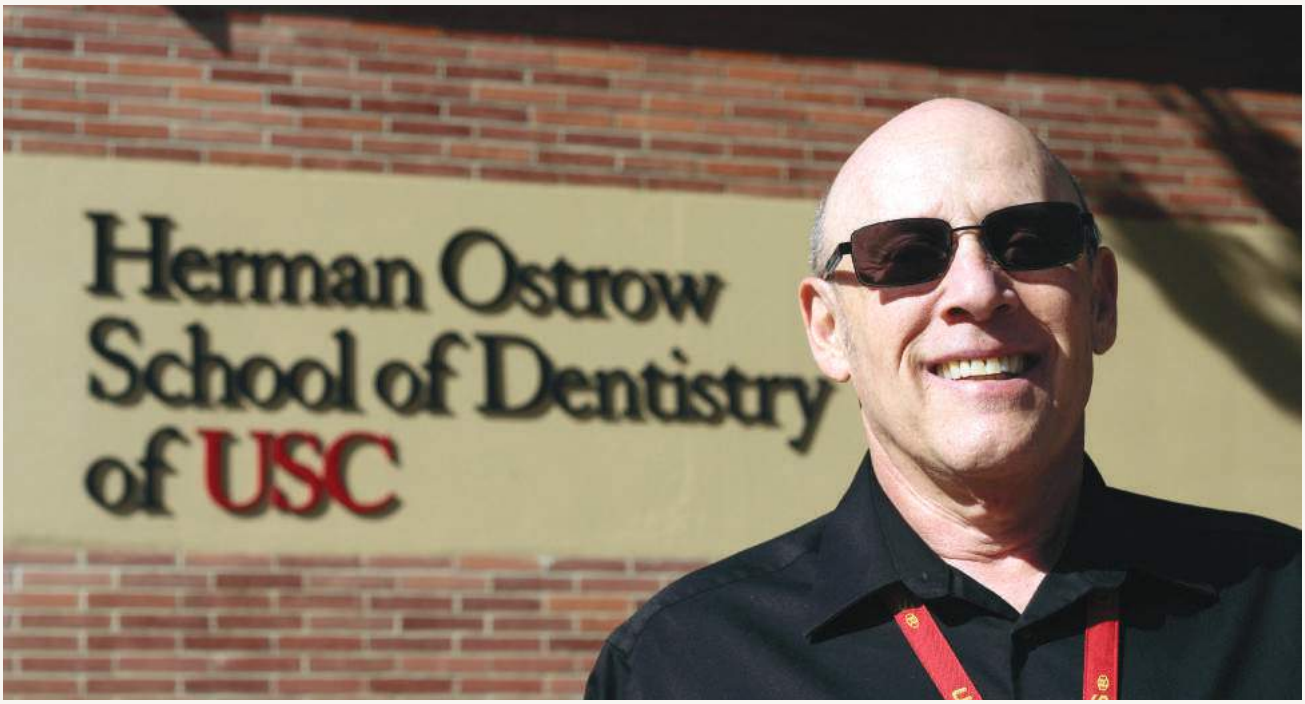
A major advantage of the GPR program at USC is that it is very hands-on, and the residents are given a lot of independence concerning how they want to treat their medically compromised patients. For example, residents have the liberty of choosing between amalgam or composite restorations, or between porcelain fused to metal or ceramic crowns, so that they can formulate an ideal treatment plan for each particular patient. Even though the residents have this freedom, they must consult with the patients' physicians, ranging from their cardiologists to their oncologists to their primary care providers, in order to make the appropriate treatment modifications and come up with the best treatment plan that is tailored for that individual patient.

The residents, as mentioned above, rotate through anesthesia, medicine, the special patients' clinic, and the oral surgery program. They also spend a week working with mentally and medically disabled patients at Rancho Los Amigos Hospital and several days at the Miller Children's Hospital working with pediatric patients. Additionally, at the end of every month, there are case conferences where they discuss the various types of procedures performed during that period. On top of their curriculum, the residents are scheduled every day to see two patients in the morning and two patients in the afternoon, and as they gain more experience they can start double-booking themselves. According to Dr. Green, "our residents hit the ground running: just two months in the GPR program, you are basically done with all the requisites for dental school." The first day of the program they could be doing root canals, taking impressions for dentures, or even restoring implants. Fortunately, GPR residents at USC have dental assistants who save them time and allow them to do more procedures. They also have Dr. Green and other attending clinicians, usually general dentists, for consultation, guidance, and supervision.

With the advancements of modern medicine, we are seeing patients who are living much longer than ever before. The older the patients, the more medically complex their situation becomes. Therefore, students who want to gain more experience and have an edge when it comes to the geriatric population should consider applying to the GPR program at USC. The curriculum is so impeccably designed, thanks to Dr. Green and his team, that upon completion of the program residents have the confidence and speed to handle many difficult cases, such as patients with uncontrolled diabetes or patients with chest pain of cardiac origin, whereas a general dentist would typically have to refer these cases out.

To be admitted into the program, one needs to go through a rigorous selection process. There are only four spots available each year and the selection process can be very challenging. The GPR program generally receives about 70-80 applications each year and only 30 applicants are selected to be interviewed. Applicants are chosen to be interviewed based on several factors. First, they must meet the grade point average requirements to show they will be able to handle the workload of the curriculum. Then, the faculty review the applicants' extracurricular activities and community service. From there, the faculty seeks to determine which students are interested in working with medically complex individuals and if they have the necessary leadership qualities to allow them to successfully finish the program. Another important aspect is a letter of recommendation from a faculty member assessing the qualities, characteristics, and capabilities of the applicant. The applicants have an interview at both the VA and the LAC+USC Dental Clinic. Of the 30 interviewees, 10-12 are submitted to Match and four students will start their journey in USC's GPR program.

Dr. Green recommends the GPR Program to all interested individuals. He feels it increases the residents' clinical competency and their ability to treat medically complex patients. This program also teaches its residents how to provide dental care in a hospital setting, including training in how to interact with health care providers of different disciplines. The confidence the residents gain after graduation gives them the confidence and quick decision-making and clinical skills they need to treat most patients that walk into their practice. Not only is USC's GPR program great for students interested in hospital dentistry or working with medically complex patients, it is also excellent for those interested in doing a specialty program since it allows for in-depth exposure to endodontics, prosthodontics, and periodontics, among other specialties.



Dr. Richard S. Green, Director of the USC General Practice Residency Program, Chairman of the Department of Dentistry at the Los Angeles County + USC Medical Center, and Associate Professor in the Herman Ostrow School of USC Dental Hygiene Program

Schedule of Events
April 4th, 2018

08:00 am – 9:00am **Registration** (Presenters and Judges)

09:00 am – 12:00 pm **Poster Presentations Judging**

11:30 am – 12:00 pm **General Registration**

11:30 am – 12:30 pm **Lunch**

12:30 pm – 12:45 pm **Opening Remarks**

Michael Quick, PhD
USC Provost and Senior Vice President for Academic Affairs

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 pm – 01:25 pm Keynote Speaker

Martha J. Somerman, DDS, PhD

Director of the National Institute of Dental and Craniofacial Research (NIDCR), National Institutes of Health

01:30 pm – 02:10 pm Keynote Speaker

Parish P. Sedghizadeh, DDS, MS

Associate Professor of Clinical Dentistry Division of Periodontology, Diagnostic Sciences and Dental Hygiene

Herman Ostrow School of Dentistry of USC

02:15 pm – 02:55 pm Keynote Speaker

Beth E. Fisher, PT, PhD, FAPTA

Professor of Clinical Physical Therapy

Division of Biokinesiology and Physical Therapy

Herman Ostrow School of Dentistry of USC

03:00 pm – 04:30 pm Poster Viewing

04:30 pm – 05:00 pm Award Presentations

05:00 pm – 06:00 pm Reception

03:30 pm – 05:30 pm Vendor Fair (Hall of Fame, South)

Keynote Speakers

Martha J. Somerman, DDS, PhD

Director - National Institute of Dental and Craniofacial Research

Dr. Martha J. Somerman is the Director of the National Institute of Dental and Craniofacial Research, National Institutes of Health. She also is Chief of the Laboratory of Oral Connective Tissue Biology at the National Institute of Arthritis and Musculoskeletal and Skin Diseases. The NIDCR mission is to improve dental, oral and craniofacial health through research, research training, and dissemination of health information. It is our vision that these activities will be recognized as a catalyst of change in transforming how oral health care is delivered.

Prior to becoming NIDCR's director, Dr. Somerman was dean of the University of Washington School of Dentistry, Seattle, a position she held from 2002-2011. Before joining the University of Washington, she was on the faculty of the University of Michigan School of Dentistry, Ann Arbor, from 1991 to 2002, and University of Maryland, 1984-1990. An internationally known researcher and educator, Dr. Somerman's research has focused on defining the key regulators controlling development, maintenance and regeneration of dental-oral-craniofacial tissues. Further, she has been a recipient of numerous honors and awards throughout her academic career, including most recently the 2018 International & American Associations for Dental Research (IADR) Distinguished Scientist Award for Basic Research in Biological Mineralization.

Dr. Somerman holds a DDS from New York University, a certificate in Periodontology from Eastman Dental Center, Rochester, New York and a PhD in Pharmacology from the University of Rochester, School of Medicine and Dentistry.

Parish P. Sedghizadeh, DDS, MS

Dr. Parish P. Sedghizadeh is an Associate Professor of Clinical Dentistry at the University of Southern California (USC), Herman Ostrow School of Dentistry, and Director of the USC Center for Biofilms. Dr. Sedghizadeh serves as the Section Chair of Diagnostic Sciences, in the Division of Periodontology, Diagnostic Sciences, and Dental Hygiene. He is also the Director of the Oral Pathology and Radiology Hybrid Distance Learning Program. As a clinician-scientist, Dr. Sedghizadeh conducts research, publishes, consults, and teaches oral and maxillofacial pathology, radiology, and medicine with an active intramural clinical practice. He has over 80 peer-reviewed publications, and his research laboratory and clinical research projects at USC focus on the characterization and treatment of microbial biofilm infections, particularly osteomyelitis and osteonecrosis where he has developed novel bone-targeted antimicrobial therapeutics.

Beth E. Fisher, PT, PhD, FAPTA

Dr. Beth Fisher is a Professor of Clinical Physical Therapy in the Division of Biokinesiology and Physical Therapy at the University of Southern California. Dr. Fisher is the director of the Neuroplasticity and Imaging Laboratory primarily using Transcranial Magnetic Stimulation (TMS) to investigate brain-behavior relationships during motor skill learning and motor control in both non-disabled individuals and individuals with neurologic disorders. With an interest to be a part of developing physical therapy interventions that would maximize neural and behavioral recovery in individuals suffering from pathological conditions affecting the nervous system, she is currently studying the effects of skill training on motor learning and brain repair in Parkinson's disease.

POSTER CATEGORY AWARDS

Advanced Specialty Program Resident

Biokinesiology and Physical Therapy Candidate

Biokinesiology and Physical Therapy Student

Dental Hygiene Student

Dental Hygiene Master's

Graduate Post-Doctoral Trainee

Graduate Pre-Doctoral Candidate

Occupational Science and Occupational Therapy Doctoral Student (PhD, OTD)

Occupational Science and Occupational Therapy Professional Student (BS-MA, MA)

DDS Student - Basic Science

DDS Student - Clinical Science

Dean's Research Award – Awarded to the most outstanding project poster

USC STEVENS CENTER FOR INNOVATION AWARDS

"Most Disruptive" (Innovative) and "Best Commercial Potential" Awarded to the posters with the highest likelihood of transferring into practical use. The USC Stevens Center for Innovation is a university-wide resource for USC innovators in the Office of the Provost. Designed to harness and advance the creative thinking and breakthrough research at USC for societal impact beyond traditional academic means, they focus on the licensing of technologies, expanding industry collaborations and supporting start-ups. Their mission is to maximize the translation of USC research into products to public benefit through licenses, collaborations and the promotion of entrepreneurship and innovation.

RESEARCH DAY POSTER ABSTRACTS

FACULTY

Poster #: 1

Title: Feasibility of a primary care lifestyle intervention for late-midlife Latinos

Name: Stacey Schepens Niemiec

Background: The prevalence of chronic disease and early-onset disability is high in Latinos. Those living in rural communities are also vulnerable to the consequences of limited healthcare service access. **Purpose:** This study evaluated the feasibility of ¡Vivir Mi Vida! (VMV), a culturally tailored lifestyle intervention co-led by community health workers (CHWs) and occupational therapists (OTs) and designed for late-midlife Latinos receiving primary care services. **Methods:** Forty Spanish-speaking Latinos (50–64-year-old) were recruited from a primary care clinic in the Antelope Valley of California. Piloted as a 4-month program, VMV was adapted for rural-based implementation and included in-home visitations with a CHW and telehealth OT. The program targeted health challenges by focusing on meaningful social, physical, and productive activity. Electronic medical record information helped guide treatment. Subjective health, cardiometabolic measures, and health behaviors were collected pre- and post-intervention; pre-post change scores were analyzed using paired sample t-tests or Wilcoxon signed rank tests. Participants and key stakeholders (e.g., interveners) also participated in follow-up interviews. **Results:** Session adherence averaged 77%. Of those who completed post-testing (n=37; 93%), most were female (91%), were Mexican-born (65%), and had ≥2 comorbidities (68%). Participants demonstrated significant pre-post improvements in symptom impact on activity (p=.008), systolic blood pressure (p=.006), sodium and saturated fat intake (p≤.0001), and numerous psychosocial outcomes such as stress (p=.02). Physical activity engagement and weight did not change (p>.05). Participants were extremely satisfied with VMV; stakeholders identified some implementation challenges. **Conclusion:** A tailored lifestyle intervention led by CHWs and OTs is feasible and can improve health in rural-dwelling, late-midlife Latinos.

Poster #: 2

Title: Late-midlife Latinos' long-term health outcomes following a lifestyle intervention

Name: Stacey Schepens Niemiec

Background: Rural-living Latinos experience significant health disparities, ranging from increased risk for chronic health conditions to early-onset disability. Barriers to accessing healthcare services exacerbate these issues. Our previous pilot study demonstrated that late-midlife Latinos receiving primary care through a Federally Qualified Health Center and who participated in the four-month occupational therapist-community health worker-led ¡VMV! program experienced positive psychosocial, behavioral, and cardiometabolic health effects. **Purpose:** Preliminary assessment of the long-term health benefits of ¡Vivir Mi Vida! (¡VMV!), a culturally tailored lifestyle intervention for late-midlife (50–64 years old) Latinos receiving primary care services. **Methods:** ¡VMV! pilot study participants were eligible for this long-term follow-up (LTFU) study. Twelve months after completion of the four-month intervention, a battery of self-report and physiological health measures was administered. Using Wilcoxon signed rank tests, we analyzed both (a) pre-treatment vs. LTFU and (b) post-treatment vs. LTFU change scores. **Results:** Of the 40 pilot study participants, 27 were available for reassessment. Participants demonstrated significant positive pre-to-LTFU changes in all dimensions of the Measure Yourself Medical Outcome Profile (Cohen's d≥0.82; p≤0.004), with additional gains observed from post-to-LTFU (d≥0.38, p≤0.05) for all but one subscale. Improved levels observed post-treatment in systolic blood pressure, social satisfaction, sodium intake, and saturated fat intake were maintained at LTFU (p≥0.14). Though not apparent from pre-to-post assessment, improved sleep was observed from both pre-to-LTFU (d=0.52, p=0.005) and post-to-LTFU (d=0.32, p=0.004). **Conclusion:** A tailored lifestyle intervention led by community health workers and occupational therapists has potential to achieve long-term health benefits in multiple physical and psychosocial domains in rural-dwelling, late-midlife Latinos.

Poster #: 3

Title: Leucine-rich Amelogenin Peptide Prevents Bone Loss

Name: Yan Zhou

Background: Wnt signaling plays an important role in bone formation and regeneration. We have shown that Leucine-rich Amelogenin Peptide (LRAP) promotes osteogenesis of bone marrow mesenchymal stem cells (BMMSCs) at the expense of adipogenesis through activating Wnt signaling in vitro. This discovery makes LRAP amenable to novel therapies and interventions to treat Wnt-related skeletal disorders such as osteoporosis and bone healing. Compared to the glycosylated Wnt proteins (over 40 KDa), LRAP is much smaller (~ 6 KDa), giving LRAP a distinct advantage as a small molecule for delivery as a therapeutic agent. **Purpose:** Characterize the in vivo effect of LRAP on bone loss. **Methods:** Transgenic mice were generated in which LRAP is overexpressed in bone marrow. Bone loss associated with aging and ovariectomy was characterized. **Results:** Two bone loss models were employed: aging (23 month old) and ovariectomy. MicroCT analyses indicated higher trabecular bone mass in femora of LRAP transgenic mice in comparison to wildtype controls. **Conclusion:** LRAP is an effective regulator of mesenchymal stem cell fate to promote osteogenesis in vivo thereby preventing bone loss.

Poster #: 4

Title: Evaluating the Development of Musculoskeletal Injuries in Dental Hygienists

Name: Shawn Roll

Background: Work-related musculoskeletal disorders of the hands, shoulders, and neck affect dental professionals at a high rate, primarily due to the amount of time using scaling instruments and working in sustained postures. There has been limited prevention and intervention research, and no studies to evaluate all the potential risk factors for developing injuries. **Purpose**: This longitudinal study is identifying risk factors for the development of injuries in dental hygienists. **Methods**: This study is a collaboration among USC dental hygiene (DH) and occupational therapy (OT), and DH at Loma Linda University. Repeated measures occurring each semester for two years, include: morphology of anatomical structures using sonographic imaging; neurophysiologic function using nerve conduction testing; symptoms and function using multiple questionnaires; and task exposure to extra-curricular activities and from patient visit logs. **Results**: DH (n=104) and OT (n=55) participants are similar in age (DH, 24.4 yrs., SD=3.6 yrs.; OT, 24.8 yrs., SD=2.6 yrs.), and are primarily right handed (92.3%, 87.3%) females (83.7%, 89.1%). At one-year, OT students had no changes in symptoms;

whereas, DH students had a significant increase in prevalence of hand pain at 1-year (37%; baseline = 13%). Severity of increased by 1.5 points on a 10-point scale, with 20% of DH students rating pain > 5/10. **Conclusion**: Despite equivalency at baseline, DH students show increased intensity and prevalence of symptoms in the hand after 1-year of training. After year 2, data will be compared again and statistical models will be developed to evaluate salient variables associated with development of symptoms.

Poster #: 5

Title: Integrated National Board Dental Examination Preparation and Test Item Development

Name: Nasrin Bahari Chopiuk

Background: The INBDE will test students' knowledge of basic, behavioral and clinical sciences in an integrated format and is scheduled to replace the National Board Dental Examination Part I and II in August 1st, 2020. At Herman Ostrow School of Dentistry of USC (HOSD), the pre-doctoral curriculum is delivered in an integrated format. Thus, INBDE is a natural extension for assessing test takers knowledge and ability to apply knowledge of different disciplines in a patient scenario. In 2009, a Committee for Integrated Examination (CIE) appointed by the Joint Commission on National Dental Examinations (JCNDE) created the Foundational Knowledge (FK) content areas. FKs are deemed to be imperative for an entry-level general practitioner to address preventive, diagnostic and management of oral disease. **Purpose:** The purpose was to develop and implement Integrated National Board Examination (INBDE) format of test questions/vignettes, which are designed to assess students' cognitive ability and application of knowledge gained through PBL cases, in preparation for the upcoming INBDE. **Methods:** To prepare for INBDE, several steps were taken: 1. Faculty at HOSD mapped the PBL cases to FKs. 2. Students mapped their major and minor learning need topics to the FKs. 3. Exam questions were developed using a template. 4. INBDE questions were first implemented in Tri I for the class of 2021 for MCQ and COMBOT midterm and final exams. **Results:** A total of 45 items were integrated into the conventional MCQ and COMBOT exams. Our field test included 10 INBDE items on each MCQ and COMBOT, which were counted as bonus points. The difficulty and discrimination indices for INBDE items revealed no significant differences compared to the conventional MCQ or COMBOT questions; therefore, an increasing number of INBDE vignettes will be added to all future exams. **Conclusions:** Since the announcement of new INBDE format, our faculty has been actively engaged in transitioning to INBDE and FK areas to better prepare our students for the changes in the very near future. We believe that our PBL curriculum has, and will, continue to prepare our students for an easy transition and successful performance in the INBDE.

Poster #: 6

Title: Vestibular Neural Circuitry in Typical-Adults and Children with Hearing Loss

Name: Stefanie Bodison

Background: Imaging of children with USNHL, either with high definition CT or structural MRI, reveals abnormal inner ear anatomy in approximately 19% of individuals. This abnormal inner ear anatomy is theorized to result in diminished or absent vestibular sensory input to the brainstem and cortex during critical motor skill development. Little research has investigated the peripheral and central neural circuitry of the vestibular system, as measured through structural and functional neuroimaging techniques, in either typical adults or children with USNHL. **Purpose:** We used advanced multimodal imaging techniques to trace vestibular neural circuitry from the peripheral vestibular organs through the brainstem in typically developing adults and children with unilateral sensorineural hearing loss (USNHL). **Methods:** 10 children (5 male; mean age 9.23 years) with USNHL (mean hearing loss of 103.5 dB HL) received assessments using advanced MRI techniques. MRI data was collected on a Siemens Prisma 3T scanner. Additionally, we accessed a large-scale database of MRI scans of typically developing adults. **Results:** Figures representing the neural pathways of the vestibular nerve from the peripheral sensory organs through the brainstem, and comparisons between typically developing adults and children with USNHL, will be visually represented. **Conclusions:** In typical adults, there are relatively consistent neural pathways that are in-line with histological studies. In the children with USNHL, there is significant variability in both peripheral and brainstem projections.

DENTAL HYGIENE

Poster #: 7

Title: A Bad Bite Can Throw You Off Balance

Name: Nazanin Olyaei

Faculty Advisor: Joan Beleno

Background: Research indicates that there is a potential relationship between dental occlusion within the cranio-mandibular system and the overall posture of the body. It has been suggested that problems arising in the dental occlusion have the potential to lead to problems in the spine and posture. **Purpose:** To study the relationship between malocclusion and postural abnormalities. **Methods:** Studies focused on children ages 3-14. Among these children, prevalence of postural abnormalities were related to those diagnosed with malocclusion. **Results:** Research suggests that individuals with malocclusion are more likely to have postural abnormalities such as kyphotic posture, oblique shoulder, scoliosis, and oblique pelvis. **Conclusion:** By identifying malocclusion in children, dental professionals may be able recognize and possibly prevent postural problems that may arise in the future. The unique interdisciplinary healthcare approach characterized by collaboration and communication among healthcare professionals in fields of dentistry and medicine can play a role on prevention, diagnosis, and treatment of abnormalities of posture due to malocclusion.

ADVANCED SPECIALTY PROGRAM RESIDENTS

Poster #: 8

Title: Programmable Orthodontic Expander for Treating Cleft Lip and Palate Patients

Name: Ana Torres

Faculty Advisor: Stephen Yen

Background: The NiTi Expander is a novel appliance that has several advantages over the other methods of expansion, such as shape memory, reprogrammability, surgical field non-interference, and cost. Currently there are no controlled studies comparing different kinds of expansion in patients with UCLP. **Purpose:** The aim of this study was to analyze the dentoalveolar effects of the NiTi Expander in patients with complete unilateral cleft lip and palate (UCLP) and compare them to the effects of a conventional Rapid Palatal Expander and Quad-Helix. **Methods:** This clinical trial has a sample of 71 patients with complete UCLP, ages 7-14 years, who were divided in three groups and had expansion with Rapid Palatal Expander (RPE), Quad-Helix (QH) or NiTi Expander prior to the secondary alveolar bone graft surgery. Occlusal changes were measured in digital models that were obtained pre-expansion (T1) and 6 months post-expansion at the time of appliance removal (T2). **Results:** The NiTi Expander and QH were able to produce a differential expansion with more anterior than posterior expansion. The RPE overexpanded the posterior segments. The expansion with NiTi expander was successful in 100% of the subjects. Complications occurred in 10% of the patients and included impingement of the appliance, wire breakage, and wire embedment into palatal tissue if the expander size was too large to begin with. **Conclusion:** Due to the successful expansion results obtained in this study, ability to customize the NiTi expander with reprogramming, lack of interference with the surgical field

and its reduced cost, the NiTi Expander could be an alternative to the current methods of expansion for the treatment of patients with UCLP.

Poster #: 9

Title: SLC26 gene family participate in pH regulation during amelogenesis

Name: Kaifeng Yin

Faculty Advisor: Michael Paine

Background: Amelogenesis features two major developmental stages—secretory and maturation. During maturation stage, hydroxyapatite deposition and matrix turnover require delicate pH regulatory mechanisms mediated by multiple ion transporters. Several members of the Slc26 gene family (*Slc26a1, Slc26a3, Slc26a4, Slc26a6,* and *Slc26a7*), which exhibit bicarbonate transport activities, have been suggested by previous studies to be involved in maturation-stage amelogenesis, especially the key process of pH regulation. However, details regarding the functional role of these genes in enamel formation are yet to be clarified, as none of the separate mutant animal lines demonstrates any discernible enamel defects. **Purpose:** To investigate the functional role of SLC26 gene family in enamel formation. **Methods:** Continuing with our previous investigation of *Slc26a1–/–* and *Slc26a7–/–* animal models, we generated a double-mutant animal line with the absence of both *Slc26a1* and *Slc26a7*. **Results:** We showed in the present study that the double-mutant enamel density was significantly lower in the regions that represent late maturation-, maturation- and secretory-stage enamel development in wild-type mandibular incisors. However, the "maturation" and "secretory" enamel microstructures in double-mutant animals resembled those observed in wild-type secretory and/or presecretory stages. Elemental composition analysis revealed a lack of mineral deposition and an accumulation of carbon and chloride in double-mutant enamel. Deletion of *Slc26a1* and *Slc26a7* did not affect the stage-specific morphology of the enamel organ. Finally, compensatory expression of pH regulator genes and ion transporters was detected in maturation-stage enamel organs of double-mutant animals when compared to wildtype. **Conclusion:** Combined with the findings from our previous study, these data indicate the involvement of SLC26A1 and SLC26A7 as key ion transporters in the pH regulatory network during enamel maturation.

Poster #: 10

Title: Root Resorption of Maxillary Molar After Intrusion by Using TADs

Name: Jae Kim

Faculty Advisor: Glenn Sameshima

Background: Temporary anchorage devices (TADs) have transformed treatment planning in orthodontics as they can provide alternative options to orthognathic surgeries; however, there still are many aspects of TADs that need to be investigated to maximally utilize them in safe and controlled manners. It has shown that when TADs are used to intrude molars, root resorption can occur. **Purpose:** The objective of our study was to determine the amount of root resorption on maxillary molars after TAD intrusion and determine if the amount of root resorption is correlated to the amount of intrusion. **Methods:** TADs were used to intrude maxillary molars of 18 Korean patients between the ages under 30 years old. Cone Beam Computed Tomography (CBCT) scans which had been taken pre-treatment and post-intrusion were analyzed to assess root resorption. The scans were superimposed (OnDemand Software and Invivo 3D Imaging software) to assess the molars from which the following were measured in mm: (1) amount of molar intrusion, (2) length of the mesial root of the molar before treatment, and (3) length after treatment. **Results:** Intrusion amount varied from 0 to 4mm and root resorption amount varied 0 to 3mm when measurements were made on the superimposition images. Teeth with significant amount of intrusion did not undergo the most amount of root resorption and teeth with the smallest amount of intrusion did not undergo the least amount of root resorption. Furthermore, MB roots were not always the roots with the most significant root resorption. **Conclusion:** The amount of intrusion after TAD intrusion had no correlation to the amount of root resorption on maxillary molars. Thus, this study suggests that when TADs are used to intrude maxillary molars, root resorption may be unpredictable, but the amount may not severe or significant.

Poster #: 11

Title: TGF-β Signaling Regulates Gingival Epithelial Wound Healing and Barrier Function

Name: Nicha Ungvijanpunya

Faculty Advisor: Jian Xu

Background: The transforming growth factor-β (TGF-β) signaling pathway is involved in the regulation of cellular growth and differentiation and has multiple roles during craniofacial development and injury repair. **Purpose:** The aim of this study is to assess whether TGF-β signaling is an underlying mechanism for impaired gingival epithelial tissue repair by examining its role in the promotion of wound healing and maintenance of epithelial junction integrity. **Methods:** We used a mouse model of ligature insertion-induced periodontitis and immunostaining with phospho-Smad3 to measure TGF-β-induced intracellular signaling activity in the vicinity of the wound site. To assess the role of TGF-β in gingival epithelial wound healing and barrier function, we incubated human gingival epithelial cell (HGEC) with TGF-β for 48 hours to assess cell motility using wound healing assay and examine epithelial junction protein expression using Western blot analysis. **Results:** We found that during ligature-induced periodontitis, TGF-β signaling is activated in gingival epithelium of the diseased animal, but is impaired at the injury site, as determined by the absence of phospho-Smad3 staining, an indicator of TGF-β signaling activity. Wound healing assay showed significant higher percentages of wound closure in TGF-β-treated group but lower in SB431542-treated group. Western blot analysis showed a significant increase of claudin-1 in TGF-β-treated group but decrease in SB431542-treated group. For ZO-1 detection, there was no significant difference between control and treatment groups. **Conclusion:** We concluded that TGF-β promoted junctional integrity and wound healing in gingival epithelial tissue.

Poster #: 12

Title: The correlation between implant dimensions and marginal bone loss

Name: Shantia Kazemi Esfeh

Faculty Advisor: Homa Zadeh

Background: The relationship between the dimensions of implant or prosthesis and implant outcomes remains controversial with conflicting data. **Purpose:** The aim of the present retrospective study was to evaluate the relationship between implant or prosthesis dimensions and peri-implant marginal bone loss (MBL). **Methods:** This retrospective study consisted of 1) patients with single unit non-splinted implant restoration with adjacent teeth, being in function for more than a year in the posterior zone, 2) diagnostic radiographic images. Radiographic images were imported into Photoshop (CC 2015, Adobe) for linear measurements. The relationship between crown dimensions, implant dimensions and MBL was analyzed with Pearson correlation test. Statistical significance was considered as p-value <0.05. **Results:** Data included 100 patients with single unit non-splinted posterior implants. A positive correlation was detected between IL and mesial/distal MBL for CHS>10 (P=0.02, 0.0), between IL and distal MBL for CHS>12 (P=0.0). A positive correlation was detected between crown height space(CHS) and mesial/distal MBL for implant length(IL)>8 (P=0.03, 0.0), for IL>11 (P=0.04, 0.02), between CHS and distal MBL for IL>10 (P=0.03). MBL did not exhibit significant correlation with any of the additional parameters, including crown-to-implant ratio, crown surface, implant surface, crown width and implant diameter. **Conclusion:** According to the current study, a positive correlation between IL & MBL was detected for implants restored with CHS longer than 10 or 12mm. Additionally, CHS and MBL were positively correlated only in long implants (IL>8) whereas such correlation was not detected in shorter implants.

Poster #: 13

Title: Evaluating Efficacy of Grafting the Facial Gap at Immediately Implants

Name: Diana Sedler

Faculty Advisor: Homa Zadeh

Background: The therapeutic benefit of biomaterial added in the horizontal gap between the implant and alveolar bone during immediate implant placement remains controversial. The aim of this randomized controlled clinical trial was to evaluate whether placement of anorganic bovine bone minerals (ABBM) in the facial gap at immediately placed implants is correlated with peri-implant bone and mucosal changes. **Purpose:** The aim of this randomized controlled clinical trial was to evaluate whether placement of anorganic bovine bone minerals (ABBM) in the facial gap at immediately placed implants is correlated with peri-implant bone and mucosal changes. **Methods:** Patients with a non-restorable maxillary anterior tooth were enrolled in this study. Following tooth extraction, implants with sloped platform and crestal microthreads (Astra Tech Osseospeed Tx Profile) were placed into extraction sockets of maxillary anterior teeth and premolars, without flap elevation. Participants were randomly assigned to either experimental group (ABBM; Bio-Oss large particle size cancellous; Geistlich, Wolhusen, Switzerland) placed within the horizontal facial gap or control group (no graft). PVS impressions and CBCTs were obtained at pre-operative baseline and one year after implant placement. Study models were optically scanned and exported as STL files. The DICOM and STL files were imported into a 3D image analysis software (AMIRA) and superimposed for volumetric analysis. Linear measurements were performed to evaluate horizontal contour changes of the facial (buccal/labial) plate as well as the soft tissue thickness one year after treatment. Linear measurements were made to evaluate pre-op and post-op facial bone thickness, the position of the implant relative to the pre-op facial plate, and gap distance between implant and facial bone. Volumetric analysis were performed to evaluate the volumetric changes in the facial gap and compare them between the 2 groups. **Results:** The analysis of a representative sample is shown in Figure 1, illustrating superimposition of surface optical scans and CBCT images of per- and post-operative scans. This has allowed for determination of following quantitative measurements shown in Table 1. **Conclusion:** Superimposition of surface optical scans over CBCT imaging is a novel technique and is feasible to make linear and 3D quantitative measurements of peri-implant bone and soft tissues.

Poster #: 14

Title: Classification of 3D Maxillary Incisor Root Shape

Name: Courtney Clayton

Faculty Advisor: Glenn Sameshima

Background: Several studies in the literature have contradictory reports for the different root shapes of maxillary incisors and the susceptibility of root resorption. Most studies used 2D imaging to classify the root and subgroups identified are not consistent across studies. CBCT (3D) imaging provides for better evaluation of root shape and root resorption. **Purpose:** To determine: 1. The prevalence of abnormal root morphology. 2. If a subjective classification scheme for maxillary incisor roots can be constructed from 3D surface models using basic geometric shapes and common arch forms for criteria descriptors. 3. The reliability of a subjective 3D classification scheme for diagnosis of abnormal root forms. **Methods:** ITK-SNAP software was used to create 3D models of the pre-treatment CBCT images of maxillary incisors of each patient. All incisors were subjectively categorized using geometric shapes and common architectural arch forms. Based on classification criteria for each category, resident orthodontists and experienced orthodontists assessed the 3D models and subjectively categorized each incisor root. **Results:** Both groups of assessors identified approximately 88% of abnormally shaped roots. Experienced orthodontists identified 81.7% of the incisors as being normal in length and the orthodontic residents identified 50% of the incisors as normal in length. Assessor intra-class agreement on length and shape was low to moderate for experienced orthodontists and low for orthodontic residents. **Conclusion:** There was a low to moderate inter- and intra-class agreement for classifying incisors based on root length and shape. Therefore, the subjective incisor root classification criteria and the method for testing category reliability as presented in this study needs to be revised.

Poster #: 15

Title: 3D Assessment of Lingual Bracket Position Accuracy Using CAD/CAM Technology

Name: Tarim Song

Faculty Advisor: Andre Weissheimer

Background: While lingual orthodontics have evolved and matured to deliver excellent outcomes comparable to labial braces, and despite the meticulous digital setup and transfer of lingual appliances, bond failure is inevitable throughout the course of treatment. **Purpose:** The aims of this pilot study were to quantify and compare the accuracy of rebonding brackets with a flexible tray (FT), 3D-printed rigid jig (RJ), and direct bonding (DB); compare the accuracy of the three methods for different tooth morphologies (molar vs. premolar vs. incisor), and compare the accuracy of each rebond method in each translational dimension (buccolingual, mesiodistal, occlusogingival). **Methods:** 30 identical malocclusion models were 3D-printed, for 10 per rebond method. After bonding, they were scanned with an iTero for a superimposition study of the bracket deviations using a proprietary imaging software. **Results:** The largest deviations were observed for the DB and RJ methods, while the FT method had significantly less error. There was a lingual displacement tendency using the RJ. A gingival deviation tendency was observed using DB for all teeth and the FT for the incisor and premolar. **Conclusion:** The overall most accurate rebond method was the FT. Placement onto the molar was the most accurate across all methods. The most accurate placement was in the mesiodistal dimension for all methods. The FT method resulted in the overall most accurate bracket placement in each of the translational planes. Brackets were positioned most accurately in the mesiodistal dimension for all methods.

Poster #: 16

Title: TMJ Morphological Changes and Scoring System based on CBCT Imaging

Name: Nehi Ogbevoen

Faculty Advisor: Dan Grauer

Background: Background: CBCT imaging eliminates many of the disadvantages associated with previous modalities of imaging the TMJ. There are only a few studies focused on the prevalence of various condylar osseous changes and position. Additionally, there are currently no efficient or effective ways to quantify the severity of changes in the TMJ. **Purpose:** The purpose of this study is to further understand the prevalence of the morphologic changes to the condyle and to establish a scoring system of the morphological changes and position of the TMJ based on CBCT images to quantify the changes. **Methods:** The sample consisted of 100 patient CBCT images from a single practitioner's office in Santa Monica, CA. The condylar osseous changes and position were evaluated. **Results:** Most common findings found were flattening (23%) and posterior position of condyle (15.5%). Only sclerosis and posterior position of the joint occurred significantly more often in females as compared to males($p<.05$). No significant differences in changes to the joint between left and right condyles. No significant correlation between condyle health score and age, side, or gender. **Conclusion:** 42% of condyles evaluated by CBCT imaging showed at least one change in condylar morphology or position. The most prevalent changes seen were flattening (23%) and posterior position of the condyle (15.5%). A scoring system (scores from 0-11) to quantify changes and degree of severity in the health of each condyle was developed. In our sample showed no statistically significant association between a condyle's health score and gender, side, or age.

Poster #: 17

Title: GBR with tenting screws: retrospective analysis

Name: Navid Nobaharestan

Faculty Advisor: Homa Zadeh

Background: GBR is the most commonly used method for alveolar ridge augmentation. Various methods have been used for gaining stability of the particulate bone and membrane. One such method is the application of tenting screws to create a "tent-pole" effect. **Purpose:** The aim of this retrospective study was to investigate the dimensional gains in alveolar bone following GBR with tenting screws. **Methods:** CBCT imaging was conducted prior to ridge augmentation and again after healing of the grafted area (mean 6 months). Titanium tenting screws were installed into host bone. In all cases, autogenous bone shaving was mixed with xenograft or allograft. Attempts were made to use autogenous particulate bone and bone substitute in 1:1 proportion, though the actual ratio varied. Particulate graft material were placed into deficient alveolar bone and covered with bioabsorbable collagen membrane. Membrane was stabilized in place using bone tacks. Flap releasing was achieved to reduce flap tension by means of superficial incision in the periosteum in apical areas of the flap. Measurements were done after superimposition of pre- and post-operative CBCT images, using fixed reference points. Patient's chart were also reviewed to measured for biologic and technical complications. **Results:** Ten subjects fulfilled the inclusions and exclusion criteria of the study. All patients healed uneventfully. The mean pre-op and post-op alveolar bone width and heights were quantified. The data will be presented at USC Research Day. **Conclusions:** Significant horizontal bone gain was achieved using tent-pole technique with a relatively low complication rate.

Poster #: 18

Title: Chronic Headache Self-Efficacy Scale (CHASE): Preliminary Assessment of Reliability

Name: Meghan Lamothe

Faculty Advisor: Erica Sigman

Background: Chronic headaches affect many adults in the United States, with a debilitating impact on quality of life. Self-efficacy, or the ability to manage and control headaches, in patients with chronic headaches is low. Defining the specific elements of self-efficacy in patients with chronic headaches has not previously been measured. A patient-reported measure entitled the Chronic Headache Self-Efficacy Scale (CHASE) has been developed, but measurement properties have not been examined. **Purpose**: The purpose of this study is to examine the reliability of the CHASE. **Methods**: Participants provided demographics and completed the CHASE at the initial time-point (T1) and 24-72 hours after the initial time-point (T2). Demographics included: 1) number of headache days in the past month; 2) number of work/school days missed due to a headache; 3) current headache intensity (0-10; 0=no headache, 10=worst headache). The CHASE is a 15-item patient-report scale assessing self-efficacy of headache management and belief in the ability to perform daily activities without causing or increasing a headache. The 15 items are scored on a 5-point Likert scale (0=no confidence, 4=complete confidence; total score 0-100, 100=high positive self-efficacy). Reliability of the total score of the CHASE was measured using Interclass Correlation Coefficient (ICC 3,1), which was then used to calculate the Standard Error of the Measurement (SEM) and Minimal Detectable Change at the 90% confidence interval (MDC 90). **Results**: On average, participants reported having headaches 18±9 days in the prior month and missing 1.3±2.4 days of work/school because of headaches. 9/15 participants reported having headache at T1 (intensity 4.22±1.20); 7/15 participants reported having headache at T2 (intensity 3.71±1.60). The CHASE total score was T1: 54±21 points, T2: 53±19 points. The ICC 3,1 =0.87(CI: 0.62,0.96); SEM=7.3 points; MDC 90 =16.9 points. **Conclusion**: Preliminary results indicate excellent reliability of the CHASE, with error estimates for a single score (SEM) and change scores (MDC) that are comparable to error estimates of other patient-report scales. Participant recruitment continues in order to fully assess reliability, measurement error and responsiveness of the CHASE. This scale may provide clinicians a means to assess self-efficacy and behaviors specific to the management of chronic headaches.

Poster #: 19

Title: A diagnostic alternative to postherpetic neuralgia: varicella-zoster virus neuritis

Name: Laurel Henderson

Faculty Advisor: Kamal Al-Eryani

Purpose: Report of a case of reversible focal neuritis associated with viral infection. **Methods**: A patient was referred to the USC Orofacial Pain Clinic for focal pain in the right anterior mandible. She reported intermittent pain over the last several years that recently became persistent and continuous for one month. Clinically she exhibited severe pain and paresthesia of the right mental nerve and lip. During the first visit, we verified dental vitality and ruled out periodontal infection, cracked tooth, and dental caries. Her health history was noncontributory. At the second visit, the patient presented with history of a blister and with a clinically evident ulcer on the buccal attached gingiva adjacent to the focal pain. The patient also endorsed a history of shingles on the left side of the body five years ago. Based on this history and the recent clinical presentation, we prescribed valacyclovir 1g three times a day for one week, asked for IgM and IgG blood tests, and followed an A-B-A-B treatment design. **Results**: The patient's pain remitted completely after the valacyclovir therapy. Unfortunately her blood draw was clotted in the tube and no results were available. We discontinued antiviral therapy at this time. A few weeks after resolution, her pain returned at a mild level and we put the patient on maintenance low dose acyclovir 400mg which again completely remitted her pain. **Conclusion**: The presentation and symptoms in this case could be due to neuritis of the trigeminal nerve ganglion because the trigeminal nerve ganglion is typically where VZV resides and it is known to actively shed. We do not believe this presentation is consistent with postherpetic neuralgia because her pain history is not continuous and she has a burning symptomology. However, the rapid treatment results with valacyclovir and the sustained response with acyclovir maintenance therapy suggest actively shedding virus as the etiopathogenesis in this case. An additional blood draw after a drug holiday would be necessary to verify our conclusions in the future.

Poster #: 20

Title: 10-year institutional risk assessment for medication-related osteonecrosis of the jaw

Name: Laurel Henderson

Faculty Advisor: Parish Sedghizadeh

Background: The connection between antiresorptive medications, like bisphosphonates and denosumab, and osteonecrosis of the jaw has been well studied in the literature. **Purpose**: The findings of this study should help guide clinicians to identify patients at high risk for MRONJ, and thus patients that would benefit from risk reduction and prevention protocols. **Methods**: A 10-year retrospective case-control analysis of the patient population at the University of Southern California, Herman Ostrow School of Dentistry, found a robust population of patients of record with a history of bisphosphonate or denosumab use and a significant subset of those patients had medication-related osteonecrosis of the jaw (MRONJ). This study explores the demographic and clinical factors associated with risk for MRONJ in patients taking antiresorptive medications. **Results**: Multivariate analysis indicated that patients at greatest risk were over 60 years of age, female sex, Asian race, had cancer as a comorbidity, had a history of tooth extraction, and also patients on long-term antiresorptive pharmacotherapy. **Conclusion**: Clinicians can help guide patients at high risk of medication-related osteonecrosis of the jaw. Morbidity may be decreased in patients with several risk factors by decreasing frequency of tooth extraction by maintaining adequate oral health and utilizing prophylaxis regimens.

Poster #: 21

Title: A Novel Biofilm Mediated Osteolytic Infection Model- A Micro-CT Analysis

Name: Jasveen Wadia

Faculty Advisor: Homayoun Zadeh

Background: Peri-implantitis is a major biologic complication of implant dentistry. One obstacle in studying peri-implantitis is the lack of an appropriate animal model. Bacterial biofilm is the main cause of peri-implantitis. Bacterial biofilm is more resistant to clearance by immune components or antimicrobial agents. **Purpose:** This study was designed to establish a novel animal model to study the peri-implantitis by establishing *Aggregatibacter actinomycetemcomitans* (Aa) biofilm in vitro and transferring it to our in vivo animal model. **Methods:** Modular titanium implants and abutments were used. The abutments were inoculated in vitro with Aa. Sham-inoculated abutments served as control. Sterile titanium implants were inserted into the buccal maxillary alveolar ridge in laboratory rats. The abutments with or without established Aa biofilm were attached to implants and were followed for 8 weeks. In vivo Micro-CT imaging was performed at baseline, 3- and 8-week to examine peri-implant bone volume. The micro-CT images were superimposed in AMIRA software to evaluate the bone loss in a volumetric fashion. **Results:** Utilization of imaging software to quantify peri-implant bone loss was very sensitive and capable to detect minute linear and volumetric peri-implant bone loss and bone to implant surface contact (BISC). We analyzed the images according to bone volume and BISC at baseline, week 3, and week 8. Quantitation of peri-implant bone loss is ongoing and will be reported at USC Research Day 2018. **Conclusions:** Biofilm mediated osteolytic infection model in concert with quantitative volumetric analysis of peri-implant bone loss can provide valuable insights into the pathogenesis of peri-implantitis mediated by specific pathogens.

Poster #: 22

Title: New method of simultaneous measurements of bone and soft tissue

Name: Peiman Mehriar

Faculty Advisor: Homa Zadeh

Background: Root coverage periodontal plastic surgery procedures have long been used for the treatment of gingival recession.It's well documented that Untreated recession defects in individuals with good oral hygiene have a high probability of progressing during long-term follow-up.To the best of our knowledge, no data have been reported on the volumetric evaluation of both soft-tissue and hard tissue together. Three-dimensional (3D) optical scanning and subsequent superimposing procedures on CT scan data could be used for reproducible volumetric evaluation of gingival recession. **Purpose:** The aim of the study is to determine that whether three-dimensional (3D) optical scanning and subsequent superimposing procedures could be used for reproducible volumetric evaluation of gingival recession. **Methods:** Study models were optically scanned and digitally superimposed over pre-operative CBCT images in Amira 3D Visualization and analysis software. Measurements included Total dehiscence: CEJ-bone crest Covered dehiscence: Gingival margin-bone crest Recession depth- CEJ-gingival margin Gingival margin thickness at 1-10 mm from CEJ **Results:** The analysis of a representative sample at baseline is shown in Figure 1, illustrating superimposition of surface optical scans over CBCT imaging. This has allowed for determination of following quantitative measurements shown in Table 1. **Conclusions:** Superimposition of surface optical scans over CBCT imaging is a novel technique which allows for many clinically useful measurements, which will be used in the present investigation.

Poster #: 23

Title: Comparison of 3 modalities of root coverage: Patient-reported outcome measures

Name: Julio Moreno-Aleman

Faculty Advisor: Homa Zadeh

Background: Understanding patients' experience is an important determinant in selecting appropriate therapeutic modality. There is inadequate evidence to allow comparison of PROMs as an outcome measure for patients undergoing therapy for gingival recession defects. **Purpose:** To evaluate the patient reported outcomes (PROMs) of patients undergoing three different interventions for the treatment of multiple gingival recession defects, and attempt to compare post-operative pain of 3 modalities for coronal advancement of gingival margins to achieve root coverage: Coronally Advanced Flap (CAF), Vestibular Incision Subperiosteal Tunnel Access (VISTA) and Intrasulcular tunneling (IST) and to determine whether the addition of Leukocyte-Platelet Rich Fibrin (L-PRF) had any additional post operative benefits. **Methods:** Participants with Miller class I, II or III recession defects are currently being recruited for this study. Three days after the intervention, a visual analog scale (VAS) was administered to the volunteers to assess PROMs, including pain experience. Analgesic use was determined by counting the number of analgesic tablets used by each patient **Results:** The initial PROMs and analgesic usage data are shown below. Initial data revealed high degree of variability in pain experience and in analgesic use. Preliminary results showed VISTA + LPRF to be associated with low post-operative pain and analgesic use. A questionnaire will be completed by the participants at the end of the 12-month follow up. **Conclusions:** PROMs are a crucial element of recognizing patient experience. Further recruitment is needed to support these findings and evaluate PROMs of different modalities for the treatment of gingival recession.

Poster #: 24

Title: Histological analysis of wound healing following ridge preservation procedures

Name: Jassem Alsharah

Faculty Advisor: Homa Zadeh

Background: Alveolar ridge resorption has been considered as an inevitable consequence of tooth extraction. Atrophy of the alveolar ridge may cause esthetic and functional problems. Ridge preservation has been proposed as a strategy to reduce post-extraction bone resorption. **Purpose:** The aim of this RCT was to examine the histologic response of alveolar bone following different ridge preservation procedures. **Methods:** Thirty-six extraction sockets in 29 patients were randomly assigned to the following four treatment modalities: G1: Unassisted wound healing; G2: L-PRF; G3: collagen membrane alone; G4: algae bone graft covered with collagen membrane. Bone core was harvested 4 and 6 months post ridge preservation for histologic and histomorphometric analysis of wound healing. **Results:** Histologic observations revealed no signs of inflammation. All groups demonstrated that distinct reversal lines were evident in the woven bone, and in areas of active apposition osteoblast-like cells as well as osteoclast-like cell were observed within Howship's lacunae. Histomorphometric analysis revealed the percentage of bone volume relative to tissue volume (BV/TV) for unassisted wound healing, L-PRF, collagen membrane alone, BGM+ collagen membrane were 44± 20%, 46±26% 34±14%, 29±21% respectively. The only statistically significant difference detected was between L-PRF and BGM+collagen membrane (p=0.04). **Conclusions:** The results of vital bone formation were consistent with previous publications. The application of L-PRF was associated with significantly more vital bone than sockets with BGM+collagen membrane. Data regarding the influence of dimensional changes of sockets in various groups is currently under analysis.

Poster #: 25

Title: Conventional and Digital Methods to Evaluate Mucogingival Deformities around Teeth

Name: Goncalo Carames

Faculty Advisor: Homa Zadeh

Background: A periodontal probe until today remains the most important diagnostic tool in periodontal diseases. However, current probing methods are subject to a multitude of errors. A 3D volumetric evaluation would produce consolidated data describing the progression of gingival recession and could also be used to monitor the healing dynamic and gingival dimensions after periodontal surgery. **Purpose**: The aim of this study was to assess the correlation and agreement between conventional and digital methods to measure mucogingival deformities around teeth. **Methods**: Gingival recessions and papilla heights were measured from 12 patients at 46 sites by three examiners using the following methods: (A) clinical measurements using a periodontal probe intraorally; (B) on cast models using a caliper or (C) digital measurements on virtual models obtained by optical scans of cast models. Statistical tests were performed to analyze Intra-examiner reliability, Inter-examiner reliability, Intra-technique reliability and Inter-technique reliability analysis. **Results**: For the clinical measurements, the mean recession height was 2.98mm (±0.931); recession width was 4.37mm (±1.806) and papilla height was 3.76mm (±0.899). For the cast measurements, the mean recession height was 2.53mm (±0.767); recession width was 3.91mm (±1.479) and papilla height was 3.70mm (±0.949). For the geomagic measurements, the mean recession height was 3.48mm (±0.830); recession width was 4.23mm (±1.708) and papilla height was 4.29mm (±1.230). The Intraclass Correlations for Inter-Rater Reliability for recession height was 0.92; for recession width was 0.94 and for papilla height was 0.95. **Conclusion**: The results of this study indicate excellent Intraclass Correlations for Inter-Rater Reliability for the cast and 3D measurements. Providing a more reliable and examiner-independent technique for measurements of the soft tissue architecture could improve data quality in periodontal research and in the analysis of different clinical treatment modalities.

Poster #: 26

Title: Anti-BMP-2 Immobilized on Anorganic Bovine Bone Mineral for Vertical Augmentation

Name: Goncalo Carames

Faculty Advisor: Homa Zadeh

Background: Antibody Mediated Osseous Regeneration (AMOR) involves immobilization of anti-BMP-2 mAb on a scaffold. AMOR is intended to capture endogenous BMPs, inducing osteogenic differentiation of mesenchymal stem cells. **Purpose:** This study sought to evaluate the efficacy of chimeric anti-BMP2 mAb immobilized on anorganic bovine bone mineral (ABBM)-Collagen block stabilized with MODfix screws in bone tissue engineering. **Methods:** Eight New Zealand White Rabbits were used in this study. Extra-oral flap was used to expose the mandible. MODfix modular titanium screws were installed into the inferior border of the mandible. Anorganic Bovine Bone Mineral with 10% Collagen was pressed through the two MODfix screws followed by attachment of tenting abutment. The ABBM-C for test group was functionalized with chimeric anti-BMP-2 mAb (25 mg/ml) and for control group with isotype matched control mAb. After 12 weeks, animals were euthanized; specimens were imaged by CBCT analysis followed by histomorphometric analysis. The height of osseointegration, surface of de novo bone formation, height of de novo bone formation, number of osteocyte, osteoblast, osteoclast were measured. Test and control group outcomes were compared. **Results:** The radiographical and histomorphomertical assessments revealed that ABBM functionalized with anti-BMP-2 mAb filled was not statistically difference in all parameters at 12 week postoperatively except for the number of osteocyte at the area of 1.0-1.5 mm above than parental bone. Histologic observation demonstrated that the chimeric anti-BMP-2 mAb group revealed strongly eosinophilic osteoid tissue containing round to ovoid osteocytes within lacunae demonstrating its viability. De novo bone formation in chimeric anti-BMP-2 mAb and isotype matched control mAb groups was restricted to the region near the host bone (<1.5mm to parental bone), as well as continued up on the tenting screws. No evidence of significant osteogenesis was noted in both groups. **Conclusion:** Antibody mediated osseous regeneration (AMOR) has shown limited bone regeneration under the stringent nature of the present defect model. de novo bone formation was only observed in close proximity (<1.5mm) to the host bone. Higher number of osteocytes in the coronal portion of newly regenerated tissue was observed in sites treated with chimeric anti-BMP2 mAb. Failure of de novo bone formation may be due to lack of local injury, which normally produces mediators, including BMPs.

Poster #: 27

Title: Maxillary sinus and alveolar wrist alterations following maxillary molar extractions

Name: Essa Alwazan

Faculty Advisor: Homa Zadeh

Background: Maxillary sinus pneumatization has been proposed to occur after maxillary tooth extractions. Dimensional changes occurring in the alveolar crest after extraction have been extensively studied, however, maxillary sinus pneumatization and its possible relationship to maxillary molar extraction has not been investigated using CBCT imaging modality. **Purpose:** Investigate post-extraction spatial and dimensional changes in the maxillary sinus floor and alveolar crest ridge in extracted molar sites treated with ridge preservation using anorganic bovine bone minerals (ABBM). **Methods:** 23 pre- and post-operative CBCT images of 23 individuals who had maxillary molar tooth extraction were analyzed using Simplant 17.0 software. Pre- and post-operative CBCT images were oriented and aligned by utilizing coincident reference lines, and superimposed. Linear measurements were made for mesiobuccal (MB), distobuccal (DB) and palatal (P) roots for the height of alveolar crest, reference line to the maxillary sinus floor, and reference line to alveolar ridge.Root anatomical factors including root inclination, root width at 2mm from the radiographic apex, inter-radicular distance, periapical lesion diameter and sinus membrane thickening were also investigated in relation to post-extraction sinus floor change **Results:** Changes from pre-extraction to post-extraction were calculated and it was found that the mean for all three roots for the Vertical Height Change (VHC) of the alveolar crest was 1.45 ± 1.72 mm. This change was related to the Crest Height Change (CHC) having a mean for all three roots of 0.76 ± 1.66 mm, whereas the mean Sinus floor Change (SC) was 0.56 ± 0.46 mm. No statistically significant correlation was found between any root anatomical factors and sinus floor change. No statistically significant correlation was found between sinus floor change and vertical alveolar crest height change or between alveolar crest height change and sinus floor change for MB, DB and P roots at the p = 0.01 level. There was however, significant correlation between CHC and VHC for each root (p = 0.00). **Conclusions:** Within the limitation of the study, the result of this retrospective analysis demonstrated minimal linear dimensional changes in marginal bone height, as well as maxillary sinus floor following maxillary molar extraction and ridge preservation grafting with Anorganic Bovine Bone Minerals (ABBM). The results also demonstrated that root anatomical factors did not seem to significantly affect sinus floor change. This study has important clinical implication, suggesting that maxillary molar tooth extraction managed by ridge can lead to stable alveolar crest outcomes. The relative effect of ridge preservation on sinus floor and alveolar crest has change dimensions should be experimentally substantiated in a future randomized control clinical trial which will also include a non-grafted control group.

Poster #: 28

Title: 3D volumetric analy of post extraction sinus floor retrospective Analysis

Name: Sara Elhusseini

Faculty Advisor: Homa Zadeh

Background: Dimensional changes of the alveolar ridge crest following tooth extraction have been extensively stud-

ied. However, post extraction changes in the maxillary sinus floor have not been investigated. **Purpose:** The aim of the present retrospective study was to explore changes to the maxillary sinus floor using 3D volumetric analysis. **Methods:** 27 Pre- and post-operative CBCTs of 27 individuals who had maxillary molar tooth extraction at USC Ostrow School of Dentistry were included in this study. The CBCT images were imported into 3D software called AMIRA . Pre- and post-operative CBCTS studies were segmented so that discreet volumes of the maxillary sinus and the alveolar ridge were created. The volumes of the pre-op and post-op sinus and alveolar ridge were oriented and superimposed. Cross sections were made perpendicular to the curvature of the maxillary arch in the center of each extracted tooth. These super-imposed pre-op and post-op images were utilized for two-dimensional and three dimensional analysis of the sinus floor changes. **Results:** Examination of representative superimposed pre-op and post-op CBCT images revealed very little change in the position of the maxillary sinus floor following tooth extraction and significant dimensional changes in the alveolar ridge. This is consistent with linear measurements from 2D images reported by Hameed, et al., who have observed that the mean sinus floor vertical height changes were 0.62, 0.37, 0.4mm and the mean crestal bone height changes were 3.07, 3.33 and 2.99 in the sites of MB, DB and P maxillary molar roots, respectively. Linear measurements of superimposed CBCT 3D pre-op and post-op reveal a mean of sinus floor change of 0.10 mm in a superior direction, this mean change is less than what was reported by Hameed and the position change is in a coronal direction not apical, volumetric analysis of the sinus also revealed minimal volume change. **Conclusions:** Demonstrated feasibility of superimposing pre- and post- extraction alveolar crest and maxillary sinus. Maxillary sinus floor position at pre- and post-extraction was unchanged in vast majority of cases. Alveolar crest exhibited severe horizontal and vertical atrophy. Super-imposition of CBCT's yielded more accurate results than comparing two individual CBCTs of the same patient.

Poster #: 29

Title: Effect of Zirconia Surface Treatment on the Long-term Bond Strength

Name: Sarah Hazime

Faculty Advisor: Neimar Sartori

Background: Efficiently bonding to zirconia is an ongoing issue. Several surface treatment techniques have shown adequate short-term bond strength, however the long-term bonding still unreliable. **Purpose:** To evaluate the effect of surface treatments with potassium bifluoride (KHF2) and sandblast on long-term shear bond strength between resin cement and two dental zirconia. **Methods:** 120 multi-layered and 120 ultra-translucent multi-layered zirconia blocks (Katana, Kuraray Noritake) were randomly assigned into six groups, according to the surface treatments. Control, post-etching (post-KHF2), pre-etching (Pre-KHF2), sandblast (SB), SB + post-KHF2, SB + pre-KHF2. All blocks were then ultrasonically cleaned and primed (Clearfill Ceramic Primer, Kuraray). Composite resin (Filtek Z250, 3M ESPE) cylinders (3mm x 4mm height) were cemented to the zirconia treated surface using a dual-cure resin cement (Panavia V5, Kuraray). Half of the samples subjected to shear bond strength (SBS) testing after 24 hours and the other half were tested after artificially aging by thermal-cycling (20,000 cycles). Data were subjected to three-way ANOVA followed by Tukey post-hoc tests (α=0.05). **Results:** The bond strength was affected by the surface treatment, the aging process, and the type of zirconia ($p < .001$). Post-KHF2 of zirconia significantly increase the highest bond strength. The bond strength value of post-etched multi-layered zirconia was not affected by artificially aging process ($p > 0.05$). **Conclusions:** Potassium bifluoride etching of post-sintered multi-layered zirconia significantly improves the long-term zirconia-resin cement bonding strength.

GRADUATE POST-DOCTORAL TRAINEES

Poster #: 30

Title: Interplay between MSCs and osteoclasts supports calvarial-bone homeostasis and repair

Name: Yuxing Guo

Faculty Advisor: Yang Chai

Background: The bone remodeling process is maintained by the balance between osteoblast-driven bone formation and osteoclast-driven bone resorption. The suture provides a niche that includes mesenchymal stem cells (MSCs), osteoblasts and osteoclasts, which help maintain calvarial bone homeostasis. In the suture, osteoblasts at the osteogenic front and MSCs in the midline are in close proximity during the intramembranous ossification process. **Purpose:** Although it is known that osteoclasts are present in the suture, their functional significance has yet to be determined. The potential involvement of these cell types in the regulation of suture homeostasis remains unknown. Furthermore, a greater understanding of the relationship between MSCs, osteoblasts and osteoclasts may ultimately provide important insights into osteogenic related diseases. **Methods:** We investigated the function of Bmpr1a during suture homeostasis using mice in which Bmpr1a is conditionally deleted in Gli1+ cells (*Gli1Cre^{ERT2};Bmpr1a$^{fl/fl}$* mice). We analyzed the phenotype of these mice using microCT, H&E staining and immunofluorescence. **Results:** Here, we show that suture MSCs depend on BMP-mediated IHH signaling to balance osteogenesis and osteoclastogenesis activity in maintaining tissue homeostasis. IHH signaling and RANKL function synergistically to promote the differentiation and resorption activity of osteoclasts. CD200 and CD200R act downstream of IHH to modulate osteoclastogenesis through suture MSCs. In addition, the healing of calvarial defects after injury is regulated by MSC-mediated IHH signaling via the coordination of osteogenesis and osteoclastogenesis. **Conclusion:** Our study indicates that the interplay between MSCs and osteoclasts supports calvarial bone tissue homeostasis and repair.

Poster #: 31

Title: Constitutive activation of Shh in epithelium causes submucous cleft palate

Name: Jingyuan Li

Faculty Advisor: Yang Chai

Background: Palatal fusion is a complex, multi-step developmental process. The consequence of failure in this process is cleft palate, one of the most common human birth defects. Cleft palate is associated with multiple genetic and environmental risk factors. Mutations in the genes encoding signaling molecules in the sonic hedgehog (SHH) pathway have been identified as genetic risk factors for cleft palate in both humans and mice. However, the function of Shh signaling in the palatal epithelium during palatogenesis remains largely unknown. **Purpose:** To investigate the function of Shh signaling in the palatal epithelium during palatogenesis **Methods:** Given that the negative effect on palatogenesis following specific inhibition of Shh signaling in palatal epithelium cannot clearly explain that important components of Shh pathway are all localized in the palatal epithelium, we utilized a gain-of-function of Shh signaling mouse model, *K14-Cre;R26SmoM2* mice, to uncover the role of Shh signaling in the palatal epithelium during palatal fusion. **Results:** In this study, we discovered that constitutive activation of Shh signaling in palatal epithelium results in the occurrence of submucous cleft palate with the persistence of MEE. Further investigation revealed that precisely and temporally induced downregulation of Shh signaling is specially required in the MEE during palatogenesis, mainly because upregulation of Shh signaling in palatal epithelium affects the fate of MEE cells, maintaining the proliferation possibly due to the dysfunctional p63/Irf6 regulatory loop, and resistance to apoptosis likely induced by the enhanced cell adhesion network

through the maintenance of p63 expression. **Conclusion:** Collectively, our data illustrate that altered Shh signaling in palatal epithelium contributes to the etiology and pathogenesis of submucous cleft palate through interaction with the p63/Irf6-dependent biological regulatory loop and the p63-induced cell adhesion network.

Poster #: 32

Title: Bone targeted bisphosphonate-antibiotic conjugates for the treatment of osteomyelitis pathogens

Name: Esmat Sodagar

Faculty Advisor: Parish Sedghizadeh

Background: Osteomyelitis is a limb and life-threatening infection of bone, and is difficult to treat clinically because of inadequate efficacy of current systemic antibiotics to sites where causative bacteria can reside as biofilms on bone surfaces. BPs are a class of drugs that bind to bone and are effectively utilized for pharmacotherapy in a number of bone diseases. **Purpose:** We have designed pharmacologically inert bisphosphonates (BPs) to investigate a "target and release" chemistry approach for treating bone infections which involves delivery of antibiotics to the hydroxyapatite (HA) mineral of the skeleton via conjugation to BPs. **Methods:** For experimental purposes, the following microbial strains were used: *S. aureus* ATCC 6538, *P. aeruginosa* ATCC 15442 and *Aggregatibacter actinomycetemcomitans* (Aa) D7S1. The following antibiotics were tested: minocycline, ciprofloxacin, tedizolid, and vancomycin. The following experimental BP-antibiotic conjugates were synthesized and tested: bisphosphonate-carbamate-ciprofloxacin, bisphosphonate-carbamate-tedizolid, and bisphosphonate-ester-tedizolid. All antimicrobials were tested for their affinity to HA using HPLC, and then tested in standard susceptibility studies following EUCAST guidelines. MIC and MBEC values were calculated in planktonic and biofilm cultures, respectively. Finally, antimicrobials were tested in the setting of biofilm preventative and eradication experiments with HA in vitro and ex vivo. **Results:** In planktonic cultures using polystyrene, all tested antibiotics were more efficacious than the BP-antibiotic conjugates. However, when HA was used to test the same pathogens, the conjugates were more efficacious (K-W test, * $p<0.01$; comparator=control) than all tested antibiotics in osteomyelitis preventative and eradication experiments in vitro and ex vivo. **Conclusion:** Results show that this class of conjugates, incorporating osteoadsorptive BPs with high bone affinity, and fluoroquinolone or oxazolidinone antibiotics for bone-targeted delivery to treat osteomyelitis biofilm pathogens, constitutes an effective and promising approach to providing high antimicrobial potency at bone tissue.

Poster #: 33

Title: Molecular pathways in soft palate muscle development

Name: Eva Janečková

Faculty Advisor: Dr. Yang Chai

Background: The soft palate represents the most posterior part of the secondary palate and consists of four muscles in mice. It has several functions, including involvement in breathing, hearing, swallowing and speech, which are disrupted if the soft palate is clefted; in cases of clefting, the muscle fibers are also not well oriented and their surgical restoration is very complicated. The signaling pathways and molecular mechanism underlying soft palate muscle development are not known in detail. The results from our laboratory have shown that the mouse is an excellent model for studying soft palate development. **Purpose:** To improve understanding of the molecular pathways involved in soft palate muscle development, we investigated Wnt, Shh, Fgf and Tgfβ signalling pathways during the development of soft palate muscles. **Methods:** RNAScope was used in combination with immunohistochemistry to study the co-localization of muscle cells with various signaling molecules (Axin2, Gli1, Fgfr1/2/3/4, Fgf7/8/10, Tgfbr2). Conditional knockout mice will be generated based on the expression patterns observed. **Results:** RNAScope expression data showed the activation of Wnt, Shh, Fgf and Tgfβ signaling pathways in the soft palate muscles in mice. After co-localization with MHC (myosin heavy chain) it was shown that they are active mainly in the supporting cells around the muscle fibers and scarcely in the muscle cells. **Conclusion:** Based on RNAScope results it was concluded that the Wnt, Shh, Fgf and Tgfβ signaling pathways are expressed in the supporting cells, suggesting their possible roles during soft palate muscle development.

Poster #: 34

Title: Alk5 regulates mandible patterning and morphogenesis independent of Tgfbr2

Name: Yuan Yuan

Faculty Advisor: Yang Chai

Background: Micrognathia is a common birth defect that can be either syndromic or non-syndromic. It is also a known cause for cleft palate as well as abnormal tooth development. TGF-β signaling is critical for skeletal development, cartilage formation as well as cardiovascular development. In addition, mutations in TGF-β receptors lead to Loeys-Dietz and Marfan syndromes both of which have severe craniofacial malformations including micrognathia. This clear suggests a crucial role that TGF-β signaling played in mandible development. **Purpose:** Mutations in TGF-β receptors lead to Loeys-Dietz and Marfan syndromes both of which have severe craniofacial malformations including micrognathia. This clear suggests a crucial role that TGF-β signaling played in mandible development. I would like to investigate the different roles of TGF-β type I and II receptors played in mandible development. **Methods:** To investigate the effect of TGF-β signaling on craniofacial development, we generated mice with conditional knockout of *Alk5* or *Tgfbr2* in neural crest cells (*Wnt1-Cre;Alk-5*$^{fl/fl}$ and *Wnt1-Cre;Tgfbr2*$^{fl/fl}$). **Results:** *Alk5* and *Tgfbr2* mutant mice developed similar craniofacial phenotype including cranial bone malformation, cleft palate and short mandible. However, in certain regions, such as frontonasal area and mandible, *Alk5* mutant mice have a more severe phenotype compared to *Tgfbr2* mice. We looked at developing mandibular process at E10.5, and increased cell apoptosis was found in the aboral region of *Alk5* mutant mice whereas no significant difference was found in *Tgfbr2* mutant mice. Also, both proximal-distal and oral-aboral axis patterning have been disrupted in *Alk5* mutant mice due to the altered expression of a series key patterning genes. Inhibition of BMP signaling partially reversed the increased apoptosis in mandibular arch of Alk5 mutant mice. **Conclusion:** In conclusion, our data suggests that Alk5 regulates mandible patterning independent of Tgfbr2. Also Alk5 controls the survival of CNC cells by regulating expression of *Foxc1, Gsc* and other genes in the aboral region of the developing mandible.

Poster #: 35

Title: Distinct skeletogenesis capacities of mesenchymal stem cells from different origins

Name: Xia Han

Faculty Advisor: Yang Chai

Background: The origins of facial bones and the mechanism of their skeletogenesis are different from those of the appendicular skeleton. Previous studies have shown that cranial neural crest-derived mandible MSCs (CNCCMSCs) form more cortical bone than mesoderm-derived bone marrow MSCs (BMMSCs) from long bones. In this study, we investigate the regulatory mechanisms underlying this phenomenon. **Purpose:** To investigate the regulatory mechanisms underlying the distinct skeletogenesis capabilities of mesenchymal stem cell (MSC) populations from different origins. **Methods:** We used cell sorting to isolate BMMSCs from femurs of 8 weeks old *Wnt1-cre;tdTomato* mice, using CD45, CD31 and Ter-119 as negative selectable markers to eliminate hematopoietic cells. CNCCMSCs were similarly isolated from mandibles of the same group of mice, using Wnt1 as an additional positive selectable marker. We performed RNA-seq on these CNCCMSCs and BMMSCs. In order to understand the regulation of the differential gene expression in these two cell populations, we also performed ChIP-seq, ATAC-seq and motif analysis to characterize the gene regulatory elements. **Results:** We found that several neural crest specifier genes have higher expression in CNCCM-

SCs compared to BMMSCs. We also found BMMSCs have higher expression of genes related to endochondral ossification and angiogenesis. We are performing ChIP-seq and ATAC-seq analyses to identify the different landscapes of gene regulatory elements and how origin-specific genes regulate the different enhancer landscapes. **Conclusion:** This study will contribute to our understanding of how MSCs from different origins give rise to distinct skeletogenesis capacities. This work may lead to the development of better strategies for different types of bone regeneration.

Poster #: 36

Title: Ezh2 determines the molar root number

Name: Junjun Jing

Faculty Advisor: Yang Chai

Background: EZH2 is a key component of polycomb repressive complex 2 (PRC2), which is responsible for Histone 3 Lysine 27 trimethylation (H3K27Me3). EZH2 is the subunit of PRC2 that catalyzes this methylation, leading to transcriptional repression of target genes. Ezh2 is required for neural crest derived cartilage and bone formation. However, the role of Ezh2 in tooth development is unknown. **Purpose:** We aim to elucidate the role of Ezh2 in molar development and its function in patterning the tooth furcation. **Methods:** Four transgenic mouse models were generated in this study: *Osr2KI-Cre;Ezh2$^{fl/fl}$*, in which *Ezh2* expression is lost in the tooth mesenchyme; *DMP1-Cre;Ezh2$^{fl/fl}$*, in which *Ezh2* is knocked out in odontoblasts; *K14-Cre;Ezh2$^{fl/fl}$*, in which *Ezh2* is knocked out in epithelial cells; and *Gli1-Cre^{ER};Ezh2$^{fl/fl}$*, in which *Ezh2* is lost in root progenitor cells. MicroCT scanning and histological analysis were combined to analyze the phenotypes of these mice. **Results:** When Ezh2 expression was lost in the tooth mesenchyme in *Osr2KI-Cre;Ezh2$^{fl/fl}$* mice, only one root formed and the root furcation was defective. Moreover, the alveolar bone and periodontal ligament were also affected. Interestingly, the development of the upper jaw appeared same phenotype with mandible in *Osr2KI-Cre;Ezh2$^{fl/fl}$* mice, indicating the root development in upper jaw and mandible share similar mechanism. In contrast, inactivation of *Ezh2* in epithelial cells lead to delayed furcation development. Loss of *Ezh2* in odontoblasts and root progenitor cells resulted in normal furcation and molar development. **Conclusion:** Our study provides evidence that *Ezh2* in the tooth mesenchyme determines the root number in mouse molars by determining the pattern of the furcation prenatally. Our future studies aim to identify critical downstream genes or signaling pathways that are associated with furcation development.

Poster #: 37

Title: The First Year Inventory in High-Risk Sample for Autism Diagnosis

Name: Helen Lee

Faculty Advisor: Grace Baranek

Background: The FYI is a 63-item parent-reported screening instrument that is designed to identify 12-month-old infants at risk for ASD in a community sample. However, to date, there has been limited research on the FYI's utility in the high-risk population. **Purpose:** The purpose of present study is to examine the performance of the First Year Inventory (FYI) in a high-risk sample of 12-month-old infants who are the younger siblings of children diagnosed with autism spectrum disorder (ASD). **Methods:** In the study, 86 parents of high-risk infant siblings of children diagnosed with ASD and 35 low-risk control infants filled out the FYI at 12 months of age. At 36 months follow-up, the clinicians blinded of the infants' risk backgrounds made the clinical diagnosis of ASD. **Results:** The results showed that FYI discriminated the infants who later diagnosed with ASD from who did not within the high-risk group, as well as from the low-risk control group at 36 months. The non-ASD high-risk infants showed higher total and domain FYI risk scores than the non-ASD low-risk control group, and the high-risk non-ASD infants were more likely to later diagnosed with other developmental problems than the low-risk non-ASD groups. **Conclusion:** Overall, the performance of the instrument in the high-risk sample using the community-normed FYI cutoff points was moderate to fair in sensitivity, specificity, and negative predictive values, although they seemed to be less optimal. Findings are discussed with respect to the importance of considering the risk status and other characteristics of the sample population in designing effective screening instrument.

Poster #: 38

Title: Molecular regulatory mechanisms of soft palate development

Name: Jifan Feng

Faculty Advisor: Yang Chai

Background: Our previous studies suggested that cranial neural crest (CNC)-derived cells migrate into the primordium of multiple myogenic sites in the craniofacial region, and are in close contact with myogenic cells at later stages. Tissue-specific ablation of the TGFβ signaling pathway in CNC-derived cells leads to defects in the proliferation, pattering, and differentiation of myogenic cells in the tongue and other craniofacial muscles. Therefore, we hypothesized CNC-derived cells regulates soft palate myogenesis through tissue-tissue interaction. **Purpose:** The coordinated movements of the soft palate and pharyngeal muscles are crucial for speech, swallowing, breathing and hearing. The aim of this study is to understand the molecular mechanisms controlling soft palate muscle formation for better repair of soft palate defects. **Methods:** We performed RNA sequence to compare gene-expression profile of CNC-derived cells with non-CNC-derived cells, and identified signaling molecules that are enriched in the CNC-derived cells. **Results:** From the RNA sequence data analysis, we found that the retinoic acid (RA)-synthesizing enzyme retinaldehyde dehydrogenase 2 (Raldh2) gene, *Aldh1a2*, is enriched in the CNC-derived cells. In the developing soft palate of embryonic mice, we further confirmed that Raldh2 is expressed specifically in the CNC-derived cells in close contact with myogenic cells, and that retinoic acid signaling is exclusively activated in the myogenic cells. **Conclusion:** Cranial neural crest cell-derived retinoic acid may regulate soft palate muscle formation via tissue-tissue interaction.

Poster #: 39

Title: Cardiac Specific Deletion of PRMT1 Protects against TAC-Induced Ventricular Dysfunction

Name: Jiang Qian

Faculty Advisor: Jian Xu

Background: Cardiac fibroblast and its programmed conversion into activated myofibroblasts are critical regulators in myocardial extracellular matrix (ECM) homeostasis. Our lab recently identified protein arginine methyltransferase 1 (PRMT1) as a new in vitro regulatory mechanism for cardiac fibroblasts differentiate to myofibroblasts. **Purpose:** To define the in vivo roles of PRMT1 in fibroblasts to myofibroblasts conversion and whether it regulates cardiac fibrosis and dysfunction during chronic injury. **Methods:** We generated a fibroblastic-specific *Prmt1* knockout mouse model (*PnMCM$^{+/+}$:Prmt1$^{flox/flox}$:R26R$^{YFP/YFP}$*). We performed TAC or sham surgery in *PnMCM$^{+/+}$:Prmt1$^{flox/flox}$:R26R$^{YFP/YFP}$* (experimental group) and *Prmt1$^{flox/flox}$:R26R$^{YFP/YFP}$* (control group) mice and maintain their tamoxifen diet throughout the experiment. **Results:** We found that deletion of *PRMT1* in cardiac fibroblasts prevented the myofibroblasts differentiation, decreased cardiac fibrosis, increased the vessel density and preserved the ventricular function after 8w TAC, compared with controls. **Conclusion:** PRMT1 is a key regulator in cardiac fibroblasts fate and plays an important role in cardiac remodeling and heart failure.

Poster #: 40

Title: African-ZIKV Causes More Severe microcephaly than Asian-ZIKV and Dengue

Name: Qiang (Eric) Shao

Faculty Advisor: Jian-Fu Chen

Background: Zika virus (ZIKV) infection has been linked with fetal brain abnormalities. By developing the first postnatal mouse model associated with ZIKV, we recently established the causative link between ZIKV and microcephaly. Specifically we discovered that Zika virus infection disrupts neurovascular development and results in postnatal microcephaly with brain damage (Development, 2016). The Zika virus (ZIKV) has two lineages: the ZIKV-Asia and ZIKV-Africa isolates. There is no scientific documentation of ZIKV-Africa related brain defects. Dengue virus (DENV), a close family member of ZIKV, is also not linked with brain disorders. **Purpose:** The purpose of this study is to understand the virulence differences of ZIKV-Asia lineage, ZIKV-Africa lineage, and Dengue virus on brain development. **Methods:** Dengue Virus Serotype 2 (DENV2) was used to infect fetal brains in our comparison study . E14.5 embryos were injected intracerebrally with either DENV2 or ZIKV (African or Asian lineage strain). Cell culture of in vero cells were utilized for our in vitro experiments. **Results:** We found that DENV2 is sufficient to cause microcephaly due to increased cell death in neural progenitor cells (NPCs) and neurons. Compared to ZIKV-Asia, DENV2 grows slower, causes less neuronal death, and fails to cause postnatal animal death. Surprisingly, our side-by-side comparison uncovers that ZIKV-Africa is more potent in causing brain damage and postnatal lethality than ZIKV-Asia. In comparison to ZIKV-Asia, ZIKV-Africa grows faster in NPCs and in the developing brain, causes more pronounced cell death in NPCs and neurons, resulting in more severe neuronal loss. **Conclusion:** Together, these results reveal that DENV2 is sufficient to cause microcephaly but in a less severe manner than ZIKV-Asia. ZIKV-Africa is more virulent and causes more severe brain damage than ZIKV-Asia, highlighting the need to better understand the neurological complications associated with ZIKV-Africa.

Poster #: 41

Title: Characterization of the BBDS mouse: conditional knock-in of *FGFR2*^{M391R} allele

Name: Diana Rigueur

Faculty Advisor: Amy Merrill-Brugger

Background: Fibroblast Growth Factor Receptor 2 (FGFR2) regulates osteoprogenitor proliferation, self-renewal and terminal differentiation during skeletal development, yet it remains unclear how the receptor distinctly elicits these cellular processes. We discovered a nuclear feature of FGF signaling that will elucidate with more specificity how FGFR2 regulates skeletal development. This mechanism emerged from our analysis of Bent Bone Dysplasia Syndrome (BBDS), an FGFR2 disorder where the cell-fate decisions of osteoprogenitor cells are biased towards self-renewal over differentiation. We developed a mouse with a conditional knock-in of the *FGFR2* M391R mutation that causes BBDS in humans that renders FGFR2 in the nucleus. **Purpose:** The purpose of the study is to understand the breadth of roles that nuclear FGFR2 plays in the development and in pathology of skeletogenesis. **Methods:** Primary cell isolation of chondrocytes and osteoblasts was conducted. To mediate recombination, cells were either infected with control Adeno-GFP or with Adeno-Cre. DNA and mRNA was isolated from these cells to observe genomic recombination and expression of the conditional allele. Another batch of cells also infected with Adeno-GFP or Adeno-Cre were subjected to immunofluorescence to observe FGFR2 localization of the cell. A cross with the neural crest driver, Wnt1-Cre and the *FGFR2*^{M391R} floxed allele was conducted to ask what role nuclear FGFR2 plays in the development of craniofacial development in vivo. **Results:** DNA sequencing of cultured primary chondrocytes treated with Adeno-GFP or Adeno-Cre, confirmed efficient Cre-mediated recombination of the knock-in allele. Cell culture experiments and immunofluorescence further showed that the knock-in *FGFR2*^{M391R} allele functions like that of BBDS, aberrantly translocating FGFR2 to the nucleus. Moreover, generation of a *Wnt1-Cre; FGFR2*$^{M391R/+}$ mouse renders a phenotype, in neural crest derived tissues, strongly suggesting that the mutation is dominant in mouse as it is in humans. **Conclusion:** Overall our preliminary data shows that the conditional knock-in *FGFR2*^{M391R} mouse can be used to model human BBDS and can also be used to parse out the unknown endogenous and pathogenic functions of nuclear FGFR2 during development.

Poster #: 42

Title: Protein Methylation in Epithelial-to-Mesenchymal Transition of Epicardial Cells.

Name: Olan Jackson-Weaver

Faculty Advisor: Jian Xu

Background: The epithelial to mesenchymal transition (EMT) is an important cellular mechanism in a diverse range of biological processes such as development, wound healing, cancer metastasis, and organ fibrosis. EMT is a key mechanism for epicardial cell activation and differentiation. Epicardial cells are progenitors for cardiac interstitial cells and a source of growth factors during development. Our recent work has established an important function for the protein arginine methyltransferase PRMT1 in EMT. **Purpose:** We tested the hypothesized that PRMT1 is required for EMT and invasion in epicardial cells. **Methods:** Cell culture, western blots, real-time PCR, siRNA, RNA sequencing, embryo culture using Epicardial specific WT1-CreER mouse line. **Results:** We found that PRMT1 siRNA treatment of epicardial cells prevented EMT protein changes and the migratory and invasive EMT phenotypes. PRMT1 siRNA increased levels of p53, a regulator of EMT. RNA sequencing demonstrated that PRMT1 is required for a significant fraction of EMT gene expression changes in epicardial cells. PRMT1 flox/flox Wt1-creER mice showed a loss of epicardial EMT and caused a thin myocardial wall with dilated blood vessels. **Conclusion:** Epicardial EMT requires PRMT1. PRMT1 reduces p53 expression to allow EMT to occur. These studies establish a role for protein methylation in the EMT process, and could lead to potential treatments for heart failure and other diseases affected by EMT through manipulating PRMT1 activity.

Poster #: 43

Title: C9orf72 Insufficiency Contributes to Bone disorders and neurodegeneration through autophagy

Name: Li Ma

Faculty Advisor: Jianfu Chen

Background: Both neurodegeneration (e.g. amyotrophic lateral sclerosis (ALS), Alzheimer's disease (AD), Parkinson's disease (PD), and cerebrovascular disease (CVD)) and bone disorders (e.g. osteoporosis, fragility fracture, and osteoarthritis) are widely known to increase in prevalence with age. Interestingly, a strong correlation between poor bone health and neurodegenerative diseases has been observed during the past decade. While current studies on bone disorders and neurodegenerative diseases have generally been conducted independently from each other. Although aging is a common risk factor, what common molecular and cellular processes underlie aging in these tissues and how they drive aging-related bone disorders and neurodegeneration remain largely unknown. **Purpose**: Our goal is to establish autophagy deficiency as a shared aging mechanism that drives dysfunctional craniofacial bone regeneration and neurodegeneration by focusing on autophagy regulator C9orf72. **Methods**: We investigated the function of C9ORF72 during bone homeostasis and neurodegeneration using mice in which *C9orf72* gene are conventionally deleted (*C9orf72*$^{-/-}$). We analyzed the phenotype of our mice model using microCT, H&E staining and immunofluorescence. **Results**: We found that C9orf72 is expressed in suture MSCs, osteoclasts, macrophages/microglia, and neurons. Aged *C9orf72*$^{-/-}$ mice exhibit motor defects and neurodegeneration as well as a delay in bone development and healing and osteoporosis-like defects. Molecular and cell biological studies shows that C9orf72 forms a protein complex with Atg101 and promotes autophagy, **Conclusion**: 1. C9ORF72 is a positive regulator

of autophagy through interaction with SMCR8 and ATG101, insufficiency of which can cause autophagy impairment. 2. C9orf72 is expressed in suture MSCs, macrophages/microglia, and neurons. 3. *C9orf72* null mice exhibit both bone development and homeostasis defect and neurodegeneration phenotype, which may indicate that autophagy deficiency is a shared aging mechanism that drives both bone disorders and neurodegeneration in C9ALS/FTD. Future directions: 1. Test the hypothesis that impaired autophagy due to C9orf72 deletion exacerbates aging of MSCs, neurons, and macrophages; 2. Determine the importance of C9orf72-mediated autophagy in macrophages for craniofacial bone regeneration and neurodegeneration; 3. Test the hypothesis that C9orf72-mediated autophagy in suture MSCs and neurons is essential for craniofacial bone regeneration and neurodegeneration, respectively; 4. Use *C9orf72* MSCs- or neurons- conditional knockout mice to test the crosstalk between neuro and bone system.

Poster #: 44

Title: Disruption of Smcr8-dependent lysosomal regulation promotes macrophage dysfunction and inflammation

Name: Mei Yang

Faculty Advisor: Jianfu Chen

Background: Hexanucleotide repeat expansion in C9ORF72 causes the most common forms of frontotemporal dementia (FTD) and amyotrophic lateral sclerosis (ALS). SMCR8 forms a protein complex with C9ORF72, yet the in vivo function of SMCR8 is unknown. *C9orf72* knockout mice developed progressive splenomegaly and lymphadenopathy. Autophagy-lysosome dependent macromolecule degradation is regulated by mTORC1 signaling. However, in terminally differentiated cells, such as peritoneal macrophages, it is unclear that whether mTORC1 signaling has a distinct role or not. **Purpose**: We aim to elucidate the role of Smcr8 in regulating lysosome function and inflammation in peritoneal macrophages. **Methods**: All animal studies were conducted under protocols approved by the institutional animal care and use committee at the University of Georgia or University of Southern California. Peritoneal macrophages, or spleen tissues were lysed with RIPA buffer (RIPA buffer). Protein lysates were separated utilizing SDS-PAGE, and were incubated with antibodies indicated in the figures followed by Horseradish Peroxidase (HRP)-labeled secondary antibodies (Bio-Rad, USA). **Results**: We found that *Smcr8* knockout mice developed splenomegaly and lymphadenopathy. Increased inflammatory cytokines and defective polarization in mutant peritoneal macrophages. Impaired lysosomal degradation in mutant peritoneal macrophages. Hyperactive mTORC1 signaling with proper reactivation capacity in mutant peritoneal macrophages. Pharmacological inhibition and promotion modulation of lysosomal function increases or decreases alters mTORC1 signaling. **Conclusion**: Smcr8 regulates lysosomal degradation, disruption of which leads to defective macrophage polarization, inflammation, and splenomegaly and lymphadenopathy in mice. We found that lysosomal inhibition activates mTORC1 signaling in peritoneal macrophages. Future studies should determine C9orf72's potential roles in lysosomal degradation, macrophage polarization, and inflammation regulation. Whether normal functions of C9orf72/Smcr8 are disrupted in related FTD/ALS diseases should also be determined.

Poster #: 45

Title: RNA-Seq: Profiling Gene Expression Patterns in *Aggregatibacter actinomycetemcomitans*

Name: Natalia Tjokro

Faculty Advisor: Casey Chen

Background: *Aggregatibacter actinomycetemcomitans* (Aa) is a Gram negative oral facultative anaerobe associated with periodontitis. The acquisition of accessory genes via horizontal gene transfer leads to the emergence of five evolutionarily distinct clades of human Aa. The functions of these genes, many were organized into genomic islands, were unknown. These accessory/genomic island genes accounted for 14.1 – 23.2% of Aa genomes, and they might confer Aa with survival advantages under stress conditions. **Purpose**: To investigate the distinct functions of Aa accessory and core genes by examining the gene expression profiles of a wild type Aa strain D7S-1 in different growth conditions. **Methods**: Aa strains were grown in Trypticase Soy Broth with 0.6% yeast extract, RPMI media, or in a Green's medium (Green et al. 1982) at 37°C with 5% CO_2. RNA was isolated and strand-specific direct cDNA sequencing (RNA Seq) was performed. The sequencing reads were then mapped to each strain's corresponding genomes. The number of transcripts for each gene was normalized and log2-transformed to yield the expression level. **Results**: The expression levels ranged from 2-215 with a normal distribution pattern for both core (N=1,704) and accessory genes (N=409) in all experimental conditions. The median expression value for core genes was ~2 fold higher than that of the accessory and island genes. The core and island genes were affected differently under stress, and differentially expressed genes had been found in different growth conditions. An example is the fimbrial gene operon, which showed the highest ratios in gene expression between biofilm and planktonic Aa, with a noticeable decrease in the differential gene expression ratios from the first to the last gene in the operon. **Conclusion**: Accessory and island genes share a similar expression pattern but lower expression level in comparison to core genes. Differentially expressed core and island genes may explain strain-to-strain variation in Aa phenotypes.

Poster #: 46

Title: Fgfr2 patterns cell fate at the tendon and bone interface

Name: Ryan Roberts

Faculty Advisor: Amy Merrill

Background: Tendon is joined to bone through a transitional connective tissue known as the enthesis. The enthesis is morphologically graded from tendinous to osseous and arises from bipotent progenitors that co-express Scleraxis (Scx) and Sox9 (Scx+/Sox9+). **Purpose**: While it is known that Scx+/Sox9+ progenitors differentiate into either tenocytes or chondrocytes, the mechanisms that spatially resolves their bipotency has remained unclear. **Methods**: Using mouse genetics, we demonstrate that FGF signaling determines the spatial pattern of Scx+/Sox9+ progenitor cell differentiation in the mammalian lower jaw. **Results**: We show that conditional inactivation of *Fgfr2* in the neural crest-derived Scx+/Sox9+ progenitors of the mandible disturbs their regional differentiation into tenocytes and chondrocytes, induces ectopic bone formation, and disrupts the gradation of the tendon insertion. We find that, upon loss of Fgfr2, altered Scx+/Sox9+ progenitor differentiation is tightly correlated with changes in Notch-Jagged-Delta signaling, including loss of salt-and-pepper expression of Notch2. Correspondingly, conditional deletion of Notch2 and Jagged1 in neural crest cells leads to abnormal development of mandibular entheses. **Conclusion**: These results suggest that Fgfr2 establishes a spatial gradient of cell fate during enthesis morphogenesis by regulating Notch signaling.

Poster #: 47

Title: Modeling Wdr62-related microcephaly disease in 3D cerebral organoid system

Name: Wei Zhang

Faculty Advisor: Jianfu Chen

Background: Primary microcephaly is a neurodevelopmental disorder in which brain size is markedly reduced. Mutation in *WDR62* is one of common genetic causes of autosomal recessive primary microcephaly (MCPH) in human. Mouse model studies suggest that Wdr62 depletion mediates the reduction of neural progenitor cells (NPCs), which in turn underlies microcephaly phenotypes. However, mouse mutants have failed to recapitulate the severely reduced brain size seen in human patients. The complexity of the human brain has made it difficult to study many brain disorders in model organisms, highlighting the need for an in vitro model of human brain development. The development of 3D cerebral organoid system offers an opportunity to generate human brain-like organs to investigate mechanisms of human brain development and

disorders. **Purpose**: Using 3D cerebral organoid system to recapitulate MCPH disease phenotypes seen in human patients and study the mechanisms of action of WDR62 during human brain development. **Methods**: We used CRISPR-Cas9 technology to generate the *WDR62* mutation human pluripotent stem cell (PSC) lines. Then cerebral organoids were generated in 3D culture system using wild-type and gene-edited PSC lines. **Results**: We found that *WDR62* deletion causes smaller cerebral organoid sizes than wild-type control group, which is similarly found in *Wdr62* null mouse model. WDR62 ablation leads to NPCs population reduced, delayed cell cycle re-entry and premature differentiation of NPCs during cerebral organoid development. **Conclusion**: Our results demonstrated that 3D cerebral organoid system can be used to recapitulate Wdr62-related microcephaly disease in human, suggesting a new strategy to study human developmental diseases in central nerve system.

Poster #: 48

Title: Novel targets for mesenchymal stem cell osteogenic differentiation.

Name: Andres Stucky

Faculty Advisor: Jiang Zhong

Background: Multiple myeloma (MM) is a disease characterized by multifocal malignant plasma cells depositions that arise in the bone marrow, usually in the skull, ribs, long bones, and vertebrae. Among the most dramatic symptoms of MM is bone disease, caused by increased bone resorption by osteoclast, which weakens the bone matrix and makes bones highly susceptible to fracture. Traditional chemotherapeutic measures to treat MM usually include a combination of radiation, immunomodulators, monoclonal antibodies and, bisphosphonates. **Purpose**: Recently, manipulating the Mesenchymal Stem Cells (MSC) in bone marrow showed promise for treating MM. MSC are multipotent stem cells that have the unique ability to localize to the bone marrow and other cancer sites where they can control the tumor microenvironment (TME) by interacting with host cells through, gap, tight adherent junctions, and desmosomes, in addition to cytokines. Further MSC can be ushered to differentiate into bone forming osteoblast to restore bone density and counteract the pernicious consequences of bone disease. **Methods**: We used single cell capture and next generation sequencing to identify molecular facilitators of osteogenic differentiation. **Results**: We have elucidated two previously unidentified checkpoints directing MSC mobility/adhesion and osteogenic differentiation. Namely the integrin regulating, Fak and Pyk2 proteins whose activity can directly regulate MSC focal adhesion and osteogenic differentiation respectively. **Conclusion**: These results indicate that FAK PYK2 inhibitors can eventually be used to alleviate Myeloma induced bone disease and restore osteogenic differentiation.

Poster #: 49

Title: Relapse Pathway of Glioblastoma Revealed by Single-cell Molecular Analysis

Name: Xuelian Chen

Faculty Advisor: Jiang Zhong

Background: Glioblastoma multiforme (GBM) remains an incurable brain tumor. The highly malignant behavior of GBM may, in part, be attributed to the heterogeneity of its intraclonal (subclonal evolution) genetic and phenotypic diversity. **Purpose**: Identifying the molecular pathways driving GBM relapse may provide novel, actionable targets for personalized diagnosis, characterization of prognosis and improvement of precision therapy. **Methods**: We screened single-cell transcriptomes, namely RNA-seq data of primary and relapsed GBM tumors from a patient, to define the molecular profile of relapse and further verified by meta-analysis of RNA-seq data from more than three thousand patients. **Results**: Characterization of hundreds of individual tumor cells identified three mutated genes within single cells, involved in the RAS/GEF GTP-dependent signaling pathway. **Conclusion**: The identified molecular pathway was further verified by meta-analysis of RNA-seq data from more than three thousand patients. This study showed that single-cell molecular analysis overcomes the inherent heterogeneity of bulk tumors with respect to defining tumor sub-clonal evolution relevant to GBM relapse.

Poster #: 50

Title: Integration and expression of beta-galactosidase in *Aggregatibacter actinomycetemcomitans*
Name: Eduardo Ayala

Faculty Advisor: Casey Chen
Background: Gram-negative *Aggregatibacter actinomycetemcomitans* (Aa) is a major etiological agent of periodontitis. Conventional gene expression reporter constructs are often made in extrachromosomal vectors, which may be dependent on selective agents to maintain their stability. This requirement often precludes the use of reporter gene constructs in experiments that involve co-culture of multiple microbial species. **Purpose**: As a proof of principle we designed a stable genome-integrated beta-galactosidase construct in Aa. **Methods**: A non-functional secA pseudogene in the genome of Aa strain D7S-1 was chosen as the insertion site for the reporter. The construct consisted of the upstream region of secA, a transcriptional terminator sequence, two test promoters (ltx and fim), a beta-galactosidase coding sequence, a spectinomycin resistance cassette, and the downstream region of secA. These fragments were cloned into pUC19 and then used as a template for PCR. This amplified donor DNA was then used for natural transformation of Aa. Transformants were screened by PCR and verified by sequencing and X-gal cleavage. A promoterless negative control was generated by linking the transcriptional terminator directly to the beta-galactosidase CDS. **Results**: Two beta-galactosidase expressing Aa strains were made, driven by either a JP2-type leukotoxin promoter or a wildtype fimbrial protein promoter as well as a promoterless negative control. Both of the ltx and fim driven reporter strains were found to exhibit beta-galactosidase activity as detected by visual examination of X-gal cleavage on agar plates and through luminescence using the Beta-Glo Luciferase Assay System while the negative control exhibited no beta-galactosidase activity. **Conclusion**: Our results show that our genetic manipulation strategy results in a stably integrated construct and may prove useful for gene expression studies in Aa.

Poster #: 51

Title: Expression profiling of different PRMTs during osteogenic differentiation

Name: Abhijit Shinde

Faculty Advisor: Jian Xu

Background: PRMTs catalyze the methylation of arginine residues of different proteins, including histone and non-histone proteins, to regulate processes like mRNA translation and splicing, DNA repair, cell fate determination and signal transduction. It has been linked with cancer, muscular, metabolic as well as neurodegenerative disorders. However, it's functional significance in bone development and homeostasis is unknown. In this project we characterize the expression pattern of all PRMTs during osteogenic differentiation. **Purpose**: To determine the expression pattern of different protein arginine methyltransferases (PRMT1-9) during osteogenic differentiation. **Methods**: We employed immunohistochemical (IHC) staining and qRT-PCR to evaluate PRMT expression during osteogenesis in the MC3T3 and C2C12 cell lines as well as in Newborn Mouse Calvaria derived pre-Osteoblasts (NeMCO). **Results**: Results of IHC staining showed slightly increased expression of PRMT3 only in MC3T3 cells but not in NeMCO or C2C12 cells during osteogenesis. PRMT4 expression and nuclear localization increased in all three types of cells after inducing osteogenesis. qRT-PCR data showed that different Prmts show distinct patterns of expression in MC3T3, C2C12 and NeMCO during osteogenic differentiation. **Conclusion**: IHC results suggest that PRMT4 might have functional importance in osteogenic differentiation. Additional experiments are needed to further investigate the role of PRMTs in osteogenesis.

Poster #: 52

Title: Cardiomyocyte-specific deletion of PRMT1 improves heart function after myocardial infarction

Name: Jian Wu

Faculty Advisor: Jian Xu

Background: Every 42 seconds an American will suffer for a heart attack. Protein-arginine-methyltransferase-1 (PRMT1) is a primary asymmetric dimethyltransferase. It methylates histone H4R3 facilitating histone acetylation and chromatin accessibility. It also methylates multiple non-histone proteins (e.g., FoxO). *PRMT1* global knockout leads to embryonic lethality. Tissue specific role of PRMT1 was not well studied. **Purpose**: We assessed PRMT1 cardiac specific functions in a mouse heart attack model. **Methods**: Myocardial infarction induced by left-anterior-descending-coronary artery (LAD) ligation; Ultrasound; Western Blot; Immuno-Fluorescence; Fibrosis analysis (Sirius Red staining). **Results**: Cardiomyocyte-specific deletion of PRMT1 was achieved by crossing *Myh-6^{mer}Cre^{mer}* to *PRMT1$^{fl/fl}$* mouse. Left-anterior-descending-coronary-artery (LAD) ligation were used for myocardial infarction (MI) induction. We found PRMT1 is highly expressed in the nucleus of cardiomyocytes and forms irregular structures at the infarction-border. Genetic deletion and pharmacological inhibition of PRMT1 both dramatically improves heart function (e.g, left ventricle ejection fraction) and decreased infarction-induced left ventricle dilation. A group of non-myocyte cells, with surged signal of asymmetric dimethyl-arginine (ADMA) and PRMT1 expression, thoroughly infiltrated into the PRMT1-deleted heart, but not control mice, starting from 24h up to 2 weeks post injury. **Conclusion**: Suppression of PRMT1 facilitates the mouse heart recovery from "heart attack" induced by LAD ligation. We will further characterize the roles of PRMT1 in the heart, and identity the infiltrating PRMT1 high non-myocyte population and their function. Fully understanding the protective mechanism will pave the road in the future when pharmaceutical inhibition of PRMT1 could be used in clinical trials for heart attack patients.

Poster #: 53

Title: Performance of Light Emitting Diode Curing Units and Dental Radiometers

Name: Reham Alsamman

Faculty Advisor: Jin-Ho Phark

Background: Efficient LCUs are necessary to polymerize resin composites properly. Conventional LCUs can degrade over time, however, minimal data is available on the degradation of modern LED LCUs. **Purpose:** (1) Evaluate the long-term performance of light emitting diode (LED) light curing units (LCUs) used in a dental educational institution. (2) Evaluate the effect of tip contamination on the radiant emittance of LCUs. (3) Compare the performance of two dental radiometers measuring the radiant emittance of LED LCUs. **Methods:** (1, 2) The radiant emittance of 780 LED LCUs used in pre-clinical and clinical courses at Herman Ostrow School of Dentistry of USC was measured with a handheld dental radiometer (Bluephase Meter [BM-I]). Each LCU was measured yearly between 2013 and 2016 as part of a quality control program. Type of LCU (cordless or corded), manufacturer, model, age (in years), and tip contamination were recorded. (3) Additionally, 142 brand new LED LCUs (VALO, Ultradent) were measured using BM-I and Bluephase Meter II [BM-II] radiometers. All data were statistically analyzed using a repeated measures mixed model at a significance level of α=0.05. **Results:** (1) Radiant emittance measurements were significantly reduced in year 1 ($p<0.0001$). However, values in years 0, 2, and 3 were not significantly different from each other ($p>0.05$). (2) Tip contamination significantly decreased radiant emittance ($p<0.0001$). (3) Comparing BM-I and BM-II radiometers revealed a significant difference in the measured radiant emittance ($p<0.0001$). BM-II measurements were higher than those of BM-I. **Conclusions:** Radiant emittance of LED LCUs can vary over time, but no long-term degradation was observed. Periodic performance evaluation is necessary as contamination or damage of the light tips can attribute to decrease in the radiant emittance. Different radiometers will result in different readings, which needs to be considered when switching devices over time.

Poster #: 54

Title: Twist1 and Tcf12 as regulators of postnatal suture microenvironment

Name: Devon Ehnes

Faculty Advisor: Yang Chai

Background: Craniosynostosis is a condition in which the sutures in the skull prematurely fuse. Saethre-Chotzen syndrome results from a mutation in the transcription factor *TWIST1*. Recently, another transcription factor, TCF12, has been identified in Saethre-Chotzen patients: mice with conventional heterozygous mutations for both *Tcf12* and *Twist1* developed bilateral craniosynostosis. Treatment for craniosynostosis requires surgical intervention in which a "suture" space is created in the patient's skull. While this treatment is often successful, as many as 50% of Saethre-Chotzen patients experience suture refusion. Our study aims to identify the mechanism behind refusion using mouse models with the ultimate goal of preventing suture refusion. **Purpose:** To understand the role of Twist1 and Tcf12 in the postnatal suture microenvironment and to identify binding sites that they co-regulate. **Methods:** *Gli1CreER;tdT;Twist1$^{fl/fl}$* and *Gli1CreER;tdT;Tcf12$^{fl/fl}$* were injected with tamoxifen for three days, samples were harvested at 4- and 8-weeks post-injection, fixed overnight in 4% PFA, μCT scanned, then decalcified in 20% EDTA for 1.5 weeks. Samples were then dehydrated in sucrose, embedded in OCT, and sectioned. **Results:** Conditional loss of Twist1 in adult sutures resulted in narrowed rather than fused sutures 8 weeks post-induction. However, loss of Tcf12 in preliminary studies resulted in narrower sutures only 4 weeks post-induction. Finally, Twist1 is downregulated in *Gli1-CreER;Tcf12$^{fl/fl}$* mutants, suggesting that Tcf12 and Twist1 may work together to maintain the stem cell niche. **Conclusions:** We hypothesize that Tcf12 plays a role in maintaining postnatal patency and that Tcf12 is a candidate factor involved in suture refusion following surgical intervention. We plan to investigate the role of Tcf12 in suture homeostasis, and the interaction of Twist1 with Tcf12 to control this process. We want to identify the molecular mechanism by which Twist1 and Tcf12 interact and operate to regulate MSC homeostasis. This study will advance the molecular understanding of MSC maintenance in patients with craniosynostotic diseases.

Poster #: 55

Title: Alx1 is an important morpho-modulation module in avian craniofacial development

Name: Stephanie Tsai

Faculty Advisor: Cheng-ming Chuong

Background: Craniofacial anomalies is still the most common birth abnormalities while most cases are categorized as idiopathic. The diversity of craniofacial anatomy, mostly the beak in avian, adapts birds to different eco-morphological opportunities. Thus, the avian beak is a nature-selected model to study maxillofacial morphogenesis. **Purpose:** Despite that several candidate genes, including *Alx1*, have been reported to control beak to certain shapes, how and which these potential regulators work is usually not being discussed. We hypothesize that Alx1 is a morpho-modulation module, which controls beak shapes through Twist/Snail and being regulated by Bmp/Smad in avian. **Methods:** *Alx1* expression in chicken, duck, and quail is examined by in situ hybridization in HH st.15-36. The function of Alx1 is studied via genetic perturbation (overexpression, dominant negative disturbance, short hairpin knockdown and CRISPR knockout by lentiviral systems). The regulatory regions of Alx1 are confirmed by lentiviral reporter system. By comparing the ChIP-seq, ATAC-seq and RNA-seq of wild types to Alx1-disturbed beaks, we can identify the up- and down- stream direct regulators of *Alx1*. **Results:** Although the general expression pattern of *Alx1* doesn't vary too much among the avian, the temporal-spatial distribution of several genes are specially remarked—which leads to the development of certain dimension in the beak. *Alx1* promoter locates near the first exon, where several transcriptional factors would

bind and regulate its expression. **Conclusions:** This study builds up several lentiviral tools to study the genetic/epigenetic in chicken. Alx1 is an important genetic modulator participating in avian beak morphogenesis.

GRADUATE PRE-DOCTORAL CANDIDATES

Poster #: 56

Title: A peptide-based bioinspired approach to reconstructing multi-layered aprismatic enamel

Name: Kaushik Mukherjee

Faculty Advisor: Janet Moradian-Oldak

Background: Two amelogenin-inspired peptides (P26 and P32) were rationally designed based on the functional domains of native amelogenin. Application of amelogenin-inspired peptides promoted the formation of durable enamel-like apatite layers. **Purpose:** To characterize amelogenin-inspired peptides and test their potential to a) assemble into an organized scaffold and b) to reconstruct an oriented layer of synthetic aprismatic enamel in situ. **Methods:** Human third molars were longitudinally sectioned into 2mm slices and immersed in a demineralizing solution (pH 4.6) at 37° C for 2 hours. Peptides were applied on days 1 and 3 and the coated slices (n=5) were incubated in artificial saliva for 7 days. The structure and assembly of the synthetic peptides at physiological pH were characterized using CD and TEM. In vitro mineralization with and without the peptides was monitored under in situ Raman spectroscopy and TEM. Crystal morphology, orientation, composition and mechanical performance of the remineralized layers were studied using SEM, XRD, EDS and nanoindentation tests. **Results:** The synthetic peptides displayed a characteristic nanostructured scaffold reminiscent of 'nanospheres' seen in the enamel matrix and effectively controlled apatite nucleation in vitro resulting in the formation of smaller crystallites. SEM and XRD images revealed that repeated peptide applications to tooth slices reconstituted multi-layer, oriented enamel-like apatite, forming a seamless interface with underlying native enamel. There was a ~2-fold increase in the hardness and modulus of peptide-treated samples when compared to demineralized enamel. **Conclusion:** Functional domains of native proteins may offer an effective strategy for designing peptides for hard tissue engineering.

Poster #: 57

Title: Translational regulation of neural progenitor cells (NPCs) and brain development

Name: Stephanie Herrlinger

Faculty Advisor: Jianfu Chen

Background: While many transcriptional regulators of neural progenitor cells have been identified, few post-transcriptional regulators have. The RNA-binding protein Lin28 is a heterochronic gene regulator. Lin28 single knockouts exhibit microcephaly. Mammals have two homologs of Lin28, Lin28A & Lin28B. Double knockouts exhibit neural tube defects and embryonic lethality. This study sought to examine the post-transcriptional roles of Lin28 in brain development. **Purpose:** To examine post-transcriptional regulation of neural progenitor cell behaviors in neurodevelopment. **Methods:** In vivo mouse models: Lin28a, Lin28b mutant mice, Rpl24 (Belly Spot and Tail) hypomorphic mice, Lin28a overexpression transgenics. Polysome profile analyses combined with RNA-seq experiments to identify downstream post-transcriptional targets of Lin28 activity in the brain. **Results:** We found that Lin28 modulates protein synthesis rate in vivo, and in doing so maintains the NPC cell fate. It does this in part by promoting ribosome biogenesis and maturation. **Conclusion:** Post-transcriptional regulators of neurodevelopment play important temporal roles to potentiate NPC proliferation. This is important for brain development, as it must grow quickly over a relatively short period of time.

Poster #: 58

Title: C9ORF72/SMCR8 complex plays a dual role in autophagy

Name: Chen Liang

Faculty Advisor: Jianfu Chen

Background: The intronic GGGGCC hexanucleotide repeat expansion in chromosome 9 open reading frame 72 (*C9ORF72*) is the most common genetic cause of both frontotemporal dementia (FTD) and amyotrophic lateral sclerosis (ALS). Reduced C9orf72 expression levels have been reported in C9FTD/ALS patients, however the normal function of C9orf72 remains largely unknown. **Purpose:** Although both C9ORF72 and SMCR8 have been implicated in autophagy, experimental evidence of their functions is lacking. This project aims at investigating C9ORF72/SMCR8's functions in regulating autophagy and its action mechanisms. **Methods:** Flag-C9orf72 complexes were purified from HEK293 cytoplasmic extract. The Smcr8tm1(KOMP)Vlcg ES cells were obtained from the University of California, Davis, Knockout Mouse Project Repository. The Mouse Genetic Core Facility at National Jewish Health at Denver, CO, performed the ES cell injections into C57BL/6N blastocysts. MEFs were isolated from E15.5 wild-type and *Smcr8* mutant embryos, and cultured in Dulbecco's modified Eagle's medium (DMEM) with 15% fetal bovine serum (FBS) and penicillin/streptomycin (50 μg/ml). **Results:** We report that C9ORF72 is a component of a multiprotein complex containing SMCR8, WDR41, and ATG101. *Smcr8* knockout cells exhibit impaired autophagy induction, which is similarly observed in C9orf72 knockdown cells. Mechanistically, C9ORF72/SMCR8 interacts with the key autophagy initiation ULK1/FIP200/ATG13 complex and the interaction is enhanced under amino acid starvation conditions. Smcr8 regulates the expression of the ULK1 complex and has an opposite role in regulating the activity of ULK1 compared with C9orf72. In addition to modulating autophagy induction, the complex also regulates later stages of autophagy. Whereas autophagic flux is increased in *C9orf72* knockdown cells, depletion of Smcr8 results in a reduced flux with an abnormal expression of lysosomal proteases. **Conclusion:** C9ORF72 and SMCR8 have similar functions in modulating autophagy induction by interacting with the ULK1 complex and play distinct roles in regulating late steps of autophagy.

Poster #: 59

Title: Amelogenin Ameloblastin Interactions and Function in Developing Enamel Matrix

Name: Rucha Bapat

Faculty Advisor: Janet Oldak

Background: Our lab has previously shown that amelogenin and ameloblastin colocalize in developing enamel. Their fragments continue to colocalize in the maturing enamel and are within a few nanometers of each other (Mazumder et al., 2014, 2016). N-terminal fragments of amelogenin interact with exon 5 of ameloblastin in-vitro (Su et al., 2016). Yet, few studies have observed their cooperative function in enamel development. **Purpose:** To test the hypothesis that amelogenin and ameloblastin interact and have cooperative function in enamel development. **Methods:** Three different techniques were used to show interactions between amelogenin and ameloblastin. Five-day-old mouse incisor tissue was fixed, decalcified, and immunolabeled. In-vivo colocalization patterns were analyzed and quantified with Leica SP8 confocal microscope. In-vitro binding between recombinant amelogenin-ameloblastin was shown by co-immunoprecipitation. Elutions were analyzed using Western Blots. Their in-vitro cooperative function was tested by hydroxyapatite binding. Peptides derived from different regions of ameloblastin (Su et al., 2016), and recombinant amelogenin were incubated with hydroxyapatite. Protein adsorption was measured using Pierce™ BCA protein assay kit. **Results:** Amelogenin-ameloblastin colocalized within ameloblasts and at the secretory face of ameloblasts in 5-day-old mouse incisor. Recombinant ameloblastin eluted along with amelogenin in co-immunoprecipitation experiments confirming their in-vitro binding. Full length amelogenin bound most effectively to hydroxyapatite followed by peptide derived from exon 5 of ameloblastin. Further, we will

mix amelogenin-ameloblastin to determine how their interaction affects hydroxyapatite binding. **Conclusion:** Amelogenin-ameloblastin interact, and play a cooperative role during enamel formation. Exon 5 portion of ameloblastin interacts with amelogenin as well as hydroxyapatite. Hence, together they may be responsible for controlling mineralization and maintaining enamel prism architecture.

Poster #: 60

Title: PHF6 -controlling the choice of neural crest and neural fates

Name: Yuhan Sun

Faculty Advisor: Ruchi Bajpai

Background: *PHF6* mutations cause a rare X-linked disease, Borjeson Forssman Lehmann syndrome (BFLS). When observed the patients, we realized that many phenotypes (thick calvarium, broad jaw, and big earlobes) are neural crest-derived cells expansion and brain tissue reduction (Mental retardation, Microcephaly), which indicates that PHF6 may have some important function in making choice between NCC and neural fates. NCC is known differentiating from the neural plate, however, how does PHF6 influence this process is not known yet. **Purpose:** This project aims to understand the function of PHF6 in making choice between neural crest cells (NCC) and neural fates. **Methods:** BFLS patient NCCs was induced in our lab in vitro to do the differentiation experiments. Xenopus was used as in vivo animal model. Phf6 morpholino was injected into the embryos to knockdown *phf6*, and then in situ hybridization was used to detect some marker genes' expression. **Results:** We found that, in the patient induced cells, there are accelerated differentiations happened in many different steps. In Xenopus, phf6's expression in the outer layer of the NCC was showed by in situ hybridization. A significant neuro plate reduction was observed in *phf6* knockdown side. **Conclusion:** We showed that when knockdown *PHF6*, more NCCs were formed from the neural plate through the accelerated differentiation, which causes the reduction in brain tissue and expansion in craniofacial tissue later. Moreover, PHF6 may have a very fundamental role in these processes, and the knowledge of how PHF6 control the differentiation may help us understand more about the brain and face development.

Poster #: 61

Title: Understanding Mechanism of Endocrine-Resistant Metastatic Breast Cancer

Name: Jonathan Amzaleg

Faculty Advisor: Min Yu

Background: Breast Cancer (BC) is the most prevalent cancer amongst women and is the second most lethal cancer in women. The survival percentage is drastically reduced in metastatic BC patients. Metastasis is caused by tumor cells shedding from the primary site and entering the blood stream to travel to other organs. These shed tumor cells are called circulating tumor cells (CTC) and they provide an important understanding of the genetic changes that take place in these cells during metastasis. More than two-thirds of breast cancer patients are ER positive meaning they express ERα. Due to this fact a common treatment for early stage breast cancer is endocrine therapy. This can either be drugs which prevent estrogens from binding to the ERα or Aromatase Inhibitors (AI) which prevents production of estrogens through androgens. Despite these treatments, 30% of patients show innate resistance and 40% of those who initially respond well eventually acquire resistance. One of the mechanisms by which this works is some of the tumor cells bear a ESR1 mutation which is resistant to endocrine treatment. These cells are then become ultimately enriched in the tumor and thus make up a large portion of the cells which detach from the primary tumor site and travel in the blood. **Purpose:** The goal of this project is to elucidate the role of a mutation in the *ESR1* gene which expresses a constitutively active Estrogen Receptor Alpha (ERα). We hypothesize that the ER mutant is regulated differently than its wild type counterpart. Understanding the mechanism by which mutant ER is regulated may help develop better treatment options of women with metastatic breast cancer. **Methods:** Our lab is unique in that we have optimized the ability to grow CTCs in culture. We have successfully derived CTC cell lines from 6 different patients. One of the CTC lines comes from a patient harboring an *ESR1* mutation (BRX68). BRX68, as well as common ER-responsive cell lines, and those same cell lines but CRISPR engineered to bear the ESR1 mutation, was used to perform Chromatin Immunoprecipitation followed by High-Throughput Sequencing (ChIP-seq) on the ERα to determine if the binding enrichment changes between the Mutant ER and the Wild Type ER. We also performed RT-qPCR to determine if a combination of other inhibitors alongside current endocrine treatment (Fulvestrant) could better target ER responsive genes. **Results:** We observed that the Mutant ER is enriched more in the promoter regions compared to that of the Wild Type ER which is more enriched in the enhancer regions. We also found regions that are specific to only the mutant ER from the different cell lines, but not the Wild Type. We found that the gene *KMT2B* (which is part of the MLL complex) was enriched in our CTC line and some of the genetically engineered knock in lines. When we inhibited KMT2B and treated with Fulvestrant, ER-responsive gene expression decreased. **Conclusions:** We have shown that the mutant ER is enriched in unique regions not noted in wildtype ER which suggests a different mechanism by which the mutant ER is regulated. We also showed that inhibiting one of the genes for which the mutant ER was enriched along with endocrine therapy was effective in decreasing expression of ER target genes. These results may provide an approach for sensitizing endocrine-resistant tumor cells to therapy.

Poster #: 62

Title: Role of Fgfr2 in the development of the posterior-frontal suture

Name: Laure Bobzin

Faculty Advisor: Amy Merrill

Background: Dysregulation of developmental processes can lead to a myriad of craniofacial defects including craniosynostosis. Craniosynostosis can have serious medical implications ranging from physical deformity to cognitive and developmental defects which are currently only treatable through surgery. Research has revealed the family of fibroblast growth factor receptors, particularly FGFR2, to be central in the proper regulation of cranial suture development. However, more research is needed to understand the complex role of this molecule in controlling cellular differentiation and proliferation within the frontal bones and suture mesenchyme that comprise the posterior frontal suture. **Purpose:** This study will use the mouse model to test the hypothesis that Fgfr2 is critical for regulating development of the posterior frontal suture and acts as a switch between proliferation and differentiation through asymmetric cell division. **Methods:** Through a combination of histological, molecular, and in vitro analyses, I aim to elucidate the role of Fgfr2 in regulating cell fate determination, asymmetric cell division during cellular differentiation, and self-renewal of mesenchymal progenitor cells during the development and fusion of the posterior frontal suture. **Results:** Preliminary data shows a defect in the formation of the posterior frontal suture in neural crest specific conditional knockouts of *Fgfr2*. Further analysis is needed to determine the developmental origin of this defect and determine the key players affecting the establishment of metopic suture tissues. **Conclusions:** Going forward, we plan to use an Axin2-Cre mouse model to determine the role of Fgfr2 specifically within the undifferentiated mesenchymal progenitor cells within the suture to determine during which stage of development Fgfr2 is playing the most vital role. In addition, we are developing a cell line that has fluorescent labeling of Fgfr2 to track its localization within cells and determine if peturbation of membrane-nuclear shuttling is what causes our defect.

Poster #: 63

Title: 3D Genome Reorganization During Development and Disease

Name: Kaivalya Shevade

Faculty Advisor: Ruchi Bajpai

Background: Understanding how cell fate decisions are controlled will enable us generate patient specific cells which can be used for cell replacement therapies. Recent discoveries have revealed that the organization of the genome inside the nucleus regulates cell type specific gene expression. Hence, identifying the mechanisms of genome organization dynamics during a fate transition might help us understand how fate choices are made. **Purpose:** The purpose of the project is to identify, visualize and understand the reorganization of the 3D genome that might occur during a cell fate transition. **Methods:** We used neural crest cell (NCC) ectomesenchymal transition as a model to study genome organization changes. Ectomesenchymal fate transition was induced in the NCCs using a defined media. DNA movements were observed using a DNA binding dye DAPI or SiR-hoescht. **Results:** Within 96hr of media change, majority of the cells underwent a dramatic morphological change-from having several long filopodial processes (like ectodermal migratory cells) to becoming flat with large lamellopodia (like mesenchymal cells) along with upregulation of ectomesenchymal markers like ITGA1, FOXP1. During this fate transition, majority of the cells showed micron scale movements of DNA within the nuclei. Owing to the DNA movements the nuclei transiently expand to about 2-3 times their volume and eventually return to their normal size. The movement of DNA is independent of cell cycle progression and does not correlate with increased DNA amount as demonstrated by lack of BrDU uptake during nuclear expansion. CHD7, a chromatin remodeling protein, is necessary for micron scale DNA movements and fate transition as revealed by shRNA knockdown experiments and CHARGE patient derived NCCs. **Conclusions:** We hypothesize that, this CHD7 dependent DNA movement represents a change in 3D chromatin organization, necessary for mesenchymal fate acquisition and that CHD7 might play a direct role in the large-scale movement of DNA.

Poster #: 64

Title: Cognitive Task Analysis Instruction to Improve Learning of OMFS Procedures

Name: Daniel Kohanchi

Faculty Advisor: Allen Huang

Background: CTA helps drive the education and clinical decision-making capacity of the oral surgeon. CTA utilizes instructional protocol and simulation to ultimately increase clinical outcomes. The goal is to minimize error while improving and maximizing the learner's ability to have multiple options to refer to should different scenarios arise. **Purpose**: The purpose of this study is to determine the efficacy of CTA in improving patient outcome within the scope of an operator-anesthetist model using modern technology and simulation based scenarios. **Methods**: The experiment was a single-blinded experimental design. 3rd year dental students (n = 19) were randomly assigned to two different study groups. The first group was taught the diagnosis and treatment of obstruction of patient ventilation during a third molar extraction procedure in the operator-anesthetist model by an expert OMFS instructor using free recall. The second group was taught using a CTA-guided instructional protocol. **Results**: The time of recognition, stimulation, intervention, treatment of airway obstruction and administration of reversal agents was faster in the group that received the CTA-guided instructional protocol. The average time to recognize a change in vital signs was 6.4 seconds in the CTA-guided group and 9 seconds in the free recall group. The average time to stimulate the patient following an obstruction was 7.33 seconds in the CTA-guided group and 7.88 seconds in the free recall group. The average time to intervention was 32.33 seconds in the CTA-guided group and 47.57 seconds in the free recall group. The average time to utilize reversal agents was 36 seconds in the CTA-guided group and 72.5 seconds in the free recall group. **Conclusion**: The CTA-guided instructional protocol enables dental students to better diagnose and properly treat an airway obstruction in a time-based clinical setting at a faster rate.

Poster #: 65

Title: Neural Crest-Derived Forebrain Pericytes in Development and Disease

Name: Casey Griffin

Faculty Advisor: Ruchi Bajpai

Background: Defects in or loss of functional forebrain pericytes leads to breakdown of the integrity of the BBB, causing leakage of toxins and pathogens into the brain and compromising the immune-privileged state of the brain. Leakiness of the BBB has recently been found to play a part in numerous neurodegenerative diseases, most notably Alzheimer's disease. Despite their importance in pathophysiology and onset and progression of disease, little has been done to characterize these cells at a global and an individual level, and in the context of disease. **Purpose**: Forebrain pericytes are critical players in the blood-brain barrier (BBB). Despite their importance, little is known about forebrain pericytes and what makes this population of pericytes both able to maintain the BBB and become prone to damage with agining and disease. My project focuses on understanding what defines forebrain pericytes as a unique pericyte population, with emphasis on their developmental source as well as their transcriptome and epigenome architecture, and the changes in these aspects associated with disease. **Methods**: I have developed a system of generating forebrain pericytes from neural crest cells in vitro. I have characterized these cells functionally and transcriptomically, comparing to primary brain pericytes across different species. I have also generated pericytes from AD patient cells and compared these to primary patient pericytes and controls to begin to characterize the pericyte-specific defects in Alzheimer's disease. **Results**: I have identified pericyte defects that are common across different patients and mutations of Alzheimer's Disease, honing in on possible general pathways important to pericyte function at the BBB. I have also shown that the in vitro system I created is able to recapitulate in vivo conditions in both the wild type state and the disease state when compared to both primary human and primary rat samples. **Conclusion**: My in vitro method of generating forebrain pericytes is able to provide insights into the roles pericytes play in development and maintainence of the BBB, as well as the mechanisms of various defects associated with disease. This system can be used to study pericytes of different AD mutations, as well as be applied to other diseases involving pericytes, such as ALS and Parkinson's.

BIOKINESIOLOGY AND PHYSICAL THERAPY CANDIDATES

Poster #: 66

Title: Brain-Behavior Relationship: Interhemispheric Inhibition and Bimanual Coordination in Skilled Musicians

Name: Yi-Ling Kuo

Faculty Advisor: Beth Fisher

Background: As interhemispheric inhibition (IHI) is essential for dexterous motor control, bimanual skill developed with instrument playing may result in increased IHI in musicians. However, it is unclear whether there is any difference in the relationship between interhemispheric inhibitory circuits and bimanual motor skills in skilled musicians compared to non-trained individuals. **Purpose:** To compare the relationship between interhemispheric inhibition (IHI) and bimanual coordination in skilled musicians compared to non-musicians. **Methods:** Thirty-six musicians and 36 non-musicians participated. An 8-element finger sequence task (FST) was used to test bimanual coordination. Speed, accuracy, and variability (standard deviation) of key pressing duration were recorded. Using transcranial magnetic stimulation, IHI was measured as Ipsilateral silent period (iSP), both in left (L) and right (R) hemi-

spheres, as well as iSP difference (R - L). Canonical correlation was used to identify linear relationships between the IHI and bimanual coordination measures. A general linear model was used to compare the IHI-bimanual coordination relationship between musicians and non-musicians. **Results:** Compared to non-musicians, musicians demonstrated significantly better bimanual coordination (faster speed, higher accuracy, and less variability). No differences in iSP were observed between the two groups. However, canonical correlation showed that the composite IHI variables (L, R, and R-L iSP) were significantly related to bimanual coordination in musicians ($r = 0.5$), but not in non-musicians ($r = -0.006$). The strength of the relationship was significantly greater in musicians than in non-musicians ($p = 0.001$). **Conclusion:** Prolonged musical training strengthened the relationship between interhemispheric inhibitory circuits and bimanual motor skill.

Poster #: 67

Title: Knee valgus during running: A late swing phase problem

Name: Jia Liu

Faculty Advisor: Christopher Powers

Background: Excessive knee valgus during running has been shown to contribute to knee pain in runners.1 Compared to males, females tend to exhibit greater knee valgus during running.2-6 While most studies focused on stance phase kinematics, studies also have reported that females display greater knee valgus at initial contact than males.2-4. **Purpose:** To determine whether late swing phase knee valgus is associated with stance phase knee valgus. **Methods:** 15 female and 10 male healthy recreational runners (26.7±6.4 years old) were instructed to run at a controlled speed of 3.4 m/s along a 14-m runway. Knee joint kinematics during running were collected using an 11-camera motion capture system (250 Hz). Average knee valgus during the late swing phase and peak knee valgus during the stance phase were calculated. Pearson correlation was used to determine the association between late swing and stance phase knee valgus. **Results:** Average knee valgus angles during late swing were positively associated with peak knee valgus angles during stance of running ($R2=0.604$, $p<0.0001$). **Conclusion:** Our results indicate that knee valgus during the stance phase of running is influenced in part, by swing phase kinematics. Future studies should consider potential causes of abnormal knee valgus during the late swing to better understand mechanisms of excessive knee valgus during the stance phase of running.

Poster #: 68

Title: Piloting of Paired Associative Stimulation to Modulate Resting-state Intracortical Connectivity

Name: Andrew Hooyman

Faculty Advisor: Carolee Winstein

Background: Resting-state Intracortical connectivity measured by electroencephalography (EEG) can be used as a robust predictor of motor skill learning and stroke recovery. However, a method capable of modulating resting-state intracortical connectivity has not been well established. An innovation in Transcranial Magnetic Stimulation (TMS) research is the combined use of Paired Associative Stimulation (PAS) with electroencephalography (EEG) to modulate and measure changes in resting-state brain activity. **Purpose:** The overall purpose of this experiment is to examine the initial feasibility of using Paired Associative Stimulation (PAS) to increase targeted intracortical connectivity. **Methods:** Individual participants either received 120 pulses of real PAS with a 5 ms delay (PAS+5; N = 3) or sham PAS with a 100 ms delay (PAS+100; N = 2) between the paired pulses. The lead pulse was applied over the orbital frontal cortex and the proceeding pulse was applied to the dorsal lateral prefrontal cortex. To determine the effect of PAS, resting state EEG data was collected pre-PAS, during PAS and post-PAS. **Results:** Visual analysis of Pre/Post-PAS resting-state EEG contrast demonstrated a trend of the PAS+5 condition to increase measures of functional connectivity between the targeted electrodes compared to the PAS+100 condition. Additionally, there was also a longitudinal trend in facilitation of intracortical connectivity while PAS+5 was being applied. **Conclusion:** Preliminary results demonstrate the application of PAS+5 can feasibly modulate specific resting state intracortical connectivity. Future work should focus on recruiting larger samples sizes and utilize more robust study designs to statistically confirm PAS effectiveness at manipulating resting-state intracortical connectivity.

BIOKINESIOLOGY AND PHYSICAL THERAPY STUDENTS

Poster #: 69

Title: Assessing response rate for a Positioning Device Survey

Name: Marcelo Rosales

Faculty Advisor: Beth Smith

Background: Wearable sensors possess the capability to quantify infant physical activity; however, they lack the ability to qualitatively describe the context of the activity. Paper logs have been used to address this limitation, but electronic logs may be more practical. **Purpose:** The purpose of this study was to assess the response rate (RR) of a smart phone based application. **Methods:** Pediatric researchers developed two versions of the survey. Version 1 (V1) surveyed caregivers on 4 random days, 6 times a day, in 2-hour intervals. V1 asked about the current position and devices being used. Versions 2 (a&b) surveyed caregivers for 2 or 7 consecutive days, 6 times a day, in 2-hour intervals (2a), plus one whole day survey, in a 12-hour interval (2b). V2 asked about the duration infants spent in various positions and devices in the past 2-hours or for the whole day. Thirteen caregivers with infants (1-6months) completed one of the surveys setting described prior. Here we compare RR from 1) consecutive days and non-consecutive days and 2) 2-hour vs. full-day intervals. **Results:** V1 (n=3) had a median RR of 83.33% (max:95.83%, min:41.67%), while 2a (n=11), had 88.14% (max:100%, min:57.14%). In comparison to 2a, 2b had a median RR of 100% (max:100%, min:0%). **Conclusion:** Overall, the results from our pilot study suggest that whole day surveys asked on consecutive days resulted in a higher median RR. Further development and validation of our smart-phone survey should prompt participants once a day, consecutively to produce higher RR.

Poster #: 70

Title: Trunk/Tibia Orientation Predicts Hip/Knee Moment Ratios During Dynamic Activities

Name: Rachel Straub

Faculty Advisor: Christopher Powers

Background: It has been suggested that increased use of the knee extensors relative to the hip extensors may contribute to various knee injuries. Recent studies have shown that a forward trunk posture during lunging and squatting lessens loading at the knee, as does a more upright tibia. Whether the trunk and tibia have a distinct relationship with the hip to knee extensor moment ratio during dynamic tasks however, is not known. **Purpose:** To determine if trunk and tibia orientation can be used to infer the hip to knee extensor moment ratio during dynamic activities. **Methods:** One healthy female with no current lower-extremity pain participated. Lower-extremity kinematic and kinetic data were obtained while the subject performed 6 dynamic tasks (Drop Jump, Step Down, Lateral Shuffle, Side- Step-Cut, Deceleration, and Triple Hop) with various trunk orientations (self-selected, trunk forward, trunk upright). Regression analysis was performed to determine if the trunk/tibia orientation was a predictor of the hip/knee moment ratio among the 18 conditions. **Results:** The trunk/tibia orientation was a significant predictor of the hip/knee moment ratio across all tasks ($R^2 = 0.67$, $p < 0.001$). **Conclusion:** This pilot study suggests that the orientation of the trunk and tibia may be

used to predict the hip to knee extensor moment during dynamic tasks. As such, clinicians may be able to characterize movement strategies and muscular demands based on the relationship between the trunk and tibia during dynamic tasks.

Poster #: 71

Title: Variability of leg movements across seven days during early infancy

Name: Weiyang Deng

Faculty Advisor: Beth Smith

Background: Infants with or at risk of developmental disabilities tend to have different movement patterns and characteristics. Early intervention aims to provide beneficial motor experience for infants at risk and promote neuromotor development. To detect infants' typical movements patterns in the natural environment, we are using wearable sensors to measure the characteristics of leg movements infants produce across days and relate movement experience to skill development. **Purpose:** To determine whether one day is sufficient to represent an infant's typical performance, or more days are needed. **Methods:** We used wearable sensors to collect 7 consecutive days of full-day leg movement activity, 7-13 hours per day, from 10 infants with typical development between the ages of 1-5 months. We identified each leg movement's average acceleration, peak acceleration and duration. **Results:** Absolute difference between the average of first two days and the standards (average of seven days) of average acceleration, peak acceleration and duration dropped below 5% of the standard(3.8%, 4.4% and 3.3%). Wilcoxon signed rank test shows there is no significant different between the average of first two days and standards across all measurements (p=0.508, 0.799, 0.878). **Conclusion:** The variability of leg movement kinematic data across seven days is visually within a limited range in infants with typical development. The results suggest it is better to collect data for two consecutive days. Our results will inform the clinical measurement of full-day infant leg movement for neuromotor assessment and outcome measurement purposes.

Poster #: 72

Title: Cerebrovascular Mechanisms of Cognitive Enhancement after Periodized Resistance Training

Name: Timothy Macaulay

Faculty Advisor: E. Todd Schroeder

Background: Exercise is a promising strategy to slow or prevent the progression of cognitive decline and dementia. RT is recommended for older adults for its putative role in the protection against sarcopenia, but its effects on brain health have been less-well studied. Demonstrating rapid health benefits following high-intensity RT may improve the clinical efficacy of such interventions. In addition, further investigations are necessary to understand the mechanisms of RT-induced cognitive enhancement that link skeletal muscle physiology and function with brain morphology and neuroplasticity. **Purpose:** The purpose of this study is to investigate the effects of periodized resistance training (RT) on brain health and the underlying vascular processes that mediate cognitive enhancement in older adults. **Methods:** We will apply cognitive testing and advanced neuroimaging techniques to a 12-week periodized RT program that our lab has previously demonstrated to optimize strength gains in older adults. The overall goal is to investigate changes in cerebrovascular function and cognition in 22 healthy older adults 60-75 years of age, serving as their own controls, and explore the mechanisms that mediate these effects. The NIH Toolbox® Cognition Battery and Arterial Spin Labeling (ASL) MRI will be used to assess changes in cognition and cerebrovascular function, respectively, after 12 weeks of periodized RT. Potential mechanisms of benefit, such as physical capacity, body composition, and blood marker levels, will be investigated for associations with brain adaptations. **Results:** One pilot subject is currently being tested to verify the feasibility and safety of our intervention. **Conclusion:** N/A

Poster #: 73

Title: Older Adult Functional Fitness Following a Comprehensive Golf Training Program

Name: Andrea Du Bois

Faculty Advisor: George Salem

Background: Aging is associated with declines in muscular performance, cardiovascular endurance, and balance that can impair the ability to perform activities of daily living. Multimodal physical activity interventions are effective in attenuating these declines. Golf is a popular recreational activity that contains multiple components which include walking the golf course, bending over to pick up a golf ball, and high-velocity golf swings. **Purpose:** The purpose of this study was to investigate the effects of a comprehensive golf training program on the functional fitness of older adults. **Methods:** Eight, non-golfing older adults (Age: 70.8±3.5 y) completed a two days per week, twelve-week comprehensive golf training program. Training consisted of complimentary exercises, swing training, and a gradual introduction to golf play. Pre- and post-training, participants completed a six-minute walk (6MWT), 30-second chair stand (CHAIR), 8-foot up and go (UPGO), and grip strength (GRIP) test. **Results:** Following the golf-training program 6MWT (Δ=66.4±55.2 yd), CHAIR (Δ=1.6±1.6 repetitions), and UPGO (Δ=-1.1±0.3 s) significantly improved ($p \leq 0.024$). There were no significant changes in GRIP (Δ=0.68±3.48 kg; p=0.622). **Conclusion:** Cardiorespiratory endurance, lower body muscular strength/power and balance/agility all improved following participation in the golf training program. These improvements can be attributed to the multimodal nature of golf play. However, grip strength did not improve following the golf training program, likely due to the low-load, high-velocity movement pattern of the golf swing. Overall, these results support a comprehensive golf training program as a plausible activity intervention to improve function in older adults.

Poster #: 74

Title: Golf Intervention Improves Fast but Not Self-selected Gait Speed.

Name: Nicole Marcione

Faculty Advisor: George Salem

Background: Gait speed (GS) is an important global indicator of successful aging, and slow gait speeds are associated with poor health outcomes in later life, such as falls, hospitalization and mortality. Slower GS may also limit social interaction, functional capabilities and independence; thus, attenuating the slowing of GS should be a priority for seniors. Using golf as an exercise intervention, we hypothesized that golf may improve GS and walking endurance in older adults. **Purpose:** The objective of the preliminary investigation was to examine the influence of a 12-week golf intervention on GS in older adult military veterans. **Methods:** GS (m/s) was measured pre-and post a 12-week golf intervention in 4 older, male military veterans (65-79 years). The 12-week golf training was conducted at a 9-hole, Par-3 course. The training consisted of warmup exercises, swing practice at the net, and progressive golf play culminating in playing all 9 holes during weeks 11 and 12. Participants completed 3 gait trials (10m) of each condition: self-selected (SSGS) / habitual walking and walking "as fast and as safe as possible" (FGS) in a motion analysis laboratory. A 6-minute walk test (6MWT) was completed outside on an even, concrete walking path. Participants were instructed to "walk as fast and safe as possible, covering as much distance as possible in the 6-minute time limit." **Results:** SSGS did not change. FGS improved by 6.08% (ES 0.76) and GMWT distance increased by 4.1% (ES: 0.78). **Conclusion:** Following the 12-week golf intervention, participants improved their FGS and their 6MWT distance; however, SSGS did not change. This demonstrates that fast gait may be an important outcome measure to consider when investigating older adult activity interventions. The ability to walk faster and for longer distances can have salient effects on overall wellbeing and safety. In everyday life, habitual GS may not be sufficient when challenges in the environment emerge, such as the need

to cross a street quickly or get out of the way of a moving vehicle. Results from this study suggest that a 12-week golf training intervention changed the walking ability in older military veterans. Our study also demonstrates the utility of including other measures of walking performance in addition to SSGS.

Poster #: 75

Title: Muscle Strength and Insulin Following Exercise in Breast Cancer Survivors

Name: Kaylie Zapanta

Faculty Advisor: Christina Dieli-Conwright

Background: Breast cancer treatments may lead to elevated fasting insulin levels and weight gain causing insulin resistance and reductions in muscle strength (MST). Combined aerobic and resistance exercise (CE) reduces insulin levels and improves MST in patients with type 2 diabetes. **Purpose:** The purpose of this study was to determine the effects of a 16-week supervised CE intervention on fasting insulin and MST in obese breast cancer survivors (BCS). We further sought to examine associations between exercise-induced changes in fasting insulin and MST. **Methods:** BCS were randomized to Exercise (EX) or Control (CON) groups. EX underwent supervised CE sessions 3 times per week for 16 weeks. CON was asked to maintain their current activity level. Fasting serum insulin was measured using enzyme-linked immunoabsorbent assays. MST was assessed from 10-RM (repetition maximum) tests of the leg extension (LE) and chest press (CP). Repeated measures ANOVA's were conducted to examine the effects of exercise on MST and insulin. Pearson's correlations were performed to examine the association between MST and insulin. **Results:** At baseline, EX (n=48) and CON (n=46) did not differ by age (53.0 ± 10.4 yr.) or BMI (33.5 ± 5.5 kg/m2). Post-exercise, insulin significantly reduced (-13.5 ± 3.1%) and MST measures (35.9 ± 6.7%) significantly increased in EX compared to baseline and CON ($P<0.01$). No significant correlations were found between MST and insulin ($p>.05$). **Conclusion:** A 16-week supervised CE intervention is an effective approach to reduce insulin and increase MST. This supports CE as a vital component of cancer rehabilitation following treatment.

Poster #: 76

Title: Learning and generalization of an obstacle negotiation task in VR

Name: Aram Kim

Faculty Advisor: James Finley

Background: Obstacle negotiation is an essential skill for everyday performance. Recent studies demonstrated that goal-oriented obstacle negotiation can be trained on a treadmill with auditory feedback within a single day. However, it remains to be seen how this training generalizes to over-ground walking and whether the skill is retained after 24 hours. **Purpose:** Here, we present a novel obstacle negotiation task in VR to determine how locomotor skills are retained in VR and generalized to over-ground walking. **Methods:** On Day 1, 19 healthy young participants stepped over virtual obstacles viewed through a head-mounted display while walking on a treadmill. Participants were instructed to minimize the vertical distance between the foot and the obstacles (foot clearance). During training, three types of auditory feedback were provided: 1) pleasant sound for foot clearance within 0-2 cm, 2) error sound whose frequency scaled with foot clearance greater than 2 cm, and 3) failure sound following collisions. Moreover, participants performed over-ground physical obstacle negotiation before (PRE) and after (POST) training with the same instruction as the virtual obstacle negotiation. On Day 2, participants completed one retention block in VR without auditory feedback and over-ground retention trial. **Results:** Foot clearance during training in VR decreased on Day 1. Day 2 foot clearance was also lower than baseline foot clearance on Day 1. Participants also reduced foot clearance from PRE to POST over-ground, and maintained the POST over-ground performance on Day 2. **Conclusion:** Our findings support applicability of VR for locomotor training and transfer for interventions in the clinic.

Poster #: 77

Title: Trunk control in persons with recurrent low back pain

Name: K. Michael Rowley

Faculty Advisor: Kornelia Kulig

Background: Recurrent low back pain (rLBP) is an incredibly large problem with up to 80% of adults experiencing at least one painful episode and a third of those suffering recurrence. Motor control changes during symptom remission have been identified in these patients and are thought to contribute to recurrence. **Purpose:** The purpose of this study was to investigate trunk control during a novel Balance-Dexterity Task and the effects of dual-task interference in participants with and without rLBP. **Methods:** Nineteen back-healthy controls and nineteen participants with rLBP were recruited to participate in the IRB-approved study. Participants completed five trials of the Balance-Dexterity Task and five trials with concurrent cognitive dual-task. Trunk control was quantified using kinematic frontal-plane coupling and trunk muscle activation. **Results:** Participants with rLBP exhibited reduced trunk coupling ($p=0.024$) associated with the ratio of deep-to-superficial trunk muscle activity – both for paraspinals ($R=0.608, p=0.007$) and abdominals ($R=0.473, p=0.048$) – where greater deep muscle activation was associated with more coupled trunk motion. Participants with rLBP increased trunk coupling under conditions of dual-task interference, and this increase was modulated by difficulty rating of the cognitive task ($R=-0.497, p=0.036$), recall pain ratings ($R=-0.642, p=0.005$), and lumbar erector spinae activation change ($R=-0.580, p=0.019$). **Conclusion:** Persons with rLBP exhibited more dissociated trunk motion during dynamic balance. Trunk coupling increased in this group under dual-task interference, and those who increased the most rated the cognitive task easier, had lower recall pain ratings, and decreased erector spinae activation. These findings indicate dual-tasking could address dissociated trunk motion in persons with rLBP but will work better for certain patients.

Poster #: 78

Title: Patellar position influences patellar tendon stress: a sensitivity study

Name: Kyungmi Park

Faculty Advisor: Christopher Powers

Background: Patellar tendinopathy is common among jumping athletes. Previous research has suggested that altered patellar position may predispose the patellar tendon to the excessive stress. **Purpose:** To investigate the influence of patellar tilt and patellar height on peak maximum principal stress in the patellar tendon using three-dimensional (3D) subject-specific finite element (FE) analysis. **Methods:** A FE model of the knee joint was developed using subject-specific input parameters obtained during a squatting task (45°of knee flexion). The patella was rotated about its axis in transverse plane from the neutral position to 10° (2° increments), in both the medial and lateral directions. In addition, models with varying patellar tendon lengths were created to mimic a change in the Insall-Salvati ratio from 1.0 to 1.3 (0.1 increments). Patellar tendon stress was quantified in terms of maximum principal stress. **Results:** Both medial and lateral patellar tilt resulted in an increase in peak maximum principal stress in the patellar tendon (2.9 and 3.3 MPa/°, respectively) when compared to the neutral position. An increase in patellar height resulted in a less pronounced change in patellar tendon height compared to the neutral height position (0.9 MPa/mm). **Conclusion:** The findings of this study indicate that patellar tendon stress is influenced by patellar position. Patellar tendon stress is influenced to a greater degree by patellar tilt as opposed to patellar height.

Poster #: 79

Title: Altered trunk kinematic coordination persists beyond back pain episode

Name: Hai-Jung Shih

Faculty Advisor: Kornelia Kulig

Background: Persons with long-lasting back pain may have learned to utilize difference trunk control than back-healthy controls. However, there is insufficient research investigating whether altered trunk kinematic coordination persist beyond symptom duration, as it may contribute to higher risk of recurrence. **Purpose:** To investigate the persistence of altered trunk kinematic coordination during walking associated with low back pain by 1) comparing an asymptomatic person with a history of recurrent low back pain (hxLBP) to a back-healthy control and 2) examine the modulation of trunk coordination to different step width in those two subjects. **Methods:** After giving informed consent, one participant with hxLBP and one back-healthy control, both female, walked on a treadmill. A range of prescribed step width was implemented using real-time visual feedback. Kinematic data were captured and trunk kinematic coordination was analyzed using the vector coding approach. **Results:** In the transverse plane, the patient with hxLBP had a higher proportion of in-phase coordination and a lower proportion of pelvic-phase coordination compared with back-healthy control, regardless of step width. There is a subtle decrease in in-phase coordination and increase in pelvic-phase coordination when step width is modified, only seen in the patient. In the frontal plane, the patient with hxLBP had a higher proportion of pelvic-phase coordination than the control at preferred and wider step widths. **Conclusion:** Persistent changes in trunk coordination were seen in a person during the pain-free period of recurrent low back pain. Larger sample size is needed to draw further conclusions.

Poster #: 80

Title: Arm Movements Increase Margins of Stability During a Slip Perturbation

Name: Jonathan Lee

Faculty Advisor: Christopher Powers

Background: Slips and trips account for approximately 60% of falls, with slips contributing to a higher percentage. Although the motion of the arms during a slip event have been quantified, no study has experimentally tested how the upper extremities may assist in regaining balance from a slip perturbation. **Purpose:** The purpose of this study was to investigate the mechanical effect of the arms in regaining balance during a slip event. **Methods:** Four adults were recruited for this study and were assigned to either an arms free walking condition (N=2) or an arms constrained walking condition (both arms constrained, N=2). All participants were placed in a full body harness and asked to walk across a 10m walkway at 1.4-1.5 m/s. An unexpected slip was induced by placing oil on a Teflon tile. Full body kinematics were collected at 150 Hz. Whole body center of mass kinematics were calculated using Visual3D. The extrapolated center of mass (XCoM) was calculated in Matlab and the base of support (BoS) was defined by the most lateral right foot marker for the frontal plane. The Margins of Stability (MoS) for each participant was calculated by subtracting the XCoM from the BoS in the frontal plane. A positive MoS signified a "safer" slip, whereas a negative MoS indicated that the XCoM extended beyond the BoS. **Results:** In the frontal plane, the individuals with their arms free demonstrated a MoS of 0.06 ± 0.05m and the individuals with their arms bound demonstrated a MoS of -0.03 ± 0.02m. **Conclusion:** The results of this preliminary study suggest that arm responses assist in keeping the COM within the BoS during a slip perturbation.

Poster #: 81

Title: Neuroanatomical and Functional Substrates Associated with a Single Muscle Representation

Name: Alaa Albishi

Faculty Advisor: Beth Fisher

Background: A muscle can be recruited volitionally as a prime mover or automatically as a postural stabilizer. Any given muscle receives command signals from its representation in both primary motor cortex (M1) and supplementary motor area (SMA). Our goal is to determine if the SMA and M1 representations of an individual muscle that is used both volitionally and automatically (e.g. trunk muscles) are contained in different brain networks, such that one network would be focused on volitional and the other more focused on automatic signaling. **Purpose:** To map brain networks including M1 and SMA representations of trunk and hand muscles and determine if trunk muscles are contained in differential brain networks compared to the hand. **Methods:** Transcranial magnetic stimulation and task-based functional magnetic resonance imaging (fMRI) were used to map 3-dimensional coordinates (regions-of-interest, ROI) for the SMA and M1 representations of a trunk (external oblique, EO) and hand muscle (first dorsal interosseous, FDI). These ROI were used in a whole-brain functional connectivity analysis utilizing resting-state fMRI (rs-fMRI). For each muscle, the whole-brain functional connectivity map of SMA was compared to M1. **Results:** Basal ganglia and cerebellum are more connected to SMA while primary somatosensory and parietal cortex are more connected to M1 for both muscles. Slight differences in lateralization were observed in FDI compared to EO. **Conclusion:** Our results suggest the possibility that brain networks underlying more automatic muscle control may extend equally well to distal muscle given that the basic features of differential connectivity of SMA and M1 appeared to be muscle-independent.

Poster #: 82

Title: Combining non-invasive brain technologies to detect and stimulate brain activity

Name: Alexander Garbin

Faculty Advisor: Beth Fisher

Background: Combined neuroimaging techniques afford brain measurements that each technique alone cannot provide. TMS-EEG enables measurement of both motor and non-motor cortical properties thus providing valuable information with a single TMS pulse, such as connectivity and excitation/inhibition. However, this TMS pulse also induces significant artifacts into the EEG signal which has limited the widespread use of TMS-EEG. **Purpose**: To develop a protocol for the combined use of Transcranial Magnetic Stimulation and Electroencephalography (TMS-EEG) that facilitates measurement of cortical properties of non-motor areas. **Methods**: Utilization of concurrent TMS-EEG requires a TMS-compatible EEG system. With this system, there are still several artifacts introduced to the EEG recordings by the electromagnetic TMS pulse. To attenuate these artifacts during data collection, we have added a thin layer of foam to the TMS coil to remove 60 hz noise, utilized earplugs to mitigate auditory-potentials, and stimulated with slight separation between the TMS coil and EEG cap to prevent electrode movement. Following collection, we filtered the data and performed an independent component analysis to determine physiologic and electric artifacts that can subsequently be removed. With these techniques, we performed two trials of TMS-EEG consisting of approximately 40 pulses each and assessed the amplitude and inter-trial variability of the signal pre- and post-artifact removal. **Results**: Artifact removal resulted in significant reduction of signal amplitude and decreased inter-trial variability. **Conclusion**: Our methodology allows for collection and interpretation of TMS-EEG signals that measure motor and non-motor cortical properties.

Poster #: 83

Title: Associations between dynamic balance and spatiotemporal asymmetry during healthy gait

Name: Sungwoo Park

Faculty Advisor: James Finley

Background: Locomotor adaptation is the process of modifying or adjusting an already well-learned gait pattern that occurs over a period of trial-and-error practice when exposing the movement to a novel, perturbing context or environment. Although this process stems from minimizing sensory prediction error or energetic cost, it is also plausible that a desire to maximize balance while people adapt to the asymmetric walking might be a potential driving factor in adaptation. Therefore, in this study, we are to determine how metrics of dynamic balance is regulated and if dynamic balance can be a driving factor of adaptation. **Purpose**: In this study, we are to determine how metrics of dynamic balance is regulated and if dynamic balance can be a driving factor of adaptation. **Methods**: One approach to quantify dynamic balance is to measure whole body rotational behaviors as excessive rotation of the body might result in a fall. Since individual limbs rotate about the body's CoM, they generate 3-dimensional angular momentum about the CoM. Previous research demonstrated that the peak-to-peak range of angular momentum about the body's CoM is regulated within a small range because the rotations of individual limbs cancel each other out. Thus, we measured peak to peak range and the integrated value of angular momentum during adaptation with manipulated balance using arm strap and ankle weight. **Results**: Our results showed that the peak to peak range of and the integrated value of angular momentum were greater when walking with the manipulated balance. However, step length asymmetry did not show difference between conditions indicating that adaptation process might not be affected by the balance conditions. **Conclusion**: Based on our findings, the manipulated balance might not influence adaptation process during split-belt treadmill walking.

Poster #: 84

Title: Kinetic analysis of expert and student performance of lumbar manipulation

Name: Wilson Lam

Faculty Advisor: Kornelia Kulig

Background: The SLM is recognized as a valuable tool for therapists and taught at entry-level physical therapy programs. However, the kinetic characteristics of skilled SLMs have not been well studied. **Purpose**: The purpose of this study was to identify the ground reaction force characteristics of expert and student therapists during side-lying lumbar manipulation (SLM). **Methods**: Four expert and 13 student therapists performed SLM on healthy models. Ground reaction forces were collected from two force plates, one under each foot. The following variables were extracted and analyzed: a) normalized vertical (vGRF) and horizontal forces at the start of the manipulation; b) rate of vertical force unloading during the SLM, and c) force-force coupling quantifying the coordination of vGRF between the feet. Group comparisons were tested utilizing a student's t-test. **Results**: Experts initiated the manipulation with significantly greater front foot vertical and antero-posterior forces ($p = .036$ & $.010$ respectively), and utilized a significantly higher rate of vGRF unloading under both limbs ($p = .035$ & $.041$). Three kinetic patterns emerged from the force-force analyses: "Inphase" in which both feet's vGRF decreased simultaneously, and "Front foot" and "Back foot" in which either cephalad or caudal foot's vGRF decreased more, respectively. Using self-rated best trials, 75% of experts versus 38% of students demonstrated "Inphase" patterns. **Conclusion**: The results indicate that experts performed SLM at greater magnitudes and higher rates of change of vGRF. Also, expert vGRF patterns were predominantly synchronous between feet. These findings may serve to better inform the education of the SLM for future therapists.

Poster #: 85

Title: Do Clinicians Prescribe Open Kinetic Chain Exercises Following ACL Reconstruction?

Name: Chukwuemeka Nwigwe

Faculty Advisor: Susan Sigward

Background: Quadriceps weakness persists 6 months to 2 years following anterior cruciate ligament reconstruction (ACLr). Current evidence supports open kinetic chain exercises (OKCE) as safe and effective to improve quadriceps strength. Little is known regarding the current barriers for inclusion of OKCE in rehab following ACLr among Physical Therapists (PTs). **Purpose**: The purpose of this study was to determine the current utilization of Open Kinetic Chain Exercises (OKCE) among Physical Therapists (PTs) and their barriers for inclusion following Anterior cruciate ligament reconstruction. **Methods**: PTs were invited to complete a web-based survey via email and answer questions regarding their inclusion of OKCE from 90-0° and 90-45° during rehab. Descriptive statistics, response frequency and percentages based on total respondents were calculated for early (1-8wks), mid (9-12wks) and late (13+wks) rehabilitation. **Results**: 634 PTs completed the survey. 97.2% indicated quadriceps weakness as a concern. Less than half of PTs prescribe OKCE 90-0° and 90-45° following ACLr. Up to 70% of PTs indicated 'exercise is not functional' for not prescribing 90-0° OKCE. Up to 63% of PTs indicated the same reason for not prescribing 90-45° OKCE. Concern for harming the ACL was highest during early rehab OKCE 90-0° (43.4%). **Conclusion**: PTs agree quadriceps weakness is a concern following ACLr. However, less than half of PTs indicated they prescribe OKCE 90-0° and 90-45° across rehab. The biggest barrier was that OKCE is not functional. Over 40% of PTs indicate graft health as a barrier for not prescribing 90-0° OKCE during early rehab. OKCE are underutilized in a population of patients that struggle to restore strength. Reasons for underuse conflict with current literature.

Poster #: 86

Title: Using Exploratory Learning to Encourage Selective Hip-Knee Movement in Infants

Name: Jeongah Kim

Faculty Advisor: Linda Fetters

Background: In the US, each year more than 100,000 infants are born VPT. They are at higher risk for motor impairments, including cerebral palsy. A primary motor impairment in cerebral palsy is limited selective joint movement. We scaffolded a mobile task to encourage infants to generate more selective hip-knee movement. **Purpose**: To determine: (1) if infants born full-term (FT) and very preterm (VPT) can learn the Scaffolded Mobile Task and (2) if they generate more selective hip-knee joint movement during the task. **Methods**: Nine infants (5 FT, 4 VPT) at 4 months corrected age participated. Infants were supine under a mobile. An Optotrak Motion Capture System was used to quantify hip and knee joint angles. Day 1 consisted of a 2-min baseline "spontaneous kicking" condition followed by an 8-min acquisition condition, during which the musical mobile rotated when the infant lifted either foot vertically over an individually determined threshold. Day 2 and 3 consisted of a 10-min acquisition condition, during which the height of the threshold was systematically increased. **Results**: Four of 5 infants born FT and 2 of 4 infants born VPT learned the task (%mobile active time ratios: 1.70-3.98). Among these infants, 3 infants born FT and 1 infant born VPT exhibited more selective hip-knee joint movement (hip-knee correlation coefficients decreased by 0.11-0.62). **Conclusion**: Infants born FT and VPT can learn the Scaffolded Mobile Task and the task can motivate more selective hip-knee movement. Our data will inform motor capability in early infancy and will provide foundational knowledge for developing therapeutic interventions.

Poster #: 87

Title: Infant posture estimation with the use of wearable sensors

Name: Ivan Trujillo-Priego

Faculty Advisor: Beth Smith

Background: Infant behavior is context dependent. Once infants are rolling, they move from one context to another by changing their posture. Tri-axial accelerometers embedded in wearable sensors allow detection of changes of orientation in relation to gravity. Here, a methodology to estimate infant posture (supine or prone) from tri-axial accelerometer orientation is presented **Purpose**: Define infant postural context using wearable sensors. **Methods**: A 5-month-old infant was recorded simultaneously with wearable sensors on her ankles and video for 7 min 17 sec. Posture of the infant was visually coded (gold standard; visual posture identification (VPI)). The tri-axial accelerometer signal was used to estimate infant posture (accelerometer-based estimation (ABE)). For ABE, the magnitude and sign of the axis parallel to gravity were inspected. First, transitions from one posture to another were identified when the sign of the acceleration signal changed, creating sections. Next, sections centered around +9.81m/2 were identified as supine and -9.81m/s2 as prone. Time in each posture was compared between VPI and ABE. **Results**: Total time in supine: ABE = 4 min 23 sec, VPI = 4 min 14 sec. Total time in prone: ABE = 2 min 53 sec, VPI = 2 min 23 sec. **Conclusion**: The current ABE method counts time in transition from one posture to another as being in supine or prone. In contrast, the VPI method counts the transition time separately. This led to a discrepancy in amount of time quantified for each position. Future work will focus on improving ABE to address this discrepancy.

Poster #: 88

Title: Pelvis-femur and pelvis-lumbar spine coupling during a weight-bearing task.

Name: Jordan Cannon

Faculty Advisor: Christopher Powers

Background: Previous research has established that sagittal plane motion of the pelvis and transverse plane motion of femur are coupled. However, the coupling between the pelvis and lumbar spine has not been quantified. **Purpose**: To examine the coordination between the pelvis-femur and pelvis-lumbar spine during a weight-bearing posterior pelvic tilt task. **Methods**: Three-dimensional kinematics of the lumbar spine, pelvis, and right femur were collected from three healthy participants using an 11-camera motion capture system (150 Hz). Data were obtained as subjects performed a maximum posterior pelvic tilt in a squat position (60º femur flexion) with a forward trunk lean. Coupling between the segments were quantified using linear regression of the segment angles for each participant. The coupling ratio was determined from the slope, while unstandardized R2 values provided a measure of model goodness of fit. **Results**: On average, subjects achieved a maximum posterior pelvic tilt of 19.3 ± 6.0º, which resulted in 34.9 ± 5.6º of lumbar spine flexion and 8.4 ± 0.8º of femur external rotation. The average coupling ratio for pelvis-femur was 1:0.46 (± 0.18) and an average R^2 of 0.89 (± 0.03). The average pelvis-lumbar spine coupling ratio was 1:1.56 (± 0.53), and an average R^2 of 0.99 (± 0.006) **Conclusion**: These preliminary data demonstrate that for every one degree of posterior pelvic tilt, 1.5o of lumbar spine flexion occurred, in contrast to 0.46º of femur external rotation. The pelvis-lumbar spine sagittal motion are very tightly coupled, while pelvis-femur are highly coupled but to a lesser degree.

Poster #: 89

Title: Musculotendon architecture influences force variability

Name: Akira Nagamori

Faculty Advisor: Francisco Valero-Cuevas

Background: Tendon compliance influences the dynamics of muscle force generation by affecting the gain and phase of proprioceptive feedback. Such effects can potentially influence the sensorimotor integration necessary to precisely control isometric force. Similarly, visual error augmentation has been shown to improve visuomotor error correction, but also enhances spindle-modulated proprioceptive feedback during precise force control. This led us to hypothesize that the benefits of visual error augmentation would depend on muscle architecture, with more compliant musculotendons exhibiting greater reduction in force variability during the control of a constant isometric force. **Purpose**: This study aimed to investigate how differences in musculotendon architecture influence the variability during isometric force production. **Methods**: Twelve consenting male participants performed an isometric wrist flexion and extension force-matching task at 20 % of their maximal voluntary contraction. The visual sensitivity of the force feedback was set at four different levels. **Results**: We found that the amplitude of force variability was smaller for wrist flexors, which have longer tendons, and thus are more compliant musculotendons, compared to wrist extensors ($p = 0.035$). Most importantly, we found that visual error augmentation reduced the amplitude of force variability significantly only for flexor muscles ($p = 0.0032$). This is in agreement with predictions from a computational model of afferented muscle showing that more compliant musculotendons are more sensitive to the modulation of spindle-modulated proprioceptive feedback associated with visual error augmentation. **Conclusion**: We conclude that musculotendon architecture, by affecting the integration of proprioceptive information, affects variability during the control of a constant isometric force.

Poster #: 90

Title: Altered neuromotor control in both limbs in unilateral Achilles tendinopathy

Name: Abbigail Fietzer

Faculty Advisor: Kornelia Kulig

Background: Neuromotor control factors in Achilles tendinopathy (AT) have not been well-studied, limiting our understanding of the development of this overuse injury and preventing physical therapists from addressing these issues. **Purpose**: Determine if there are differences in neuromotor control of tendinopathic (T) & uninvolved (U) limbs in unilateral AT as compared to control (C) limbs. **Methods**: 6 subjects (age 24-48) with history of unilateral AT and 6 healthy subjects performed 25 unipedal hops at 2.0 & 2.3Hz. Uncontrolled manifold analysis parsed variability in foot-to-floor and ankle & knee angles into vertical limb length-irrelevant (Vucm) and -destabilizing (Vort) subspaces. Only stance (divided into 7 bins) was analyzed. rmANOVAs (3-limb x 7-bin) were performed. **Results**: At 2.0Hz, Vucm-T was less than Vucm-C ($p<0.01$) and Vucm-U ($p=0.07$). There was no difference in Vort ($0.15\leq p\leq 0.35$). At 2.3Hz, Vucm-T ($p=0.01$) and Vucm-U ($p=0.01$) were less than Vucm-C. There was no difference in Vort ($0.73\leq p\leq 0.78$). **Conclusion**: Vucm indicates coordination of foot, shank and thigh positioning for consistent vertical limb length. At 2.0Hz, only the T-limb appears deficient, but at 2.3Hz, the T- and U-limbs appear deficient compared to controls. Vort indicates failure to coordinate foot, shank and thigh positioning for vertical limb length consistency. There were no differences in Vort. If those with overuse injury can increase Vucm, more successful versions of performing repetitive tasks are exploited. This may minimize the risk of overloading an individual tissue or joint, decreasing symptom recurrence/progression risk.

Poster #: 91

Title: Operator's pelvic kinematics during lumbar manipulation: expert and novice comparison.

Name: Yue Wang

Faculty Advisor: Kornelia Kulig

Background: The SLM is recognized as a valuable tool for therapists. Adequate control of the therapist's body mass is necessary for rapid force production. However, the pelvic kinematics of skilled manipulations are unclear. **Purpose**: The purpose of this study was to explore the operator's pelvic kinematics during the side-lying lumbar manipulation (SLM) procedure, with the aim to identify kinematically-informed cues to enhance the teaching of this manual skill. **Methods**: Twenty-eight male clinicians [4 experts, 24 novices (13 students, 11 residents)] performed two SLM on each of two male subjects, 4 trials in total. Kine-

matic data were collected using 11 cameras (Qualisys, 200Hz). Pelvis projection angle (PPA), the construction of the virtual coordinates, and pelvis angular velocity (PAV) were processed in Visual 3DTM. The start and stop of SLM were defined by the maximum and minimum vertical position of the sacral markers. Change of the PPA indicates the magnitude and direction of the pelvis rotation in the transverse plane. The PAV reflects the rate of change of pelvic angular position. Kruskal-Wallis and Pearson's chi-squared tests were used to evaluate kinematic differences between groups (p=.05). **Results**: There was no difference between experts and novices in the change of PPA and maximum PAV. The direction of maximum PAV regarding the pelvic rotation (p<.05) were significantly different in experts compared to students, but not residents. **Conclusion**: Compared with students, experts executed the opposite direction of pelvic sidebend and rotation during the SLM. Therefore, operator moving pelvis toward optimal direction is critical to the success of the procedure.

Poster #: 92

Title: Are attention and arousal related to learning?

Name: Anvitha Shivakumar

Faculty Advisor: Linda Fetters

Background: The mobile paradigm is an early infant-active method to measure learning, also used to investigate intra limb leg joint coordination. Four-month-old, full-term infants learn the mobile task. Infants born very pre-term (<32 weeks' gestation) have previously, not learned the mobile task or changed hip and knee coordination. Participants must sustain arousal and visual attention in the paradigm. **Purpose**: To determine whether infant arousal levels and visual attention is associated with learning to activate a mobile by kicking and cause a change in joint coordination. **Methods**: Six, 4-month-old infants, participated in the mobile paradigm experiment on 2 consecutive days. Day 1 consisted of a 2-min baseline condition (inactive mobile, spontaneous kicking), followed by an 8-min mobile active condition. Day 2 consisted of an 8-min active mobile condition. There were 3 learners and 3 non-learners. The video of the experiment was coded using the Datavyu software for both days. Attention was coded as "looking at the mobile" (M) or "looking elsewhere" (O). Arousal was coded: awake and alert ("aa"), crying ("cr"), fussy ("fu"), drowsy ("dr") or sleeping ("sl"). Attention and Arousal data was extracted, and mean percentage time was calculated. **Results**: All 6 infants were "Awake and alert" during most of the experiment time which validates the inclusion criteria of the subjects. The infants have a greater mean percentage looking time on Day 1 as compared to day 2. **Conclusion**: Visual inspection of the results suggest that amount of looking time does not seem to be associated with learning of the mobile paradigm.

Poster #: 93

Title: Different means to a single end: Hemispheric-asymmetry and bimanual movements

Name: Rini Varghese

Faculty Advisor: Carolee Winstein

Background: Dominant (D) limb advantage for planning and non-dominant (ND) limb proficiency for feedback-based correction of unimanual movements has been previously reported. **Purpose:** Here, we asked if dominance-driven differences in limb control would influence the early and late phases of bimanual aiming movements. Seven neurologically intact young adults participated in this pilot study. **Methods:** We chose a bimanual aiming task reaction time paradigm, wherein the target was presented at an auditory "GO" signal, to which participants were instructed to make quick and accurate aiming movements. The experiment consisted of 16 conditions - 8 unimanual (UM) and 8 bimanual (BM) - in which we varied target index of difficulty (ID) by modifying target size, target distance, or both. These ID conditions were implemented symmetrically (equal for both hands) or asymmetrically (unequal between hands) in the bimanual experiments. Spatiotemporal coupling was quantified using Spearman correlations between the two limbs for reaction time, peak velocity, time-to-peak-velocity, and movement time. We computed linearity of movement trajectory and directional error at movement onset, peak velocity, and movement end. **Results:** Strong interlimb coupling was observed during the BM-conditions, especially for the temporal measures. More interestingly, compared to the D limb, the ND limb showed less linear movements during BM-conditions. Furthermore, compared to the D limb, the ND limb made a significantly greater change in direction in the later phase of movement. **Conclusions:** Together, the two limbs couple to behave as one during bimanual movements, but each limb employs its own solution that is consistent with its primary hemisphere of control.

Poster #: 94

Title: Gluteus Maximus Activation is related to strength and corticomotor excitabity

Name: Yo Shih

Faculty Advisor: Christopher Powers

Background: Diminished hip strength has been identified as a risk factor for knee injury. Individuals with weak hip muscles have been reported to exhibit increased GM activation during functional tasks to compensate for a lack of force production. It is not clear whether the observed increase in compensatory muscle activation is associated with suprapsinal neural drive. **Purpose**: To determine whether gluteus maximus (GM) activation during a drop jump task is associated with hip extensor weakness. We also examined whether increased gluteus maximus activation is associated with heightened corticomotor excitability (CE) of GM. **Methods**: Fourteen healthy participants were recruited. CE was quantified using transcranial magnetic stimulation. GM activation was recorded using surface electromyography (EMG) during a double leg drop jump task. Hip extensor strength was evaluated using a dynamometer during a maximal voluntary isometric contraction. Pearson's product moment correlation was used to examine the relationship between hip extensor strength and GM activation, as well as GM activation and GM CE. **Results**: A negative correlation between GM EMG and hip extensor strength was observed (r=-0.36, p=0.21). Also, a positive correlation between GM CE and GM EMG was found (r=0.43, p=0.13). **Conclusion**: Although not statistically significant at this time, our preliminary findings suggest that the enhanced muscle activation of GM during a functional task may be associated with increased supraspinal neural drive.

OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY DOCTORAL STUDENTS

Poster #: 95

Title: Evaluating Automated Lesion Segmentation Approaches for Stroke MRI Data

Name: Kaori Ito

Faculty Advisor: Sook-Lei Liew

Background: Understanding the pathophysiology of stroke is critical to enhancing the efficacy of post-stroke rehabilitation. Manual lesion segmentation remains the gold-standard for lesion annotation for stroke research, but is labor- and time-intensive. A number of automated approaches have been developed in recent years, but have not yet been systematically evaluated on a large, public dataset. To this end, we evaluate the performance of automated lesion segmentation approaches on a large stroke dataset. **Purpose:** To facilitate future use and development of automated lesion segmentation approaches. **Methods:** We evaluated three automated lesion segmentation approaches ("ALI", "lesion_gnb", and "LINDA") using a dataset of 181 chronic stroke MRIs. We compared performance among all automated segmentations with respect to manual tracing of lesions using three different evaluation metrics: Dice Coefficient (DC), Hausdorff's Distance (HD), and Average Symmetric Surface Distance (ASSD). Friedman's Tests were conducted on DC, HD, and ASSD to assess differences in performance on automated segmentation approach-

es. **Results:** For all evaluation metrics, a significant difference was found among the three automated approaches ($p<0.0001$). Pairwise comparisons (Bonferroni corrected) showed that LINDA performed best on DC and ASSD ($p<0.01$). For HD, LINDA outperformed lesion_gnb ($p<0.0001$), but did not differ from ALI ($p=1$). Performance across methods was worse on small lesions and on brainstem/cerebellar lesions. **Conclusion:** Overall, LINDA performed best on the evaluation metrics. By identifying the optimal approach for lesion segmentation, we hope to enhance stroke rehabilitation research in its discovery of clinically meaningful insights, and facilitate future development of algorithms.

Poster #: 96

Title: Mechanisms of Developing Social Play in Novel Adult-Child Dyads

Name: Cristin Holland

Faculty Advisor: Barbara Thompson

Background: Successful interpersonal processes are important for child development, but research is often focused on the caregiver-child relationships. However, children frequently interact with non-familiar adults, which may require a positive interaction be established in a short amount of time. **Purpose:** This study aimed to identify crucial components of constructing play interactions between novel adults and preschool age children. **Methods:** Twenty-two videos of adult-child play interactions were analyzed using grounded theory concepts modified for video observations. Aspects of conversation and observational analysis were combined and adapted to code the interactions for verbal communication and physical actions of both participants. Descriptive methods were used to analyze specific mechanisms elicited between social partners. **Results:** Coding produced a social interaction process of co-creating play between adult-child dyads that included three major mechanisms: bids for interaction, alignment or misalignment, and threats to alignment. Bids for interaction include initial offers, building offers, and change offers. Threats to alignment fell into two categories, exerting control or disrupting the interaction. Within exerting control, mechanisms of limiting engagement of a social partner, imposing structure, refusals and ignoring were seen. Disruptions to the interaction included wandering and incongruent bids. Each dyad enacted these mechanisms in unique, dynamic processes which produced four patterns of interactive flow seen across dyads: discordant, discontinuous, continuous, and complete. **Conclusion:** The results provide a framework of how social play interactions between novel adults and children develop, which may be useful in pediatric play-based interventions to build positive play interactions and rapport between therapists and new clients.

Poster #: 97

Title: Caregiver Perspectives on Primary Healthcare Encounters for Adults with Autism

Name: Sadie Kim

Faculty Advisor: Leah Duker

Background: Primary care is associated with positive outcomes for society, including improved access to health care services, health outcomes, and cost savings. However, adults with autism spectrum disorder (ASD) experience numerous challenges in the receipt of primary care, reporting decreased satisfaction and increased unmet physical and mental healthcare needs. Care providers and consumers need tools to improve the quality of primary healthcare encounters for adults with ASD, but little research currently exists examining primary healthcare interventions for adults with ASD. **Purpose:** To identify perceived barriers and strategies to facilitate successful primary healthcare encounters for adults with ASD, as reported by caregivers of adults with ASD. **Methods:** We conducted eight interviews with caregivers of adults with ASD living in Los Angeles and Philadelphia. This data represents a subset of a larger study which conducted interviews/focus groups with adults with ASD (n=32), caregivers of adults with ASD (n=28), and primary care providers of adults with ASD (n=10) in Los Angeles and Philadelphia. Caregiver interviews lasted an average of 32 minutes in duration and were transcribed verbatim. Thematic analysis using a grounded theory approach was employed to describe barriers and facilitators to primary care health encounters, as reported by caregivers of adults with ASD. **Results:** In progress. **Conclusion:** This study documents common barriers to successful care as well as strategies utilized during primary care encounters for adults with ASD. Findings will provide a blueprint for intervention development to address high-priority obstacles to improve the quality of primary healthcare services for adults with ASD.

Poster #: 98

Title: Sensory-Regulatory Functioning: an Important Aspect of Early Identification of Autism

Name: Yun-Ju Chen

Faculty Advisor: Grace Baranek

Background: Despite the challenges of low sensitivity of identifying ASD at 12 months, early identification is essential to obtaining early services, which may improve developmental outcomes. FYI v3.1 is a newly revised parent-report screening designed to identify infants at 8-15 months who may be at risk for a later diagnosis of ASD, and measures a broader range of behaviors, including sensory processing characteristics. **Purpose:** The current study aims to examine the utility of First Years Inventory (FYI) items as early predictors of autism spectrum disorder (ASD), with specific interests in the two domains – social communication (SC) and sensory-regulatory functioning (SR). **Methods:** There were 6,498 parents who finished the FYI-Lite survey when their infants were 8-16 months old, and 2,210 among them reported their children's outcomes at age 3 by completing Developmental Concerns Questionnaire and Social Responsiveness Scale. For the current analyses, we used the subset of FYI responses with outcomes (N=2,210) to conduct diagnostic accuracy analysis and examine the utility of domain items across ages. **Results:** FYI scores in both domains measured as young as 8-10 months can be a promising predictor of social responsiveness outcomes at age 3 given their significant associations. However, age should be taken into consideration when establishing norms for very young infants, especially for items related to social communication. Overall, at least one third of the infants who later developed ASD using a two-domain criterion could be detected around 12 months of age. **Conclusion:** Higher diagnostic accuracy achieved by incorporating sensory-regulatory items present as early as 11-16 months are important in developing targeted early interventions for infants at-risk for a later diagnosis of ASD.

Poster #: 99

Title: Oral care routines of Latino children with and without Autism

Name: Lucia Florindez

Faculty Advisor: Leah Stein Duker

Background: Children from under-served minority populations, like Latinos, or children who have special health care needs such as autism spectrum disorder (ASD), are at increased risk for oral health disparities. **Purpose:** To explore how Latino children, with and without ASD, perform in-home oral care activities, and examine the impact of disability (e.g., sensory differences) and cultural factors (e.g., family roles) on oral care routines. **Methods:** Eighteen Latino families with a child age 6-12 (n=8 neurotypical, n=10 ASD) were interviewed to identify factors that impact in-home oral care routines and asked to film their child performing oral care routines for 3 days. Two blind coders analyzed 61 videos using a template coding approach based on the American Academy of Pediatric Dentistry's practice standards for recommended oral care behaviors. Qualitative observations also were documented and examined using a cross-case analysis. **Results:** Two themes were observed. Relevant to both groups, Family Involvement identified how parents and family members participated in the child's routines, capturing how activities are culturally situated within the family dynamic. Specific to the ASD group, Sensory Modifications described adaptations made to oral care routines to meet the sensory needs of children with ASD. It was noted that consistent flossing and mouthwash use was absent

from the routines of both groups. **Conclusion:** Understanding typical oral care routines while also considering the influence of the cultural contexts, family roles, child descriptors, and systemic restrictions on the activity will contribute to the development of targeted interventions to improve in-home oral care routines.

Poster #: 100

Title: Exploring what Latino families know about diagnosing Autism

Name: Lucia Florindez

Faculty Advisor: Sharon Cermak

Background: Disparities exist regarding autism spectrum disorder (ASD) diagnosis for Latino children, making it important to explore what Latino families understand about ASD. **Purpose:** The purpose of this study was to identify the factors that inform the beliefs held by Latino families about Autism Spectrum Disorder. **Methods:** As part of a larger qualitative study on in-home oral care, 18 Latino families with a child aged 6-12 (n=8 neurotypical, n=10 ASD) were interviewed, with questions probing their beliefs about ASD diagnosis. Interviews were transcribed verbatim and analyzed using thematic coding. **Results:** Five themes were identified pertaining to family's knowledge about ASD diagnosis. The first, Misconceptions, explained the various fallacies perpetuated in the Latino community about ASD. The second theme, Parents as students and teachers, described how parents had to learn about their child's diagnosis before they could educate others. Next, Role of Family was related to family influence, including the reluctance in some extended families to acknowledge the ASD diagnosis. Outside Influence pertained to information delivered by non-family members, including health care providers. Lastly, Cultural Stigma, focused on content that originated from the family's cultural background. **Conclusion:** Psycho-social, familial, medical, and cultural factors inform the beliefs of Latino families about ASD diagnosis. Understanding how Latino families perceive ASD diagnosis helps illuminate how health information is communicated within this under-served population, and informs the development of future targeted education programs. Further research is necessary to know how these beliefs relate to quality of care.

Poster #: 101

Title: Occupational Therapy Diabetes Intervention: The REAL Diabetes Study Process Evaluation

Name: Raymond Hernandez

Faculty Advisor: Elizabeth Pyatak

Background: The REAL Diabetes Study was a randomized controlled trial that demonstrated the effectiveness of an occupational therapy intervention, emphasizing the incorporation of diabetes management tasks into daily habits and routines, in improving blood glucose control and quality of life for young adults (Pyatak, et al., 2017). **Purpose:** To conduct a process evaluation of the Resilient, Empowered, Active Living with Diabetes (REAL) intervention in order to understand its effective components and primary mechanisms of effect. **Methods:** We analyzed quantitative data (statistics on goals identified by participants and frequency and duration of different intervention modules and activities), and qualitative data in the form of client and therapist interviews. **Results:** Quantitative analysis revealed that the most common participant goals were blood glucose monitoring (74% of participants), meal preparation (47%), and exercise (36%). The most common activities were habit formation (10% of total activities), understanding blood sugar in context (8%), and communication with providers (6%). The most frequently used intervention modules were "Living with Diabetes" (144 minutes per participant on average), "Activity and Health" (91 minutes), and "Assessment and Goal Setting" (88 minutes). Results of qualitative analysis demonstrated that clients appreciated that the intervention was delivered in a manner that was non-judgmental, supported their autonomy, and was tailored to their individual contexts. **Conclusion:** The REAL Diabetes Study was effective in improving both clinical and psychosocial outcomes of individuals with diabetes by helping clients incorporate individualized self-care habits into their daily habits and routines and empowering them to take steps to improve their health.

Poster # 102

Title: Multisensory Environments to Improve Patient Outcomes: A Scoping Review

Name: Connie Chu

Faculty Advisor: Leah Duker

Background: The sensory environment of healthcare settings has the potential to impact patient, caregiver, and provider outcomes. The MSE manipulates sensory features of the environment, often including adaptations to visual, auditory, tactile, and olfactory stimuli. MSEs are popular in Europe and have been increasingly incorporated in the United States and Canada in the last decade. Despite this enthusiasm, criticism continues regarding the quantity and quality of existing MSE research. **Purpose**: To systematically review available literature regarding the impact of Multisensory Environments (MSEs/Snoezelen) on patient outcomes in different patient populations throughout the lifespan. **Methods**: Nine databases were searched using the keywords Snoezelen/Multisensory Environment. Experimental studies utilizing an MSE, written in English through 2016 were included. **Results**: The search produced 1184 articles, with 84 articles meeting inclusion criteria. Study populations included: dementia (n=29), intellectual/developmental disabilities and/or autism (n=27), mental health diagnoses (n=9), care providers (n=6), traumatic brain injury (n=3), labor/breastfeeding (n=3), cerebral palsy (n=2), chronic pain (n=2), Huntington's disease (n=1), adults in palliative daycare (n=1), and typically developing children (n=1). Fifty-four articles were published in the last decade, primarily from the US, UK, Australia, Israel, and Netherlands. Preliminary findings are promising, though limited rigorous research designs have been employed and major differences exist in the frequency, duration and MSE stimuli across studies. **Conclusion**: Use of MSEs may be a promising intervention to improve stress, anxiety, and relaxation for populations across the lifespan, but there is need for more rigorous research into the efficacy and effectiveness of MSEs.

Poster #: 103

Title: Oral health disparities of African-American children: A scoping review

Name: Dominique Como

Faculty Advisor: Sharon Cermak

Background: Oral health is essential to overall health, with poor oral health associated with increased risk of heart disease, stroke, and diabetic complications. Underserved and vulnerable populations, such as African-American children, experience more consequences of poor oral health compared to peers, including higher rates of decay and untreated caries. **Purpose**: To identify structural, social, cultural and/or familial factors that contribute to oral healthcare disparities for African-American children. **Methods**: Three databases were searched using the keywords African-American/Black, Minority Health, Healthcare Disparities, Oral Health/Hygiene/Dental Care to identify factors contributing to oral healthcare disparities. Inclusion criteria: (1) addressed oral health, and (2) focused on African-American children (0-18 years). Data from articles were organized into categories based on the Social Ecological Model. **Results**: Twenty-three (of 795) articles met inclusion criteria. Structural factors included challenges obtaining access to adequate care, availability of insurance coverage, and cost of services. Sociocultural factors (e.g., patient-provider relationship, the value placed on oral health) potentially impacted the way African-Americans experienced oral health. Familial factors that acted as barriers to care included socioeconomic status, dietary choices, and geographic location. The influence of culture on oral health was absent in the literature. **Conclusion**: This review identified many factors that are barriers to oral health in the African-American community and the gaps in the literature that require attention. Evidence suggests that a narrow focus on structural factors may omit several other levels of influence affect-

ing oral health for underserved populations, including the impact of culture. These gaps continue to perpetuate oral care disparities in African-American children.

Poster #: 104

Title: Motor Ability Correlates with Neural Activity during Imitation in Autism

Name: Christiana Butera

Faculty Advisor: Lisa Aziz-Zadeh

Background: Motor and imitation skills are significantly impaired in some children with ASD (Williams et al. 2004). Previous neuroimaging work found reduced BOLD signal activity in adolescents with ASD during imitation of hand actions as compared to typically developing (TD) participants (Wadsworth et al, 2017). Mechanisms underlying the imitation deficit are uncertain; there may be a relationship between reduced motor skill and imitation deficits in ASD. **Purpose**: The purpose of this study is to (1) compare performance on the Movement Assessment Battery for Children (MABC-2; Henderson, 2007) between a sample of typically developing (TD) children and children with autism spectrum disorder (ASD) and (2) assess how performance on this motor assessment correlates with neural activity in motor-related brain regions during an imitation task. **Methods**: Data from 9 participants with ASD (age 10.93 ± 1.86), and 15 TD participants (age 11.15± 1.39) were analyzed. In an MRI scanner participants imitated videos of hand actions, and parameter estimates from motor regions (e.g., primary motor cortex) were extracted and correlated with MABC-2. **Results**: MABC-2 scores were significantly lower in ASD compared with TD participants ($p<.001$). In the ASD group only, significant correlations between MABC-2 total standard score and imitation of hand actions were found in the right precentral gyrus ($r=.67$, $p=.04$), and the left postcentral gyrus ($r=.69$, $p=.03$). **Conclusion**: These data suggest that in ASD, MABC-2 scores may be related to activity patterns in premotor and primary motor regions recruited during hand action imitation.

Poster #: 105

Title: Mobile Health Interventions to Address Sedentary Activity in Older Adults

Name: Kristina Han

Faculty Advisor: Stacey Schepens Niemiec

Background: Prolonged SA is positively associated with poor health outcomes across the lifespan. Use of mHealth technology (e.g., smartphones) shows promise as a means to decrease SA. However, mHealth interventions are rarely applied to OAs-despite that their adoption of mobile technology is rapidly growing-thereby threatening seniors' equal access to healthy lifestyle solutions. **Purpose**: To map the existing evidence base of mobile health (mHealth) interventions that target sedentary activity (SA) in older adults (OAs) and identify key research gaps. **Methods**: We are presently conducting a scoping review of the literature. Guided by established methodology, we will continue the iterative process of identifying selection criteria (e.g., 2007-2018 publications, sedentary time as an outcome), determining key search terms (e.g., smartphone, sedentary), performing data extraction, and synthesizing information from applicable studies. To-date, we have completed an initial search of PubMed. **Results**: Our preliminary search produced two relevant studies-one featuring a RCT and the other a pre-post design-with small sample sizes (n=38, 24). Both study interventions utilized activity monitor feedback and one-on-one consultation. In one study, a smartphone application was an additional intervention component. Excluded studies focused largely on young and midlife adults, increasing physical activity versus decreasing SA, and non-mHealth intervention (e.g., educational booklet). **Conclusion**: Based on our current search, limited research is available that describes mHealth interventions to reduce SA in OAs. Findings from this scoping review, upon its completion, will characterize the current evidence underlying the use of mHealth interventions to positively impact sedentary behavior in the older population.

Poster #: 106

Title: Understanding Activity Engagement in a Green House Nursing Home

Name: Carin Wong

Faculty Advisor: Natalie Leland

Background: The Green House focuses on providing high quality care with the goal of optimizing resident quality of life in a home-like environment. In addition, this model aims to promote activity engagement, which stems from traditional nursing homes where residents are often found to be inactive and bored. **Purpose**: To examine meaningful activity engagement in a Green House nursing home. **Methods**: This study used a qualitative approach, which utilized observations and one-on-one interviews in a Green House nursing home. One semi-structured interview was done with five staff members and two long-term residents to gain their perspectives on activity engagement. In addition, observations were done in the facility over a 14 day period, with each session ranging from 4 to 5 hours in duration. The objective of the observations was to gain insight into the daily routines of the residents and staff and to identify occurrences of meaningful resident engagement. Procedures for analyzing the data were rooted in grounded theory. **Results**: The participants frequently described having limited time and multiple responsibilities as barriers to engaging residents in activities. Strategies that the participants utilized to engage residents in was integrating activity engagement in small fragments, fostering one-on-one relationships with residents to understand their preferences and reaching out to family members to assist with engaging residents in activities. **Conclusion**: Our findings demonstrate that despite resident engagement being an important focus for participants, there are barriers to engaging residents and strategies that the Green House nursing home staff utilize to overcome those hindrances.

Poster #: 107

Title: Addressing Uncontrolled Diabetes in Primary Care: A Lifestyle Redesign Approach

Name: Maggie King

Faculty Advisor: Elizabeth Pyatak

Background: Diabetes is a growing crisis which significantly impacts health and quality of life and imposes a major economic burden. The Los Angeles County Department of Health Services (LAC-DHS) has prioritized comprehensive diabetes care for patients with uncontrolled diabetes as an area for improvement. We are currently conducting a study to examine how Lifestyle Redesign (LR) OT services can be integrated into a primary care clinic within LAC-DHS, with an initial focus on diabetes management. **Purpose**: The study has two aims: 1) Evaluate the impact of Lifestyle Redesign-based OT in improving the health and quality of life of patients with uncontrolled diabetes; 2) Evaluate the process of integrating Lifestyle Redesign-based OT in an interdisciplinary primary care team. **Methods**: In this hybrid implementation-effectiveness study, we are collecting formative and summative mixed-methods data to examine both the feasibility of implementing LR-based OT and its impact on health and quality of life. Patients with diabetes with a current HbA1c level >9.0% who are referred to OT are randomly assigned to treatment or control groups. We are collecting formative data on referral patterns, provider communication, and patient enrollment and retention, and summative data on patient satisfaction, clinical outcomes, and quality of life. Data sources include participant observation, key stakeholder interviews, focus groups, pre-post assessment of clinical and self-report survey data, and medical chart reviews. **Results**: As this is a current on-going study set to conclude in June 2018, results are still preliminary. However, of the patients who have completed the LR OT program, the mean HbA1c decrease is at 2.3% coupled with positive feedback about their experience in the program. **Conclusion**: This study will provide a schematic for how LR-focused OT services can be feasibly and sustainably introduced into primary care clinics and yield information on how these services impact health and quality of life among patients with diabetes.

OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY PROFESSIONAL STUDENTS (BS, MA)

Poster #: 108

Title: Interventions Supporting Siblings of Children with Autism: A Scoping Review

Name: Breanna Howell

Faculty Advisor: Stefanie Bodison

Background: Scoping reviews are used to identify available relevant literature on a particular topic to provide insight about both what is known, and where current research gaps may be. **Purpose**: The purpose of this scoping review was to investigate research on the available interventions for siblings of children with autism. **Methods**: For this scoping review, databases accessed included PubMed, Embase, Cochrane Library, CINAHL, ERIC, Web of Science, and PsycINFO. Search terms included variants of autism and siblings. Upon completion of the initial search, titles and abstracts were reviewed by 2 authors using the following inclusion criteria: children between the ages of 0-21years; diagnosis of autism, with mixed populations accepted if autism was included; and group outpatient interventions. Full-text manuscripts were then reviewed and data extracted and synthesized. **Results**: The initial search yielded 11,547 research studies. After the removal of duplicates, the total number of abstracts screened was 5,639. Through this process, 32 studies were identified as warranting full-text review, with 12 additional studies added following hand-searching. A detailed data extraction table of included studies will be presented. **Conclusion**: There was little consistency in the type of interventions provided, length or duration of intervention, and group characteristics. Common themes addressed during intervention programs included increasing the sibling's understanding of the child with autism's diagnosis; addressing the relationship with their parents; social participation; and mental health.

Poster #: 109

Title: Preliminary Effects of Mindfulness Meditation on Spasticity in Stroke Survivors

Name: David Saldana

Faculty Advisor: Sook-Lei Liew

Background: Spasticity is a velocity-dependent increase in stretch reflexes which decreases quality of life in stroke survivors. Spasticity is thought to worsen due to stress and anxiety, and mindfulness meditation has been shown to reduce anxiety. **Purpose**: We conducted a pilot study to examine the effects of mindfulness meditation on spasticity and quality of life in stroke survivors. **Methods**: Ten chronic stroke survivors underwent two weeks of mindfulness meditation practice in a repeated measures design. Measures of spasticity, quality of life, mindfulness, and anxiety, along with qualitative journal data, were recorded. **Results**: We found statistically significant improvements in spasticity in both the elbow ($p = .032$) and wrist ($p = .023$) after two weeks of meditation. Exploratory analyses showed that quality of life measures for Energy ($p = .013$), Personality ($p = .026$), and Work/Productivity ($p = .032$) also improved. Qualitative analysis revealed themes of mindfulness competency, spasticity effects, and general relaxation effects. **Conclusion**: If larger studies with a control group show similar results, mindfulness meditation may be a low-cost, accessible, and safe technique that could be easily adopted to manage spasticity and quality of life for individuals with chronic stroke.

Poster #: 110

Title: Identifying Risks of Developing Musculoskeletal Discomfort in Dental Hygiene Students

Name: Rachel Eckerling

Faculty Advisor: Shawn Roll

Background: More than two-thirds of dental hygienists experience musculoskeletal pain and discomfort in their hands, arms, neck and back. Dental hygiene students, whose practice patterns are not yet fully refined, demonstrate a significant increase in musculoskeletal symptoms during their training. Unfortunately, there are limited published studies that quantify the activities, postures and positions that may be putting these students at risk. **Purpose**: We aimed to identify occupational patterns of risk for the development of musculoskeletal symptoms in a sample of dental hygiene students. **Methods**: Eighteen dental hygiene students treating patients in two different university-based clinics were video recorded during a patient visit. Occupational activities and postures were continuously coded across each video using the ObserverXT. Static postures were scored using the Rapid Upper Limb Assessment (RULA). Frequencies and average lengths of time were calculated to identify occupational patterns. **Results**: Average patient visit time was 166.8 min. Instrumentation was the most frequent activity in both programs. Students predominantly worked sitting during patient care between the 9 and 12 o'clock positions. Across all eighteen videos, 323 static posture video segments were identified and scored on the RULA, with average above 3.0 indicating the need for change. **Conclusion**: Dental hygiene students spend significantly longer with patients than occurs in clinical practice. Of the 2.5-4 hour visit, a majority of the time is spent either in static position around the patient or performing hand-intensive activities, which exposes students to high risk for musculoskeletal injury development.

UNDERGRADUATE DDS STUDENTS – BASIC SCIENCES

Poster #: 111

Title: Three-dimensional (3D) analysis of soft palate development in mice

Name: Michelle Cho

Faculty Advisor: Yang Chai

Background: Cleft palate is a common congenital birth defect. A cleft of the hard palate involves a bony defect, while a soft palate cleft involves improper development of muscles. While much research has been done regarding cleft palate, less is known about soft palate formation and dysfunction as opposed to the hard palate. **Purpose:** To study the development of the muscles of the soft palate in vivo through 3D immunofluorescence staining of mouse embryos. **Methods:** Wild-type mouse embryos were processed and stained via the iDISCO+ protocol. Primary antibodies of MHC and Ki67 were used to label myogenic and proliferative cells in the soft-palate, respectively. Secondary anti-mouse (red) and anti-rabbit (green) anitbodies were also used respectively to visualize the myogenic (MHC+) and proliferative (Ki67+) cells. Optical projection tomography (OPT) and confocal microscopy was performed in order to create a 3D reconstruction of the embryo. **Results:** OPT imaging and confocal microscopy of wild-type mice provided normal 3D anatomical landmarks for the muscles of the soft palate. This was visualized with 3D OPT and confocal reconstructions of mouse embryos stained with the iDISCO+ protocol. **Conclusion:** This study provides dynamic 3D reconstruction for the development of soft-palate muscles for better understanding of soft palate cleft abnormalities.

Poster #: 112

Title: Effects of Periodontal Disease on Transgenic Rat Model of AD

Name: Simon Youn

Faculty Advisor: Ruchi Bajpai

Background: A positive correlation has been observed between AD and PD in patients. Recent findings have suggested that compromised blood brain barrier, which makes the brain more susceptible to recurring infections, has been detected in AD patients prior to the onset of dementia. Bacteria that cause periodontitis such as *P. gingivalis* have been proven to be able to travel to the brain. In a study done in 2017, there was a 1.707-fold increase in the risk of developing AD for subjects who had chronic periodontitis for 10 years (Chen et al., 2017). Our lab has recently described several molecular markers underlying brain microvasculature defects in invitro models of AD. These defects are recapitulated in brain tissue samples from deceased AD patients (Griffin et al, in revision). We hypothesize that similar microvasculature defects may be the underlying cause of chronic periodontal disease in spite of good oral hygiene. Here we determine (i) whether AD rats are more prone to getting PD (ii) if similar microvasculature defects are observed in the brain and around the tooth pulp of AD rats and (iii) the natural variation in molecular markers among patients' tooth pulp with age and disease status. **Purpose**: To test whether recurring periodontal disease (PD) increases the severity of Alzheimer's Disease (AD). **Methods**: 1. Analysis of rodent tooth and brain at different ages from normal and AD model rats. 2. Analysis of mandible and brain pathology in AD and control rats with induced PD. 3. Analysis of patient teeth at different ages and disease status. **Results**: 1. Microvasculature defects in brains of AD rats predicted from our stem cell studies and consistent with microvasculature defects in patient brain samples. 2. Expression of these markers in isolated root pulp and the oral cavity from the same animal models. **Conclusion**: AD rat serves as a powerful model to assess molecular basis of the correlation between PD and AD.

Poster #: 113

Title: Functionalized Scaffold and Membrane for Ridge Preservation

Name: Taewan Kim

Faculty Advisor: Seiko Min

Background: Tissue engineering approaches to bone repair involved with scaffolds, stem cells and exogenous growth factors. An alternative was proposed involving anti-Bone Morphogenetic Protein (BMP)-2 monoclonal antibodies (mAbs) immobilized on a scaffold which captures endogenous BMP to mediate bone formation. **Purpose**: The aim of this study was to investigate the ability of anti-BMP-2 mAb used to functionalize scaffolds to mediate bone regeneration in a canine model. **Methods**: Mandibular right PM4 was extracted on eight beagle dogs and grafted with anti-BMP-2 mAb + anorganic bovine bone mineral with 10% collagen and porcine bilayer native collagen membrane (CM). The ABBM-C and CM were functionalized with either anti-BMP-2 mAb (test group) or isotype matched control mAb. (control group). Animals were euthanized at 12 weeks for radiographic, histologic and histomorphometric analyses. Across group outcomes were compared. **Results**: 3D imaging, using CBCT revealed that, compared with control groups, sites treated with ABBM-C and CM functionalized with anti-BMP-2 mAb exhibited significantly more remaining bone width, near the alveolar crest. Histologic and histomorphometric analyses demonstrated that in anti-BMP-2 mAb treated sites, unlike control sites, de novo bone formation extending significantly beyond the confines of the alveolar bone crest. In anti-BMP-2 mAb treated sites, de novo bone formation was observed under the barrier membrane. **Conclusion**: Functionalization of ABBM-C scaffold and CM appeared to have led to de novo bone formation within healing alveolar bone sockets.

Poster #: 114

Title: Cell Proliferation and Distribution in Different Animal Models

Name: Kimmie Groff & Allan Wu

Faculty Advisor: Yang Chai

Background: Studying craniofacial morphology and dysmorphology is important for understanding both craniofacial development and congenital defects. One way in which these topics can be studied is through assessing gene expression in facial bones such as the maxilla and mandible. As part of an ongoing research project supported through the NIDCR FaceBase Consortium, various different studies have been conducted that expand our understanding of facial bone development. Novel research about both the genetics and anatomy of the mandible and maxilla strives to explain the interplay between genetics and bone morphology. **Purpose:** To generate heat maps highlighting the distribution of cellular proliferation in the developing mandible and maxilla. Both wild type controls and mutants will be studied. These heat maps will be a valuable tool for FaceBase users, and will be useful for comparison in future experiments with other mutant models. **Methods:** Samples from e10.5, e12.5 and e14.5 were collected and underwent immunofluorescent staining and OPT imaging. Heat maps were generated via post-processing using Amira imaging software. **Results:** We produced comprehensive gene expression data and proliferation heat maps of mice ages E10.5-E14.5 during mandibular and maxillary bone morphogenesis. These results will serve as the basis for comparative analysis in future experiments. **Conclusion:** Researchers can compare our heat map cell proliferation to their own data or those of our mutant models in the future. This will facilitate understanding of specific signaling pathways during mandible and maxilla morphogenesis.

UNDERGRADUATE DDS STUDENTS – CLINICAL SCIENCES

Poster #: 115

Title: Thermal and bioactive optimization of a 3-step etch-and-rinse dentin adhesive

Name: Mehrdad Razaghy

Faculty Advisor: Pascal Magne

Background: Mimicking dentin bonding, considering the human dentinoenamel junction with the MTBS of 51.5 MPa, can be challenging. **Purpose:** The influence of preheating and inclusion of a bioactive glass on the 24-hour and 6-month microtensile bond strength (MTBS) of a three-step etch-and-rinse adhesive was evaluated. **Methods:** Flat mid-coronal dentin was exposed on 80 extracted molars, which were assigned to 8 groups (to be restored with Optibond-FL and Filtek-Z100): G1/G1+: control, G2/G2+: as G1 but with adhesive preheated at 155ºF, G3/G3+: as G1 but with 0.05mg of Bioglass added to primer, G4/G4+: as G3 but with adhesive and Bioglass-modified primer preheated at 155oF. Beams were fabricated for microtensile testing at 24h (G1-G4) and at 6 months (G1+/G4+). MTBS data were analyzed with a 2-way analysis of variance (ANOVA, dentin bonding modification and storage time). Scanning electron microscopy (SEM) was used to analyze the failure mode and evaluate intact dentin-composite interfaces. **Results:** Bond strength mean values at 24h were statistically different with G2 at 69.80 MPa superior to all other groups (ANOVA $p<.001$) G1 at 58.24 MPa, G3 at 60.68 MPa and G4 at 60.97 MPa were not statistically different ($p>.123$). G2 remained the highest at 6 months (G2+ with 68.32 MPa), and no decrease in MTBS was observed with time (ANOVA $p=.081$). Failure modes were mostly adhesive. Intact dentin-composite interface SEM analysis showed a more uniform and continuous hybrid layer with longer tags for G2/G2+ groups. **Conclusion:** All MTBS values were stable at 6 months. Preheating Optibond

FL significantly increased the 24-hour and 6-month MTBS. Inclusion of Bioglass did not have any effect on the results.

Poster #: 116

Title: Evaluation of endodontically-treated internally-bleached incisors restored with and without post

Name: Mehrdad Razaghy

Faculty Advisor: Pascal Magne

Background: Restoration of endodontically-treated internally-bleached incisors can be challenging. **Purpose**: To assess and compare the fatigue resistance, load-to-failure, and failure mode of ETIs submitted to the walking bleach technique and restored with three different techniques. **Methods**: Maxillary incisors were endodontically-treated, then a glass-ionomer cement was placed over the orifice. The bleaching procedure was performed with 3% hydrogen-peroxide mixed with sodium-perborate for three consecutive 1-week application. After, all the teeth were restored according to the specific procedures for three groups: 1) glass-ionomer cement base replacing dentin and covered with a composite resin restoration (GI), 2) short-fiber reinforced composite resin replacing dentin and covered with a composite resin restoration and (EX), 3) composite-resin restoration over a luted fiberglass post (FP). Masticatory forces were simulated in an artificial mouth using a closed-loop electro-dynamic system. The force was applied at a palatal angle of 30° with the flat surface of the disc contacting minimum three-fourths of the incisal edge. Samples were loaded until fracture or to a maximum of 76,500 cycles. **Results**: Only one specimen survived 76,500 load cycles, from group GI. All three groups presented with a major amount of nonrestorable failures. The GI-group seemed to present a more favorable outcome with only 69% of nonrestorable failures and the highest amount of repairable fractures compared to EX (79%) and FP (86%). **Conclusion**: Keeping this glass-ionomer base and simply replacing the surface of the defect with composite-resin will not affect the mechanical behavior of the restored tooth when compared to the more complicated alternatives such as the placement of a post.

Poster #: 117

Title: Bio-remineralization with Quantitative Light-induced Fluorescence (QLF)

Name: Amrita Chakraborty

Faculty Advisor: Janet Oldak

Background: QLF estimates mineral loss by extrapolating the change in fluorescence of the lesion compared with the fluorescence of the surrounding sound enamel. **Purpose:** To determine the validity of Quantitative Light-induced Fluorescence (QLF) for the detection of White Spot Lesions (WSLs) and quantification of peptide induced enamel remineralization in situ. **Methods:** 10 sound human molars were collected and windows of dimension 5*3mm were created on the buccal surface of each sample. Customized crowns of thermoplastic bleaching tray material were fabricated with reservoirs against the created windows. The tooth samples were subjected to a 14 day demineralization cycle at pH 4.6, 37°C. The samples were then distributed into two groups (N=5) treated with Control (Artificial saliva only) and Peptide-Chitosan (P-CS) hydrogel over a 30 day remineralization period. Artificial saliva was replenished every 24 hours and gel application made once a week. White light and fluorescence images (Shutter speed: 1/30s; ISO 1600) were obtained from each specimen in 3 stages; healthy enamel, demineralised enamel and remineralized enamel. **Results:** ΔF values were used to determine lesion depth. ΔF of sound enamel was 0 and the ΔF baseline of artificial carious lesions ranged from -7.22 to -9.74. Mineral gain was significantly higher in teeth treated with P-CS (ΔΔF = +1.14±1.76) than in teeth treated Control (ΔΔF = -1.04±2.34); (ΔΔF = ΔFremin- ΔFdemin;$p<0.05$). **Conclusion:** QLF can be proposed as an adjunctive diagnostic tool for assessing the efficacy of P-CS hydrogel inducing enamel remineralization in situ.

Poster #: 118

Title: Management of Traumatic Dental Injuries by Nurses and Health Clerks

Name: Marissa Carvalho

Faculty Advisor: Julie Jenks

Background: Dental trauma is one of the important problems to be addressed in schools. Falls, fights, and sport injuries are among the common causes of dental trauma in schools. **Purpose:** The purpose of this study is to assess the knowledge and ability of school nurses and health clerks in the Pasadena Unified School District to manage and properly treat traumatic dental injuries (TDI), specifically tooth avulsion, in school children, immediately after and 4 months after a lecture in handling TDI. **Methods:** The result from previously administered questionnaire to health clerks and school nurses in the school district of Pasadena strongly suggests that there is a need for training in the management of TDI, specifically avulsion amongst the participants. A lecture on the management of TDI in primary and permanent teeth was given to the participants by a pediatric dentist. A post training questionnaire was administered to the same population both immediately, and 4 months after training session. The questionnaire contains objective questions to measure the changes in participants' knowledge in the management of TDI after the training. The surveys contain no questions leading to any identifiable data on an individual level. **Results:** The results from the immediate post-training survey demonstrated significant improvement ($P<0.05$) in knowledge of TDI management among participants compared to the pre-training survey results in March 2017 (result interpretation will be completed in mid-March). **Conclusion:** First part of study suggested a need for CE courses for school nurses and health clerks to familiarize/train them to handle TDI properly. After TDI training, the participants demonstrated significant improvement in their knowledge.

Poster #: 119

Title: Multi-bacterial Biofilm and Bone Loss in Peri-implantitis

Name: Nathan Nourian

Faculty Advisor: Neema Bakhshalian

Background: Peri-implantitis, an infection associated with implants, has a complex etiology and pathogenesis. The lack of proper animal models where the inflammatory response to biofilms can be analyzed is a hindrance to research. Models utilizing biofilm composed of multiple bacteria would enhance the understanding of peri-implantitis. **Purpose**: The aim of this study was to compare the peri-implant bone volume among the 4 different groups (sterile, *Aggregatibacter actinomycetemcomitans* (Aa), *Dialister pneumosintes* (DP), and Aa+DP biofilm inoculated titanium abutments); bone to implant surface contact (BISC) among the 4 treatment groups; bone volume between baseline and post-op within each group and BISC between baseline and post-op within each group. **Methods**: Titanium implants were placed in the natural diastema between the first molar and incisor of the rats. Rats were assigned to 4 groups, with groups A-C involving inoculated titanium abutments, (A: Aa; B: DP; C: Aa+DP) and group D as a control group with sterile biofilm. 2 CT scans, after implant placement and 8 weeks post-op, analysis was completed using Amira, FEI. **Results**: Post-op bone volume was reduced in all test groups presented. The DP group (35.6%±31.7) showed the largest decrease in post-operational bone volume ($P>0.05$). Post BISC was also reduced in the 4 groups studied. The DP (19.5%±23.6%) group presented the lowest post-op BISC ($P>0.05$). **Conclusion**: The results describe the amount of bone loss, volume and surface contact, in rat oral cavity where DP's osteolytic destruction rate was the most rapid. This multi-bacterial model may be utilized for future investigations involving biofilm and host responses during peri-implantitis.

Poster #: 120

Title: CAD/CAM characterization techniques. Influence of sublaminar colorants on veneered restorations.

Name: Maja Chmielewska

Faculty Advisor: Pascal Magne

Background: Various CAD/CAM-composite resin materials have emerged on the market, and may be used to restore anterior teeth. To provide highly esthetic results additional characterization techniques have been developed. **Purpose**: The aim of the study was to determine if colorants applied between layers of cutback CAD/CAM-polymer incisors and veneering composite have influence on the incisal edge strength of such bilaminar restorations. **Methods**: Ninety incisor-shaped specimens were milled from three types of commercially available blocks – Lava Ultimate (LU), Shofu Block HC (SH) and Cerasmart (CS) and divided evenly between two characterization methods – cutback with composite veneering (LUC, SHC, CSC) or cutback, colorant application and veneering (LUS, SHS, CSS). The specimens were calibrated with a crown gauge as well as photographic analysis both at the cutback and veneering stages, for standardization purposes. Cyclic isometric loading (5Hz) was applied on a one-point contact, along the long axis of the crown, at an angle of 0°, starting from a load of 100 N, followed by an increase of 25 N per increment, each step lasting 1 700 cycles. Samples were loaded in submerged conditions, until final failure (specimen breakdown); Kaplan-Meier analysis was applied. **Results**: Restorations chipped at average loads of: LUC 265N, LUS 253N, SHC 271N, SHS 293N, CSC 250N, CSS 278N. **Conclusion**: Sandwich characterization technique increases the aesthetics of anterior CAD/CAM polymer restorations. Application of colorants between layers of such restorations further improves the esthetic outcome without negative effects on incisal edge strength.

Poster #: 121

Title: Prevalence of opioids in older adults in a dental population

Name: Maile Osborne

Faculty Advisor: Piedad Suarez-Durall

Background: In 2016, approximately 14.2 million Americans >65 years old filled >1 opioid prescription. Over 40% of older adults have chronic pain that is usually treated with long-term opioid use, risking drug dependence or death. **Purpose**: This study examines opioid prevalence in patients >65 years of age at our general and special needs clinics (Special Patients, Hollenbeck and Union Rescue Mission). **Methods**: Self-reported opioid medication use was extracted from the medical record for patients aged >65 years visiting the USC dental clinic in either 2012 or 2017 (IRB #UP-12-00232). **Results**: In 2012, the prevalence of >1 opioid prescription was 5.6% (4.5% in males; 6.5% in females; p=.054) as compared to 6.2% (5.3% in males; 6.9% in females; p=.094) in 2017 (p=.395). The two most common classes of opioids used in 2012 and 2017 respectively were hydrocodone (53.8%, 41.7%) and tramadol (27.4%, 36.4%). While the prevalence of 5.6% found within our study (2012) was significantly lower (p=.0004) when compared to the 7.9% opioid prevalence for Americans >60 years found by the National Health and Nutrition Examination Survey (NHANES, 2007-2012), the prevalence in the special needs clinics was 11.3% (2009-12), significantly higher than our regular clinic population (5.6%; p<.0001) and the NHANES 60+ years old (7.9%; p=.0168). **Conclusion**: Our results demonstrate significant differences in the prevalence of opioid use in patients visiting special needs clinics as compared to the NHANES data and the general USC dental clinics. An opioid campaign specifically targeting older adults treated in special needs clinics may be needed.

Poster #: 122

Title: Drug Use by Age and Gender in Geriatric Patients

Name: Dhwani Shah

Faculty Advisor: Reyes Enciso

Background: Eighty percent of people ≥65 years old have one or more chronic medical conditions requiring use of medications. Greater consumption of prescription and over-the-counter medications puts them at higher risk for medication-related problems. **Purpose**: To understand differences in types of medications taken by patients by age and gender. **Methods**: Charts of ≥65 years old patients being seen at USC Clinics under community dentistry (Special Patients, Hollenbeck and Union Rescue Mission) between 2009-2012 were reviewed. Age, gender and patients' reported medications were charted and categorized by Lexicon Plus (Cerner Multum TM, Denver, CO). The most commonly used drug, drug classification and the number of medications were calculated by age and gender. **Results**: Among 388 patients (58.2% females), the five most common classes of medications were cardiovascular+antihypertensives, analgesics, cholesterol-lowering drugs, anticoagulants/antiplatelets and respiratory drugs. The ranking differed by gender in that analgesics ranked second most common drug classification for females while for males it was the third. Compared to an age-matched U.S. population (NHANES data 2009-2012), our sample population took more analgesics (15.8% vs 32.8%) and anticoagulants/antiplatelets (16.2% vs 32.7%). From our study population, the most common self-reported single drug for females was aspirin (antiplatelet-dose); for males it was simvastatin. Similar to NHANES data, females were taking significantly more medications than males (5.0 vs. 4.0;p=.002); and the median number of medications increased significantly with age from 4.0(65-74yo), to 5.0(75-84), to 6.0(85+)(p=.002). **Conclusion**: Medication usage goes up with increase age and female gender, putting older females at higher risk of polypharmacy side effects.

Poster #: 123

Title: Trends in Dental Related Emergency Treatments for Student Athletes at USC

Name: Ryan Edalatpajouh

Faculty Advisor: Ramon Roges

Background: The main concern of the Emergency Department (ED), the interface used by student athletes for emergency dental treatments is to monitor the frequency of patient visits and provide appropriate treatments while aiding the prevention of orofacial injuries. **Purpose**: The focus of this study is collegiate athletes who present to the ED with pain and to assess the treatments performed. The treatments include: pulpal therapy, restorative treatment, and referrals to various specialty clinics. **Methods**: This retrospective non-identified study examines emergency visits by collegiate athletes between 2007-2017. Data was extrapolated from Axium, a dental management software system. The treatments at the ED were categorized as Restorative Needs, Pulpal Therapy, and Referrals. **Results**: In total, 772 treatments were recorded for 245 patients over a 10 year period. Restorative treatments were the highest including 66.4% of treatments completed. Visits for Referrals had a rate of 16.9%. Of the referred treatments, 68% of referrals were for Endodontics and 26% included referrals for Oral Surgery. Pulpal Therapy included 16.7% of total treatments performed. A total of 128 pulpal therapy treatments were conducted, with 57% of treatments completed at the Endodontics Department and 23.4% completed within the ED. The remaining 19.6% of pulp treatments had no follow up visits after initial pulpal debridement. **Conclusion**: USC's health interface is used not only to treat and prevent trauma but as a preventive interface for treatment of oral disease and health. Dental health education paired with trauma management provide administrative information to both the athletes and the coaching staff.

Poster #: 124

Title: What is the Future of Orthodontics?

Name: Emin Hartunian

Faculty Advisor: Dennis J. Tartakow

Background: Growing trends in the specialty include: the increase in general practitioners practicing orthodontics, the decrease in advertising by orthodontic specialists, the division amongst orthodontics and a decrease in interdisciplinary care. As future orthodontic specialists one should understand and be aware of how the specialty is changing. **Purpose:** Orthodontic treatment is a monumental milestone for each individual. With the increase in changes in the orthodontic field, specialists must understand the changes taking place and act upon them. The aim of this article is to highlight how the field of orthodontics has changed in terms of interdisciplinary care, advertising, American Board of Orthodontics certification and the fact that there is an increase in general dentists practicing orthodontics. **Methods:** Contemporary journal articles and orthodontic textbooks will be used to examine factors impacting the future of orthodontics. The research design used is a qualitative methodology. **Results:** There may be an increase evident in general practitioners who provide orthodontic cases on their own. Amongst the orthodontic specialty, a separation may be forming amongst those who are board certified and those who are not. Also, in terms of orthodontic advertising, patients may be increasingly attracted to the dental practice and they're starting to ask their dentists about Invisalign. A trend may be seen not only with general dentists performing many orthodontic cases- but also new smile aligning companies advertising greatly as opposed to orthodontic specialists. **Conclusions:** We need to come together as future orthodontists in the specialty and present a unified front to the dental community and the public.

OTHER AFFILIATED RESEARCHERS

Poster #: 125

Title: Three-dimensional examination of maxilla and mandible development in mouse models

Name: Thach-Vu Ho

Faculty Advisor: Yang Chai

Background: Craniofacial abnormalities including mandibular dysmorphogenesis and maxillary hypoplasia appear in multiple syndromes. Micrognathia in Pierre-Robin sequence, for example, causes airway obstruction and cleft palate. Van der Woude syndrome has a greater severity of maxillary hypoplasia than is typically seen in nonsyndromic cleft palate. However, the mechanisms of regulating these aspects of craniofacial development remain unclear. **Purpose:** We generated genetically engineered mouse models to gain a better understanding of particular genes in maxilla and mandible development. **Methods:** We used 3D microCT to analyze the maxilla and mandible of *Msx1*$^{-/-}$, *Wnt1-Cre;Tgfbr2*$^{fl/fl}$, *Wnt1-Cre;Alk5*$^{fl/fl}$, and control mice at E18.5. We used the Avizo software to reconstruct the mandible and maxilla in 3D and compared the differences between controls and mutants using morphometric analyses. **Results:** Quantitative results revealed that the mandible and maxilla of *Wnt1-Cre;Tgfbr2*$^{fl/fl}$ and *Wnt1-Cre;Alk5*$^{fl/fl}$ mice are significantly smaller than controls at E18.5. The volumes of the mandible and maxilla in *Msx1*$^{-/-}$ mutants and controls are not significantly different. **Conclusion:** Data suggest that *Tgfbr2* and *Alk5* may play an important role in the mandible and maxilla development. There was not a significant difference between *Msx1*$^{-/-}$ mutants and controls, suggesting that *Msx1* may not be a key player in the mandible and maxilla development. Further studies are needed to better understand the mandible and maxilla development in these mouse models.

Poster #: 126

Title: Evaluation of Shear Bond Strength using Adhesives and Different Composites

Name: Shirin Behdad

Faculty Advisor: Karen Schulze

Background: Combining different composites with adhesives from other companies and different generations has been a practice for many years. While some practitioners still use their fourth or fifth generation adhesive system but have an upgraded composite some other dentists use the six or seventh generation adhesive materials in combination with the latest version of composites on the market. **Purpose:** This study evaluates the shear bond strength of six commercially available composites with three different adhesive systems. The null hypothesis is that there is no difference among the three adhesive systems. **Methods:** A total of 108 human molars were cross-sectioned and embedded in acrylic composites. Six commercially available composites have been selected for shear bond testing: Filtec One Bulk Fill, 3M(Bulk); Filtec Supreme Ultra Universal, 3M(Supreme); Tetric, Ivoclar-Vivadent(Tetric); Harmonize, Kerr(Harmonize); Clearfil Majesty ES-2 Classic, Kurary(Majesty); Admira-Ormocere, VOCO(Admira). All composites were tested with a 5th generation adhesive material: Optibond Solo Plus, Kerr Dental(Optibond); with a 6th generation adhesive material: Prelude, Danville(Prelude) and with a 7th generation adhesive material: Scotchbond Universal, 3M(Scotchbond). For each adhesive group there were six tests performed. The exposed flat dentin surface from the samples was treated with one of the three adhesives according to manufacturer's instructions. The treated sample was placed in a bonding clamp followed by composite application. After removal the samples were stored for 24h at 36 degree Celsius and 100% humidity. The Ultratester(Ultradent) was used to shear off the samples at 1mm per min. Statistical analysis was done with two-way-ANOVA and student t-test at a 0.05% confidence interval. **Results:** The table shows the results of the shear bond testing in MPa. The average of all Optibond, all Prelude and all Scotchbond samples are 29.0(±11.2), 25.4(±11.9) and 34.5(±11.8) MPa, respectfully. The two-way analysis showed that there are not significant differences among the composites(p=0.950) but there are strong differences among the adhesive systems(p=0.006). Student t-tests show that Scotchbond has significant higher bond strength than Prelude(p=0.0013) and significant higher bond strength than Optibond(p=0.0474). There was no significant difference found between Prelude and Optibond(p=0.193) **Conclusion:** In this study four out of six composites exhibited highest bond strength with Scotchbond Universal. The null-hypothesis was rejected.

Poster #: 127

Title: Concordance Analysis of Foundational Knowledge in a Predoctoral Dental Curriculum

Name: Jennifer Jordan

Faculty Advisor: Mahvash Navazesh

Background: In 2013, the Joint Commission on Dental Examinations (JCNDE) published the Domains of Dentistry, comprised of Foundational Knowledge (FK) and Clinical Content areas (CC) "required for the safe, independent, general practice of dentistry by entry-level practitioners." In 2015, JCNDE published FK and CC test item distributions for the Integrated National Board Dental Exam (INBDE), to be implemented August 1, 2020. Though FKs have been adopted externally, this study set out to determine the level of support for FKs within the School. **Purpose:** This study aims to reveal the concordance of faculty and student opinion related to Foundational Knowledge Areas that should be included in a predoctoral dental curriculum. **Methods:** A Qualtrics survey requested a response of 'Need to Know' 'Nice to Know' 'I don't know' or 'Not needed', in a predoctoral curriculum, for each survey item. Survey items were not identified as FKs, though FK wording was extracted from JCNDE documentation. D4 students and faculties, from the Herman Ostrow School of Dentistry of USC, were invited to participate in 3 survey rounds. Round 1 (R1) impaneled biomedical science faculty (N=30), round 2 (R2) impaneled faculty from clinical and behavioral sciences (N=51),

and round 3 (R3) required D4 students to complete the survey during clearance (N=168). A total of 305 invitations were sent, with a response rate of 82%. A minimum of 1 invitation and 5 reminders were sent. **Results:** Three FK areas returned values below a Need to Know/Nice to Know concordance threshold of 75% in a single round (1 in R1; 2 in R2). No FKs returned a Need to Know/Nice to Know value below 75% in two or more rounds. Reviewing responses in aggregate (N=249), no FKs fell below the 75% threshold. Two FK areas returned values below 80%. 'Not sure' responses for low threshold FKs were 13%-18%, with 'Not needed' returning the lowest rates of response. **Conclusion:** Results indicate that faculty and students in the School agree that FKs reflect content that should be included in a predoctoral dental curriculum.

Poster #: 128

Title: Estimation of typical duration of infant positions across a day

Name: Avi Borad

Faculty Advisor: Beth Smith

Background: Spending time in varying positions is necessary for timely infant motor development. In particular, prone aids in upper shoulder girdle strength (Laughlin, Luerssen, and Dias, 2012). **Purpose:** The aim of this study is to use caregiver-reported infant position and activity logs to determine the typical duration of time that infants spent in specific positions across a full day. **Methods:** Data were collected from 12 infants (1-12 months) over three visits with 2 months between each visit. The infant visits were split into two groups by age: 1-4 months (8 visits) and 5-12 months (28 visits). Caregiver-reported logs described positions and activities that infants were in across a typical day, including the start and end time of each. We calculated the percent of time each infant spent in each position (unknown, unable to classify, supine, prone, standing, sitting assisted, sitting free, semi-reclined, side-lying) per day. Then, the average percentage across each age group was determined. **Results:** The highest classifiable percent for the younger group was supine (24.47%) followed by semi-reclined (19.76%), and the lowest was sitting free (0.00%) followed by prone (2.16%). The highest classifiable percent for the older group was semi-reclined (17.72%) followed by supine (13.61%), and the lowest was prone (1.34%). **Conclusion:** Our preliminary analysis shows that infants in both age groups tend to spend a larger amount of time in supine or semi-reclined with only a small percentage of the day spent in prone. Future work will focus on a comparison between infants at risk for developmental delay and with typical development.

Poster #: 129

Title: Modifying UML diagrams to improve an academic program at USC

Name: Luciano Nocera

Faculty Advisor: Glenn Clark

Background: We are building on our previous work where we described a UML diagram for the Online OFPOM Program, that once validated, allowed us to align the information from the educational process with updates on the program documentation. **Purpose:** With this research we wish to model the various components of an online program to assess and improve it's quality. **Methods:** Unified Modeling Language (UML) is a popular modeling language that has been used in to visualize the behavior of different systems, and has been successfully used in the field of education to conceptualize and evaluate pedagogical strategies. We report on how we were able to model the Online OFPOM Program. **Results:** We report on how the UML diagram of the Online OFPOM Program provides a visual representation, which allows for an immediate identification of improvement areas. The possibility of including feedback loops on the system enhances the student experience, as well as analyze the required resources on each step of the educational road. **Conclusion:** The development of an UML diagram for an academic program, combining the sequence of activities with the interactions of the different actors, highlighting the interaction between the components of the program is a valuable strategy for the continuous evaluation and improvement of a learning process, leveraging to assess and maintain the quality of the program.

Poster #: 130

Title: The Role of Runx2 for Epithelial Homeostasis in Mouse Incisors

Name: Emily Sandoval

Faculty Advisor: Yang Chai

Background: Runt-related transcription factor-2 (Runx2) is a principal regulator of osteogenesis through its critical role in the differentiation of mesenchymal stem cells (MSCs) into osteoblasts and chondrocytes. Thus, Runx2 plays a vital role in bone development. It is known that Runx2 influences the alveolar remodeling process during tooth eruption, however the role of Runx2 in late tooth development is largely unknown due to the early postnatal lethality of *Runx2*$^{-/-}$ mice. **Purpose:** Our work seeks to determine the role of Runx2 in the homeostasis of mouse incisor epithelium. **Methods:** In an effort to understand the role of Runx2 in the epithelial homostasis of mice incisors, our study generated *Runx2* conditional knockout mice (*Gli1-Cre*^{ER}*;Runx-2*$^{flox/flox}$) to produce a loss of Runx2 activity in Gli1+ incisor epithelium stem cells when induced with tamoxifen at varies stages of postnatal growth. **Results:** The results suggested an increase in dentin formation, impaired ameloblast differentiation, epithelial tissue accumulated, and the loss of the cervical loop. Additionally, the dentin was disorganized, and TA cells were virtually undetectable after the loss of Runx2 in the incisor epithelium. **Conclusion:** Taken together, our results suggests that Runx2 not only plays a critical role in osteoblast differentiation, but also in ameloblast differentiation from incisor epithelium stem/progenitor cells, and is key to homeostasis of the incisor epithelium. Because *Runx2* is a vital gene in a series of networks, we hope to continue our work by creating various conditional knockout mouse models to further understand this series of networks.

Poster #: 131

Title: Mutations in *FGFR2* activate nucleolar stress and perturb cell fate

Name: Creighton Tuzon

Faculty Advisor: Amy Merrill

Background: Fibroblast growth factor receptor 2 (FGFR2) has been shown to promote both osteoprogenitor cell proliferation and differentiation during development, raising the paradoxical question of how a receptor tyrosine kinase modulates these distinct processes. We have previously shown that, in addition to its canonical signaling transduction activities at the plasma membrane, FGFR2 also regulates skeletal development from within the nucleolus where it modulates transcription o f the rDNA repeats. We found that the *FGFR2* mutations in the skeletal disorder bent bone dysplasia syndrome (BBDS) enhance the receptor's nucleolar activity and limit RUNX2-mediated inhibition of rDNA transcription. Enhanced activation of rDNA transcription by FGFR2 consequently holds osteoprogenitor cells in a proliferative state that resist differentiation. **Purpose**: (1) To address mechanistically how FGFR2 maintains the proliferative capacity during embryogenesis and on through adulthood by disease-causing mutations in the FGF receptor; and (2) To define the molecular and cellular consequences of *FGFR2* mutations in order to provide insights into the functions of the FGFR2 in tissue development and homeostasis. **Methods**: ChIP-qPCR was utilized to determine both protein occupancy and histone modifications at rDNA repeats; polysome profiling was used to assess translational output from preosteoblasts expressing wild-type and mutant FGFR2; NOME-Seq was utilized to evaluate nucleosome occupancy and DNA methylation status; immunofluorescence was used to address protein colocalization within the nucleus and nucleolus; RT-qPCR was used to measure gene expression changes; and alkaline phosphatase assays were performed to measure osteoblast differentiation. **Results**: We discovered that BBDS specific mutations in *FGFR2* augment the receptor-mediated recruitment of histone remodeling factors

that epigenetically convert rDNA from poised to active, leading to higher levels of rDNA transcription. Higher levels of rDNA transcription, in turn, leads to the activation of p53 and the Rpl5/Rpl11-Mdm2 ribosomal stress response pathway. Inhibition of p53 rescues differentiation in osteoprogenitors with the *FGFR2* mutations, suggesting that p53 activation is an essential pathogenic factor in BBDS and a potential therapeutic target for its prevention. **Conclusion**: Our study of mutations in *FGFR2* that are associated with Bent Bone Dysplasia syndrome reveal a mechanistic connection between FGFR2, ribosome biogenesis, and cellular stress that explains disease pathology. Our work helps to establish rDNA as developmentally regulated loci that receive input from FGF signaling to balance self-renewal with cell fate determination in progenitor cells. Furthermore, our findings define a common mechanism for how a single gain-of-function mutation in *FGFR2* can lead to both congenital skeletal disorders and oncogenic transformation.

Poster #: 132

Title: Sutures possess strong regenerative capacity for calvarial bone injury

Name: Zoe Johnson

Faculty Advisor: Yang Chai

Background: Mechanisms during bone tissue remodeling and regeneration have previously been thought to be the same in long bones and craniofacial bones. Studies have shown that the periosteum and, in calvarial injuries, the dura contribute osteocytes and chondrocytes to the defect. Based on those findings, injury repair of the calvarial bone should be evenly distributed. We propose that Gli1+ MSCs found in the cranial suture mesenchyme are responsible for injury repair in calvarial defects and that their localized distribution will affect injury repair potential. **Purpose**: To investigate the role of Gli1+ mesenchymal stem cells (MSCs) from the cranial suture mesenchyme in injury repair of calvarial defects. **Methods**: A dental drill (burr size 1.8mm) was used to create three defects: one directly on the suture, one near the suture on the parietal bone, and one farther away from the sagittal suture on the parietal bone. Extreme care was taken not to damage the dura below. Gli1+ cells were detected using EdU staining. **Results**: After one month of healing, the injury made directly on the sagittal suture was completely healed and was indistinguishable from the surrounding uninjured bone. The other defects failed to heal completely. The farthest defect from the suture healed the least of the three injuries. Gli1+ cells from the suture mesenchyme quickly responded to injury and migrated to the defect to aid healing. Non-suture calvarial bone did not have this capability. **Conclusion**: Gli1+ mesenchymal stem cells in the calvarial suture contribute to, or are responsible for, injury repair. Their localized distribution causes healing of calvarial bones to progress unevenly, which possibly provides an explanation for the occurrence of critical-sized defects. We plan to investigate this aspect of injury repair in large animal models.

Poster #: 133

Title: Protein arginine methyltransferase PRMT1 is essential for palatogenesis

Name: Yongchao Gou

Faculty Advisor: Jian Xu

Background: Protein arginine methyltransferase 1 (Prmt1) catalyzes asymmetric arginine methylation which regulating pre-mRNA splicing, DNA damage signaling, mRNA translation, cell signaling, and cell fate decision. Prmt1 is known to methylate Smad6, Smad7 and Axin, therefore it can regulate BMP/TGF-beta and Wnt signaling pathway. **Purpose**: We hypothesized that Prmt1 regulates craniofacial development. **Methods**: Conditional gene knock-out, Western blots, immunofluorescence staining, HE staining, Micro-CT. **Results**: We identified a new regulator of palate development, Prmt1, and demonstrated that disruption of Prmt1 function in neural crest cells caused a complete cleft palate and craniofacial malformations. Prmt1 is the most highly expressed protein arginine methyltransferase, enzymes responsible for methylation of arginine motifs on histone and non-histone proteins. Prmt1 regulates signal transduction and transcriptional activity that impact multiple signal pathways crucial in craniofacial development, such as the BMP, TGFβ, and WNT pathways. We demonstrated that *Wnt1-Cre;Prmt1*$^{fl/fl}$ mice displayed a decrease in palatal mesenchymal cell proliferation and failure of palatal shelves to reach the midline. Further analysis in signal pathways revealed that loss of Prmt1 in mutant mice decreased BMP signaling activation and reduced the deposition of H4R3me2a mark. **Conclusion**: Collectively, our study demonstrates that Prmt1 is crucial in palate development. Our study may facilitate the development of a better strategy to interrupt the formation of cleft palate through manipulation of Prmt1 activity.

Poster #: 134

Title: The role of Runx2 in craniofacial development

Name: Jordan Malinoff

Faculty Advisor: Yang Chai

Background: Runt- related transcription factor 2 (Runx2) is involved in osteoblast differentiation and skeletal morphogenesis. Previous research has suggested that Runx2 is a possible candidate gene for cleft lip and palate. Cleft lip and/or palate are caused by a failure of fusion between maxillary and nasal processes and are the most common congenital defects affecting the craniofacial region. **Purpose**: To determine the role of Runx2 in cleft palate development. **Methods**: *Osr2-KIcre;Runx2*$^{fl/fl}$ and *Wnt1-Cre;Runx2*$^{fl/fl}$ transgenic mice were generated to knock out *Runx2* in specific cell lineages during craniofacial development. The *Wnt1-Cre* driver was used to eliminate *Runx2* in neural crest cells, whereas *Osr2-KIcre* affects the palatal mesenchyme only. Histological sections from E14 mice were stained using immunofluorescence in order to analyze Runx2 expression in control and mutant mice. Micro-CT images of newborn mice were obtained in order to compare the mandible and maxillary regions of the control and mutant models. **Results**: Immunostaining showed that Runx2 is expressed in the neural crest lineage. In the control mice, there were strong Ki67 signals found in the palate. These signals were diminished in the *Wnt1-Cre;Runx2*$^{fl/fl}$ mutant model, suggesting a cell proliferation defect. Micro-CT imaging showed there was a lack of bone formation in the *Wnt1-Cre;Runx-2*$^{fl/fl}$ mouse model. These mice showed a complete absence of the calvaria, maxilla and mandible structures. Furthermore, Micro- CT imaging of the *Osr2-KIcre;Runx2*$^{fl/fl}$ line showed defects in the palate. **Conclusion**: Taking all of this data together suggests that Runx2 is important in craniofacial bone development. Further studies are needed to understand the mechanism of Runx2 in regulating palate and craniofacial development.

Poster #: 135

Title: The accuracy of intraoral digital impressions in infants with clefts

Name: Ouliana Oguienko

Faculty Advisor: Stephen Yen

Background: In infants born with cleft lip and palate, nasoalveolar molding (NAM) using an intraoral appliance is often recommended. To fabricate it, an impression of the palate is needed. Traditional polyvinylsiloxane (PVS) impression material is associated with a number of drawbacks including the risk of asphyxiation. A digital impression using intraoral scanner may be a safer and more patient-friendly alternative. **Purpose**: To evaluate the accuracy of direct intraoral digital scans by comparing it to traditional material-based impressions in infants with unilateral cleft lip and palate. **Methods**: Infants (<3mo) born with unilateral cleft lip and palate planned for NAM therapy received a digital scan (3Shape TRIOS) and a PVS impression of the palate. Both impressions were digitized, superimposed and analyzed for differences using MeshLab software. **Results**: (preliminary) Although a visually acceptable overlap of the impressions was achieved, NAM appliance fabricated with a digital scan yielded an appliance with less ideal fit than one produced with a PVS impression. Incomplete scans, difficulties in stitching the palatal areas and capturing the sulcus were reported to be the major limitations. **Conclusion**: (preliminary) Digital impressions

are not currently suitable for fabrication of NAM appliances in infants with cleft lip and palate. Improvements in soft tissue registration of the intraoral scanners may lead to better outcomes.

Poster #: 136

Title: A comparison of two attachment types; A 3D FEA study.

Name: Shiva Mishaeel

Faculty Advisor: Mohamad Hossein Dashti

Background: The biomechanics of implant-retained overdenture using different types of attachments can lead to resorption in the posterior regions of each arch. Two of the most commonly used attachment systems for this type of prosthesis are Bar/clip and Ball with different biomechanical movements. **Purpose**: The aim of the present study was to compare two types of attachments in four implant-retained overdenture on the stresses introduced to the mandibular posterior ridge by means of 3D Finite Element Method. **Methods**: This study performed with Ansys (version 11.0 and 12.0, workbench 2.0 framework) software. The basic model was generated from data provided by CT-scan and study cast of an edentulous patient. Four root form implants (Nobel Biocare, Sweden) were placed in interforaminal region of the mandible. Models were used in order to simulate two situations: In group A, model represented an edentulous mandible supporting an overdenture retained by four-splinted implants connected with Bar/clip system (Rhein'83, Germany) while in group B, model simulated an edentulous mandible supporting an overdenture retained by four solitary implants with Ball attachments (Rhein'83). The occlusal load of maxillary complete denture was introduced in two directions for each group: vertical load as in centric occlusion, and oblique load as in working lateral excursion **Results**: The amount of stress introduced by overdenture to the mandibular posterior ridge using Bar attachment was higher in centric occlusion whereas ball attachments introduced more force in working lateral excursion. **Conclusion**: Because the time of being in centric occlusion is more than lateral excursion daily, if the only determining factor for choosing the attachment system was the amount of stress introduced to the mandibular posterior ridge, then the Ball system would be the attachment of choice.

Poster #: 137

Title: Use Wnt8Ben-GFP iPSC lines to study hippocampal neural stem cells

Name: Simiao Wang

Faculty Advisor: Ruchi Bajpai

Background: To study the hippocampal neural stem cell which has defects in CHARGE syndrome, our lab established a cell model which can help us to identify the hippocampal neural stem by establishing the Wnt8Ben-GFP reporter iPSC lines. However, the Wnt8B-GFP positive cells spontaneously lose GFP expression and differentiate. Therefore, our goal is to find a method to maintain the GFP positive cells and reduce their differentiation. Furthermore, we tested drug to see whether it can rescue the defects in Wnt8B-GFP positive cells in CHARGE syndrome. **Purpose**: Find a method to maintain the Wnt8Ben-GFP positive hippocampal neural stem cells and reduce their differentiation. Test a drug to see whether it can rescue the defects in CHARGE syndrome. **Methods**: We differentiated the Wnt8Ben-GFP iPSCs into neuroectodermal spheres and conducted FACS sorting to collect the GFP positive cells and cultured them with Notch inhibitor DAPT. After 30 days, we took confocal images of those spheres. After differentiated the CHARGE Wnt8B-GFP iPSCs into neuroectodermal spheres, we treated them with CHIC-35 and conducted FACS sorting analysis. Furthermore, we checked the rescue of migration of NCCs, adipogenic, osteogenic and chondrogenic differentiation of NCCs. **Results**: There was more than 80% of GFP positive cells in the neural spheres which treated with DAPT. After treatment of CHIC-35, the number of GFP positive cells in neural spheres was increased twice as much as the untreated group. It also rescued the NCC migration, adipogenic and osteogenic differentiation. **Conclusion**: DAPT was necessary for the maintenance of Wnt8B-GFP positive cells. CHIC-35 rescued some defects in CHARGE syndrome.

Poster #: 138

Title: Distinct arginine methylated p53 mediates distinct cell fate decision

Name: Jian Qin

Faculty Advisor: Jian Xu

Background: p53, described as "the guardian of the genome", plays a key role in cellular response to various stresses and governs cell fate decision between survival and death after stress. p53 is modified by a multitude of covalent post-translational modifications (PTM), which can not only fine-tune its function but also affect its coordination of cell cycle arrest and apoptosis to govern cell fate. PRMT5 induced arginine methylation regulates p53 response. PRMT5 is the predominant methyltransferase that is responsible for the symmetric dimethylation of arginine residues. Our previously research indicates that p53 is also methylated by PRMT1, which is the primary enzyme for asymmetric arginine dimethylation. **Purpose**: P53 can be symmetric by protein arginine methyltransferase 5 (PRMT5). We identified that p53 can also be asymmetric arginine methylated by PRMT1. Our research is to assess whether symmetric and asymmetric arginine methylated p53 control its functionality and determine p53-regulated cell fate decisions. **Methods**: Western Blot, Flow cytometry, Q-PCR **Results**: Suppression of PRMT1 expression inhibited p53 degradation, while PRMT5 inhibitor did not affect p53 degradation. When p53 expression was induced by Etoposide, a DNA damage reagent. Suppression of PRMT1 expression reduced Etoposide induced G2/M arrest, while neither PRMT5 specific siRNA nor its inhibitor altered Etoposide-induced cell cycle arrest. P53 targets genes exhibited differential expression profile following PRMT1 and PRMT5 suppression. **Conclusion**: Symmetric and asymmetric arginine methylation of p53 play distinct roles in p53 activity and p53-mediated cell fate decision.

Poster #: 139

Title: Center for Dental, Oral, & Craniofacial Tissue & Organ Regeneration (C-DOCTOR)

Name: Bridget Samuels

Faculty Advisor: Yang Chai

Background: The Center for Dental, Oral & Craniofacial Tissue & Organ Regeneration (C-DOCTOR) represents a partnership among several California universities and is funded by the National Institute of Dental & Craniofacial Research (NIDCR) to recruit, support, and accelerate the development of innovative tissue engineering/regenerative medicine (TE/RM) technologies for the dental-oral-craniofacial (DOC) region towards Phase I clinical trials. **Purpose:** To identify areas in which TE/RM technologies are most needed in the DOC complex. **Methods:** Graduate students from USC, UCSF, and UC Davis conducted interviews with 22 dentists of a variety of specialties to determine areas of clinical need. **Results:** We identified bone (alveolar, jaw, and calvarial/suture), soft tissue, tooth structures, and periodontal tissue as the top four areas where TE/RM products are needed. The results of this survey are informing C-DOCTOR's priorities and pursuit of interdisciplinary translational project teams (ITPs). Eight ITP teams were funded in late 2017 and are currently refining their target product profiles through pre-clinical studies in consultation with C-DOCTOR advisors. **Conclusion:** C-DOCTOR is a national resource for the clinical translation of innovative technologies to regenerate DOC tissues and organs lost to congenital disorders, trauma, and disease. Our primary mission is to provide comprehensive clinical, scientific, technical, regulatory, financial, and managerial resources to ITP teams in order to promote cost-effective transition and timely development of dental, oral, and craniofacial TE/RM products.

Poster #: 140

Title: Validity of the Calendar Task in College Students

Name: Eddie Chu

Faculty Advisor: Sharon Cermak

Background: Executive function (EF) is an umbrella term for the cognitive skills necessary for the performance of goal-directed tasks, and is critical to successful engagement in everyday activities. The Weekly Calendar Planning Activity (WCPA) - Student edition is a version of the WCPA designed to assess the EF skills of young adult students within a functional context. **Purpose:** To examine the validity of the WCPA by examining its relationship with other performance-based and questionnaire measures of executive function. **Methods:** Participants included 40 graduate and undergraduates aged 18-30. Participants completed a consent form, demographics form, the WCPA-Student edition, Behaviour Rating Inventory of Executive Function – Adult version (BRIEF-A), the Zoo Map Test, and the Dysexecutive Questionnaire (DEX). Correlational analyses were performed to measure concurrent validity examining relationships between them. **Results:** The results are comparable between males and females and between undergraduates and graduates, implying that the WCPA-S can be used across gender and student status in our sample. US students scored more accurately and used more strategies in the WCPA-S, but US students required nearly twice the amount of time to complete compared to Israeli student. **Conclusion:** Impairments in executive skills and related functional cognition can negatively impact participation. The WCPA-S is a measure that may be used for college students who are struggling with organizing and planning their everyday activities. This study is significant because it provides support for the validity of the WCPA-S, a tool that can be used to provide information to help understand the challenges being faced by college students.

From the **Editors**

To our esteemed faculty, staff and fellow students:

We are extremely honored to present to you the Tenth Edition of The Explorer Journal of USC Student Research. As a community, we continue to forge ahead as thought-leaders in research and innovation at the Herman Ostrow School of Dentistry of USC, the Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy, and The Division of Biokinesiology and Physical Therapy.

This past decade has been particulary exciting for USC students who are interested in research. For many of us with the intellectual curiosity, our University and especially our faculty, are extremely supportive of all our endeavors. Now, more than ever, we highly encourage all our fellow students to pursue research.

The success of Research Day would not be possible without the immense support we have received from Dr. Yang Chai, Dr. Parish Sedghizadeh and the entire Research Day planning committee. Our Student Research Group thrives on the encouragement and support we have received from our faculty advisors. We would love to recognize the wonderful work of each of the students, authors, photographers, and editors.

Thank you, and Fight On!

Photo Courtesy of Tiffany Neimar Class of 2018.

From left to right: Tarang Patel, Henry Yim, Neha Desai, Jay Patel, Lomesh Popat, Jiawei Li, Azzah Widatalla, Teresa Nguyen, Karthika Basireddy, Ana Zapata Caceres, Maretta Oganesyan, Sinead Benyaminov, Dr. Parish Sedghizadeh, Michelle Cho, Ariana Rodriguez, Ruhee Jaffer, Davita Danesh, Daniel Kohanchi, Nina Bubalo, Sara Kahng, Christie Tu, Susan Park, Yeonghee Jung, Romina Sadreshkevary, Paulomi Salvi, Amro Albaghdadi (Not pictured: Daniel Adelpour, Arian Barooty, Amrita Chakraborty, Judith Naziri)

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Front cover photo courtesy of Allan Wu and Kimmie Groff (Chai lab). Immunofluorescent whole-mount staining of E10.5 mouse embryo with Ki67 and DAPI to produce a heat map of cell proliferation, with areas of highest proliferation in red.

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