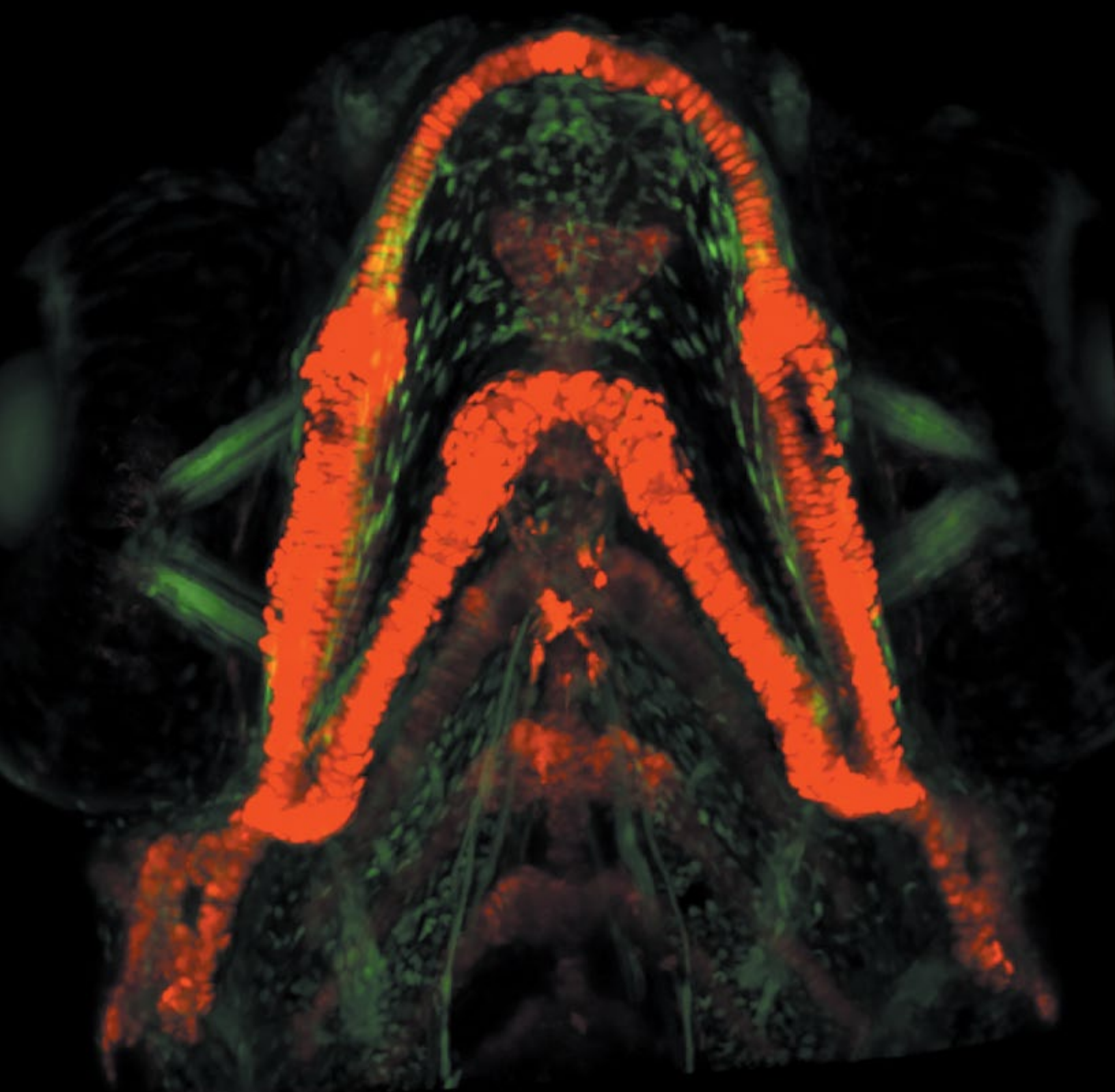
Herman Ostrow School of Dentistry of USC



THE EXPLORER

JOURNAL OF USC STUDENT RESEARCH

Previous Awards:
» 2011 American Association for Dental Research (AADR), National Student Research Group Best Student Journal Award
» 2012 American Association of Dental Editors Lawrence H. Meskin Student Journalism Award

THE EXPLORER

VOLUME 8

USC Student Research Group
Research Day - March 9th, 2016
Herman Ostrow School of Dentistry of USC

FROM THE **DEAN**

Dear students and colleagues,

Welcome to Research Day 2016!

This annual event — one of USC's only event dedicated to research — is always incredibly exciting for me to attend. I enjoy seeing the curiosity and excitement in the faces of faculty and students, including those from the USC Chan Division of Occupational Science and Occupational Therapy as well as the USC Division of Biokinesiology and Physical Therapy, as they talk so passionately about their research. More than that, I can always say I walk away from the event having learned something new. I hope you can say the same after today.

As part of a research-focused university, we at the Herman Ostrow School of Dentistry of USC take scientific inquiry and discovery incredibly seriously. For the past few years, Ostrow has been the top-funded private dental school by the National Institute of Dental and Craniofacial Research. Just last year, the USC Chan of Occupational Science and Occupational Therapy added five new extramural grants, totaling more than $8 million, to its research portfolio. Faculty members from the USC Division of Biokinesiology and Physical Therapy are regularly publishing high-impact journal articles and being recognized for their scientific innovation that is pushing their profession in new, exciting directions.

This focus on scientific inquiry, and on life-long learning in general, is critical for students to forge successful careers. Perhaps now more than ever before, we find ourselves living in an incredibly dynamic world, with new technologies and innovative ideas changing the professional landscape in ways unimaginable not too long ago. The ability to think critically, to scrutinize data and to stay apace with the constant changes will be imperative for future professionals in dentistry, occupational therapy and physical therapy. Through the academic rigors of doing research, our students will be better equipped to navigate these changes and rise to the challenge of a new century of practice.

As we embark upon this day, I'd like to congratulate all our faculty and student presenters. I am incredibly proud of your hard work, dedication and scientific curiosity.

Fight On!

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

INTRODUCTION

Dear colleagues,

Welcome to Research Day 2016! This is an annual celebration of the innovative endeavors that are the hallmark of the students, staff, and faculty of the Herman Ostrow School of Dentistry of USC.

As part of the University of Southern California, an elite research institution, the Herman Ostrow School of Dentistry is committed to excellence in research. Our students work alongside our expert faculty, providing an opportunity that few universities are able to offer as part of dental education. Our students gain hands-on experience at the cutting edge of research, which will benefit them throughout their careers, and benefit society as they become leaders of the next generation to make an important impact in science and health care.

At the Herman Ostrow School of Dentistry, we are committed to growing our research program through recruiting and developing the best and brightest new faculty members. Our junior faculty have attracted prestigious internal and external funding and are already achieving considerable success. Despite the challenging federal funding environment, we continue to rank #1 in funding from the National Institute for Dental and Craniofacial Research (NIDCR) among all private dental schools in the nation.

Our occupational science, occupational therapy, biokinesiology and physical therapy programs are national leaders in education and research. We take great pride as we celebrate our research accomplishments together and deeply value our interactions and the bonds linking the dentistry, occupational science and occupational therapy, and biokinesiology and physical therapy programs.

Our mission is to shape the future of oral health care by advancing and integrating dental and craniofacial education, scholarship, and patient services. As we translate our scientific discoveries into practical health care therapies, we are fortunate to have great partners in the Keck School of Medicine of USC, USC Viterbi School of Engineering, and USC School of Pharmacy. Working together, we can make an important impact on society.

Introducing our students to the joys and challenges of research is crucial to providing them with added value in their education at USC. Our students represent the future of our profession, and the outstanding discoveries being presented today make it clear that the future is bright. Please join me in congratulating all of our students and researchers on their successes as we gather to showcase their efforts on Research Day.

Fight on!

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

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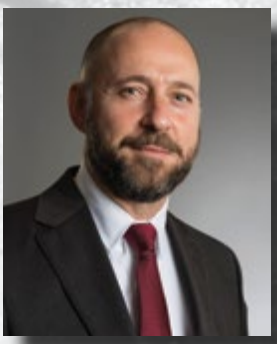

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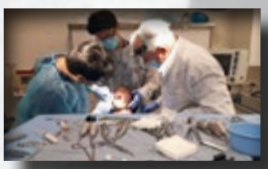

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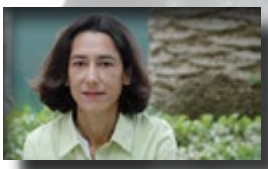

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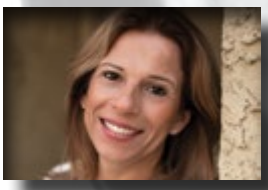

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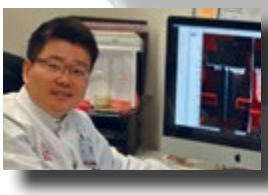

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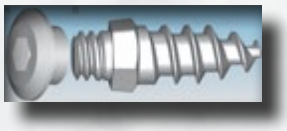

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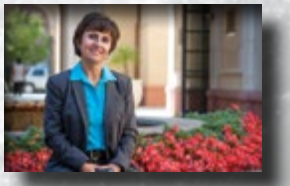

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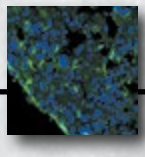

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THE EVOLUTION OF OUTPATIENT ANESTHETIC AGENTS IN ORAL AND MAXILLOFACIAL SURGERY

BY ALI SALEHPOUR '17

Oral and maxillofacial surgery (OMFS) has transformed in scope, training, and application from its primitive origins in the early 1900s to its current state treating the entire maxillofacial complex. The earliest oral surgeons were primarily exodontists who were limited to dentoalveolar surgery. Starting in the early 1900s, oral surgery as a specialty came into existence. The first oral surgeons had very minor training in comparison to contemporary schooling. After completing dental school, these initial surgeons were only required to complete one-year residency programs in order to be licensed. These preceptor-based programs were not highly competitive and were typically hospital-based. As the demand for oral surgeons increased, residency programs started to increase the length of their programs – starting in the 1950s, programs began requiring two or three years of training after dental school. One of the pioneer programs for OMFS was Los Angeles County Hospital, which was, and still is, affiliated with the University of Southern California (LAC + USC). Dr. Marsh Robinson, a pioneer in the field of OMFS who has earned a plaque in the USC Hall of Fame, started the 3-year OMFS residency program at USC in 1954. One of the many influential oral surgeons who Dr. Robinson trained was Dr. Jack Lytle, DDS, MD. Dr. Lytle graduated from USC Dental School in 1958, completed his OMFS residency in 1961, and earned his MD from USC Medical School in 1965. As one of the top clinicians in the Greater Los Angeles area, Dr. Lytle was at the forefront of the rapid changes in oral surgery, adapting to the drastically changing landscape. Dr. Lytle became universally respected both as an educator and as a clinician, and in 1977, was named the chairman of the OMFS program at USC, a position he held until 1986. During this time, he began conducting studies on the efficacy, morbidity, and mortality rates of the sedative agents used in the outpatient setting. Anesthesia was one of his greatest passions. Dr. Lytle clearly understood the limitations of the early IV drugs used for sedation. He was never hesitant to adopt newly developed drugs after studying their properties and indications. The improvement of sedative agents for outpatient oral surgery allowed implants, pathology, biopsies, and third molar removal to become relatively uncomplicated and routine procedures.

In the 1950s, ultra short-acting sodium pentothal and Demerol (meperidine) were the primary barbiturates used, in conjunction with nitrous oxide (N_2O). Sodium pentothal was developed in the early 1930s, and though it used to be the primary rapid-onset, short-acting barbiturate used in OMFS due to inducing rapid sedation and unconsciousness in under 15 seconds, its zero-order elimination kinetics require a large quantity to be administered to maintain its effect. This causes an unwanted period of unconsciousness after the procedure is completed. Similarly, Demerol was an opioid developed in 1939

and used regularly by oral surgeons in the 1940s and 1950s. It was originally thought to be a less addictive, more efficacious, and safer alternative to morphine. Unfortunately, it still carries the same side effects as conventional opioids, primarily nausea, in addition to potentiating serotonin syndrome in individuals who take antidepressants.

In the 1960s, Brevital (methohexital) became the chief sedative agent used by oral surgeons in the outpatient setting. Brevital is a rapid-onset, ultra short-acting barbiturate similar in mechanism of action to sodium pentothal. Though it has less adverse effects than sodium pentothal, it can cause a decrease in seizure threshold and only provides sub-therapeutic analgesia in many patients, so the search for a superior agent continued.

The 1970s and 1980s brought the widespread use of revolutionary drugs such as fentanyl and benzodiazepines in oral surgery. Fentanyl is an opioid that is one hundred times more powerful than morphine and provides profound analgesia, amnesia, and anxiolysis. It is still currently used by oral surgeons intraoperatively and remains one of the most efficacious analgesics on the market. Unfortunately, in addition to causing the typical opioid side effects, it can cause respiratory depression more frequently than other opioids; vitals must be cautiously monitored during use. Additionally, benzodiazepines are a class of sedative agents that provide desirable anxiolysis and amnesia. Since they do not provide profound analgesia, they are regularly combined with fentanyl, creating a very popular drug cocktail. The first benzodiazepine used in oral surgery was Valium (diazepam). Though it was a favorite of oral surgeons for the many years, its effects last longer than is desirable and it causes thrombophlebitis when administered via IV. This is a serious complication that led to the development of shorter-acting benzodiazepines.

In the 1990s, Versed (midazolam) was developed. To date, Versed is considered the ideal benzodiazepine for oral surgery and is used alongside ketamine and Propofol. Cocktails of these three drugs are used on almost all patients in the outpatient clinic. Versed is an ultra short-acting benzodiazepine with a short half-life. It is given via IV in combination with the opioid-like Fentanyl in order to provide induction of sedation with analgesia, anxiolysis, and amnesia. It wears off over twice as fast as Valium, making it an ideal agent for outpatient oral surgery. Currently, the vast majority of oral surgeons use high-dose Versed in their sedation cocktails due it its overwhelmingly positive attributes. The third common component of current cocktails, Propofol, is colloquially known as “milk of amnesia” due to its milky white appearance. Propofol was developed in the early 1990s as a hypnotic agent and is still used by almost all surgeons in the outpatient setting. Propofol provides no analgesia but is very effective at inducing anesthesia. For this reason, it is used in conjunction with Versed and fentanyl for oral surgery. It can cause respiratory depression at high doses, so care must be given to vitals if higher amounts are administered. Propofol replaced sodium pentothal as the preferred agent to induce anesthesia. Ketamine was reintroduced in the early 1990s. It induces a trance-like state while providing pain relief, sedation, and memory loss. Coronary function, breathing, and airway reflexes generally remain functional, making it a great option in individuals who do not have psychiatric problems. It is also used in conjunction with Versed as a very efficacious cocktail, especially for younger patients.

The use of many of these sedatives could lead to emergencies in the clinic, especially if reversal agents were not readily available. The two most common reversal agents are Narcan (naloxone) and Romazicon (flumazenil). Narcan is an opioid reversal agent used typically to counteract fentanyl overdose, whereas Romazicon is a benzodiazepine reversal agent used to counteract lorazepam, diazepam, and midazolam. In order to monitor vital signs in patients under these sedatives, EKG machines, pulse oximiters, and CO_2 monitors have become widely used in outpatient oral surgery clinics. These devices provide real-time feedback on the physiologic effects of the sedative agents and allow practitioners to intervene immediately if a patient begins to display adverse effects.

As the field of oral surgery continues to evolve and technology improves, newer sedatives with fewer side effects will undoubtedly be developed. These will certainly allow oral surgeons to continue performing complex procedures without having to intubate patients under general anesthesia in the operating room.

INNOVATING TO CORRECT CLINICAL PROBLEMS IN CRANIOFACIAL ORTHODONTICS

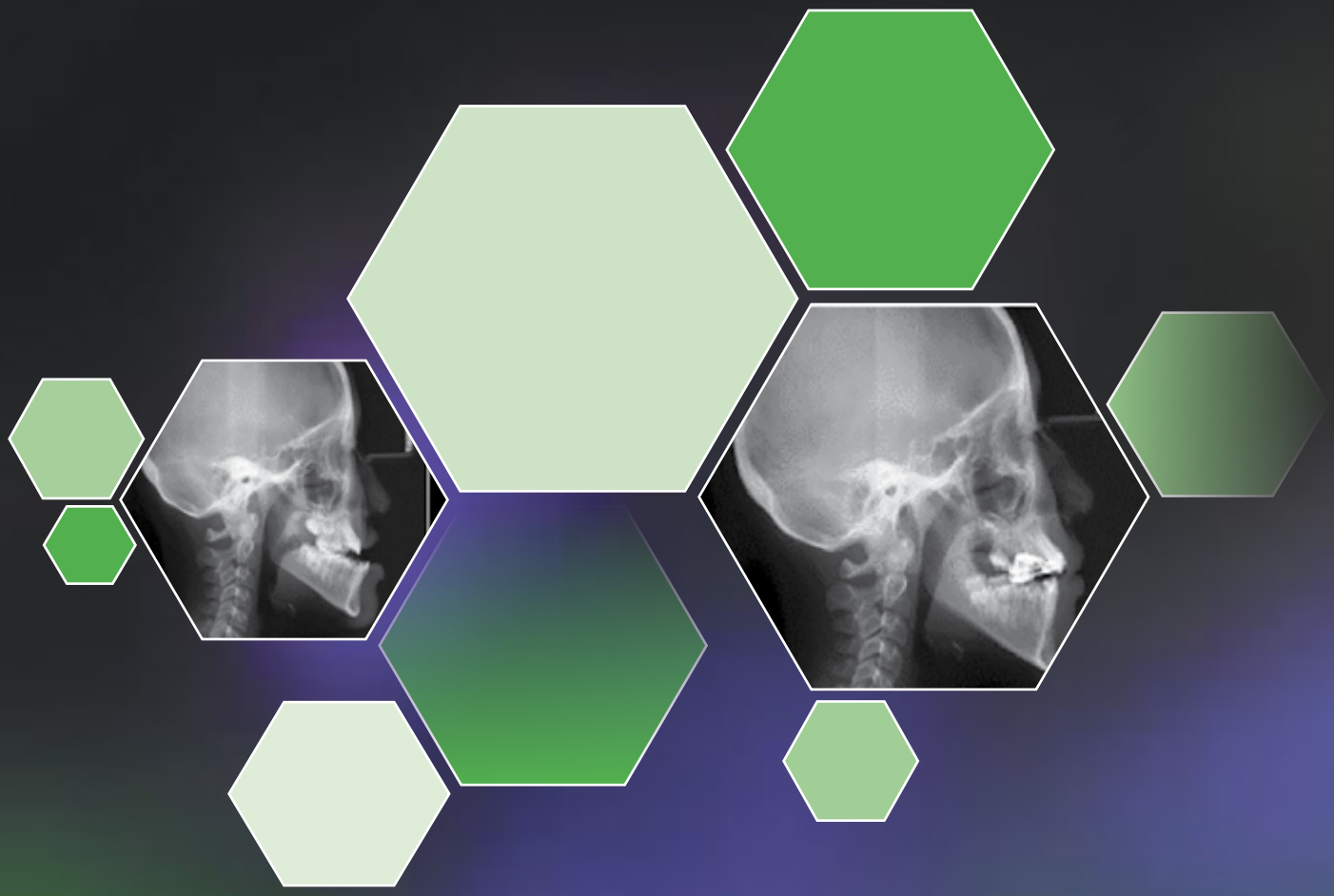
BY JANICE LEE '17 AND KAITLIN MARSH '17

Dr. Stephen Yen sees himself as a clinician and a researcher and lives by these words: "For me, it is the clinical problems that drive research." Dr. Yen attended Harvard School of Dental Medicine, and was interested in dentistry from an early age. Dr. Yen's father was an orthodontist and a bone biologist who was very passionate about his profession and exposed his son to the beauty of dentistry. "I had a great dad. He really loved orthodontics. He would come home happy and excited about his work," Yen states.

Despite his personal enthusiasm for orthodontics, Dr. Yen's father always encouraged him to explore all aspects of dentistry. After receiving his D.M.D. from Harvard, Dr. Yen was recruited by his father to teach modern dental techniques at Sun Yat-Sen University in Guangzhou, China after the university bought their first casting machines and high speed handpieces. He also taught pediatric dentistry at Hong Kong University under the tutelage of Dr. Stephen Wei. During that time, Dr. Yen applied for the combined Orthodontics and PhD program at USC. Dr. Yen's life as a Trojan began when he entered the PhD program at USC in Craniofacial Biology, which was then led by Dr. Harold Slavkin and Dr. Michael Melnick, completing his PhD under the supervision of Dr. Mary MacDougall. Shortly after, he was accepted into the USC Orthodontics residency program.

Dr. Yen treats children with facial birth defects at Children's Hospital Los Angeles as a member of a team of specialists. He also directs a CODA-approved fellowship in craniofacial orthodontics. Dr. Yen completed his PhD research at the Center for Craniofacial Molecular Biology (CCMB) at USC and has always seen CCMB as his research home where clinical problems can be solved using basic and translational research. He mentions that he has enjoyed the camaraderie and mentoring that CCMB faculty have provided through the years, and especially admires Drs. Harold Slavkin, Mary MacDougall, Margarita Zeichner-David, Malcolm Snead, Charles Shuler, Yang Chai, Anh Le, Matt Lee, and Songtao Shi for their research. Upon asking Dr. Yen to expand on some of his current endeavors, his eyes lit up as he explained his involvement in the clinical application of orthodontics in children with craniofacial defects, such as cleft lip and cleft palate. In Dr. Yen's clinical experience, many patients present with unique craniofacial problems that cannot be corrected with existing conventional approaches. He has devoted his life to finding clinical solutions for his patients "who spend a good part of their lives in and out of the hospital."

Dr. Yen discussed one of his studies on maxillary protraction that compared the use of traditional orthognathic surgery to non-surgical loosening of the intermaxil-



Above: Non-surgical correction of Cl III malocclusion. Maxillary protraction of a patient with cleft palate: pre-treatment and post-protraction

lary sutures before they fuse, inducing flexibility, to correct a skeletal underbite. The goal of maxillary protraction is to pull the maxilla forward in patients with cleft lip and palate to obtain proper bite and facial esthetics. Another area of Dr. Yen's research is surgically assisted tooth movement, which can be used to perform difficult tooth movements and to shorten treatment time. Osteotomies allow bony segments to be moved with orthodontic mechanics. Corticotomies take advantage of a natural bone healing response, the regional acceleratory phenomenon, which can cause a temporary demineralization of alveolar bone, allowing dental roots to move rapidly through the area prior to remineralization. More recently, his team has achieved the same bone response by stimulating the bone with particular wavelengths of light, thereby eliminating the need for surgical stimulation. Dr. Yen has collaborated with researchers and surgeons on projects that range from treating facial overgrowth to pioneering bone grafting made of demineralized bone matrix impregnated with BMP2. The clinical work with his CHLA colleagues, Drs. John Reinisch, Mark Urata, Pedro Sanchez, John Gross, John Meara, Amornpong Vachiramon, Lori Howell, Mark Jeff Hammoudeh, William Magee, Sally Ward, and Duke Yamashita, have led to a number of surgical orthodontic innovations for treating children with craniofacial problems.

When inquiring about his goals for the future, Dr. Yen said he would like to help younger faculty members develop their careers at USC. He asserts that USC is a wonderful place to become involved in research because the Trojan family provides a supportive and nurturing environment. In describing this, Dr. Yen reflects, "in research there is a lot of competition but the fun really comes in when you collaborate with researchers who are good people, good friends and wonderful scientists." It is with this mindset that Dr. Yen continues to be excited about research and about solving the clinical problems he faces at Children's Hospital Los Angeles. Dr. Yen exclaims that he is truly privileged to be working with wonderful patients and parents who inspire him to do his work a little bit better each day.

A JOURNEY:
FROM STATISTICS TO IMAGING

By Daniel Matatiaho ’17 and Emil Abner ’17

Since high school, Dr. Reyes Enciso has had two great passions: statistics and imaging. This led her to pursue a bachelor’s degree in the subject of computer science from Polytechnic University of Valencia in Spain. In addition to this, she earned Master’s and Doctor of Philosophy degrees from the University of Orsay in Paris

Dr. Enciso joined the Herman Ostrow family as a research associate in 2001, concurrently working at the USC Viterbi School of Engineering. Starting in 2003, Dr. Enciso became an Assistant Professor of Clinical Dentistry. She works closely with the orthodontics, endodontics, and oral surgery departments using her knowledge of 3D imaging to reconstruct images from cone-beam computed tomography (CBCT) and to detect the location of the mandibular nerve for implant placement..

Dr. Reyes Enciso

Since arriving at USC, Dr. Enciso earned a Master’s degree in clinical and biomedical investigations from the Keck School of Medicine and was promoted to the position of Associate Professor of Clinical Dentistry in 2013. Over her influential academic career, Dr. Enciso has to date over 90 publications, including 37 original articles in peer-reviewed journals such as the *Journal of Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, American Journal of Orthodontics and Dentofacial Orthopedics, Journal of Endodontics, Sleep and Breathing, and Dentomaxillofacial Radiology.*

In 2015, Dr. Enciso received the Williams H. Rollins Award from the American Academy of Oral and Maxillofacial Radiology in recognition of her research accomplishments in the field. This award acknowledged her research with CBCT, an x-ray technique that reconstructs craniofacial structures in 3-D. She has also conducted research correlating CBCT parameters with sleep questionnaire responses in the detection of undiagnosed obstructive sleep apnea. This dangerous condition is characterized by pauses in breathing during sleep as a result of collapsing soft tissue that blocks the upper respiratory pathway. Her research won the American Academy of Oral and Maxillofacial Radiology’s Arthur Wuehrmann Prize for Best Oral Radiology Article in 2010.

Dr. Enciso, together with Dr. Santosh Sundaresan and Dr. Roseann Mulligan, has also been deeply involved in the USC Mobile Dental Clinic, one of the most popular and successful programs at the Herman Ostrow School. They have been analyzing the tremendous amounts of data that have been collected at the clinics in the form of patient procedures and outcomes. All the data compiled at the various mobile clinic locations, such as local schools, shelters and community outlets, allow assessment of the efficacy of the mobile clinics. For instance,

Dr. Enciso has extrapolated the time elapsed from the initial visit at a mobile clinic to a subsequent visit for further dental care. Data from the two visits can be compared to study the amount of new decay at the second visit. This data can help program operators investigate demographic data to improve oral health care habits and allow for more investigation of what methods and protocols can be changed to increase the efficacy of the mobile clinic programs. Further data that Dr. Enciso's team is set to explore include the longevity of the restorations placed during procedures performed at clinics versus data from private practices.

One of the major concerns currently in all areas of healthcare is the availability of HIV testing. The Special Patients Clinic in collaboration with the Dental Hygiene Program at the Herman Ostrow School of Dentistry has created an initiative to allow easier access to free HIV testing. The program started with a questionnaire given to prospective patients to gauge their willingness to be tested concurrently with their dental care. The program's goal is to explore the barriers to being tested for possible HIV infection and, if necessary, to proactive treatment. Data has been collected on questions such as: "Are you willing to receive free HIV testing?" "How would you feel if your dentist offered free HIV testing?" and "Would you want a medical doctor, dentist or student dentist to reveal the test results?" The interest of patients has allowed for the program to expand to include simple and fast in-patient testing using rapid-result HIV testing.

Dr. Enciso and the graduate students from the Master's degree program in Orofacial Pain and Oral Medicine at the Herman Ostrow School of Dentistry have been heavily involved in conducting systematic reviews in the fields of orofacial pain and oral medicine. Such topics include the usage of botox in post-herpetic neuralgia patients, and premedication, specifically NSAIDs, for irreversible pulpitis and its efficacy in administering inferior alveolar nerve blocks. Dr. Enciso and her students analyzed the literature and conducted a meta-analysis, which summarized all the findings into one pooled result, allowing the authors to provide recommendations. With the help of Dr. Saravanan Ram, Dr. Parish Sedghizadeh, Dr. Glenn Clark, and Dr. Piedad Suarez, they are in the process of publishing these results.

Dr. Enciso has been dissecting numbers and patterns since her early background in engineering and has brought with her to USC a unique way of organizing data to reveal hidden insights. The knowledge and skills in quantitative analysis Dr. Enciso shares with her peers are an invaluable asset for the dental community here at USC, and we should all continue to look for her future endeavors and collaborations with the research and clinical departments at USC to advance the dental field as a whole.

CHANGING DEMOGRAPHICS IN SPECIAL PATIENTS

BY MATHIAS FALLIS '17 AND JAMES TSE '19

As healthcare becomes more effective and societal conditions change, new populations emerge with unique dental considerations. Dr. Piedad Suarez, who manages the Special Patient Care and Geriatric Dentistry Department at the Herman Ostrow School of Dentistry of USC, is committed to providing the best possible care for these patients. In particular, USC dentists are treating more geriatric patients and more members of the LGBT community than ever before. Due to the efforts of Dr. Suarez, USC clinicians are increasingly aware of the special needs of the diverse patient population and trained to provide each patient with sensitive, personalized care.

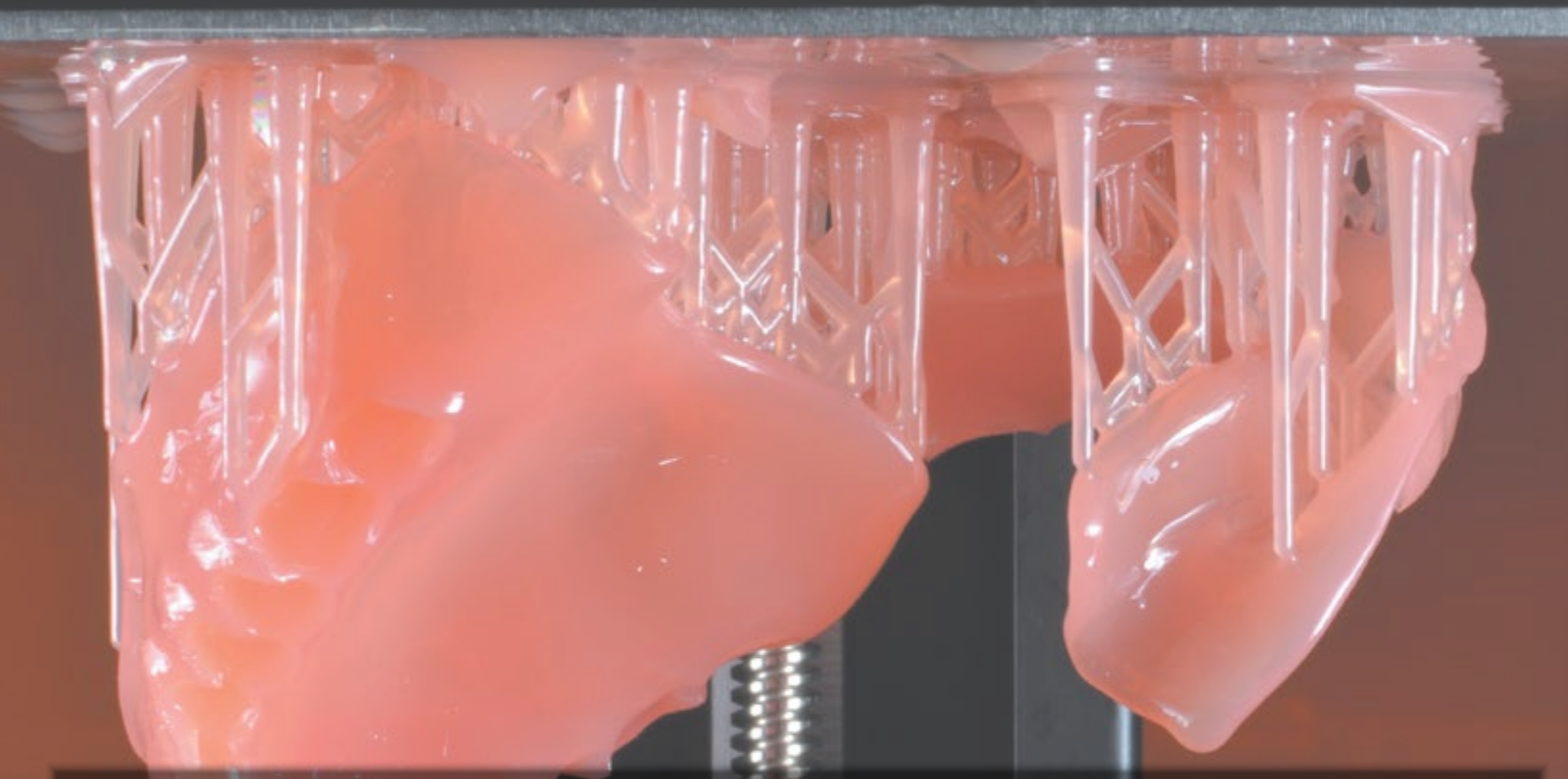
Dr. Suarez was originally born 3,471 miles away from Los Angeles in Colombia. When she was a child, her family moved to Costa Rica, where she was raised and eventually earned her dental degree. Dr. Suarez attended the Universidad Latina de Costa Rica, which at the time was the only dental school in Costa Rica. After graduating, Dr. Suarez worked in corporate and private practices, and founded a dental product distribution business with her colleagues. However, in her study groups a few of her colleagues began to pursue residency programs in the United States, specifically at the UCLA School of Dentistry in Orofacial Pain. Her thirst for knowledge and the influence of her colleagues lead her to apply to USC's Orofacial Pain Program. After two years of immersing herself in the field with other like-minded individuals at USC, she decided to stay at USC to pursue a career in academia. Many of the patients she treated with orofacial pain also happened to be medically compromised patients, so ultimately over the years her interest gravitated from orofacial pain to special and geriatric patients. The Special Patient Care clinic at USC, now managed by Dr. Suarez, is the oldest in the country. The clinic is designed to offer the highest quality of care to medically compromised patients.

Dr. Suarez continues to further her education as she is currently pursuing a Master's degree in gerontology. She stresses the need for a long-term model for geriatric care, similar to the one offered for pediatric patients in the state of California. Additional research in the field of geriatrics can help this idea to become a reality. Currently, much dental research stops with patients at the age of 65. However, the number of patients above 65 is growing and therefore their dental care needs must be addressed. Dr. Suarez emphasizes that more screening needs to be done with the elderly and the data collected can be used to increase the insurance coverage. In addition, more geriatric research may lead to more government funding.

As the nation becomes more progressive in the way it views gender, so should health care institutions. This belief held by Dr. Suarez has led her to work to make sure that the tolerance toward the LGBT community currently growing in the United States is also growing within dentistry. She has given lectures in California specifically on the transgender community and has begun modifying the curriculum of USC's cultural sensitivity courses. Dr. Suarez hopes that by increasing care providers' education and awareness of the LGBT community, patients will feel more comfortable when visiting their local dental clinic and thus receive equal care.

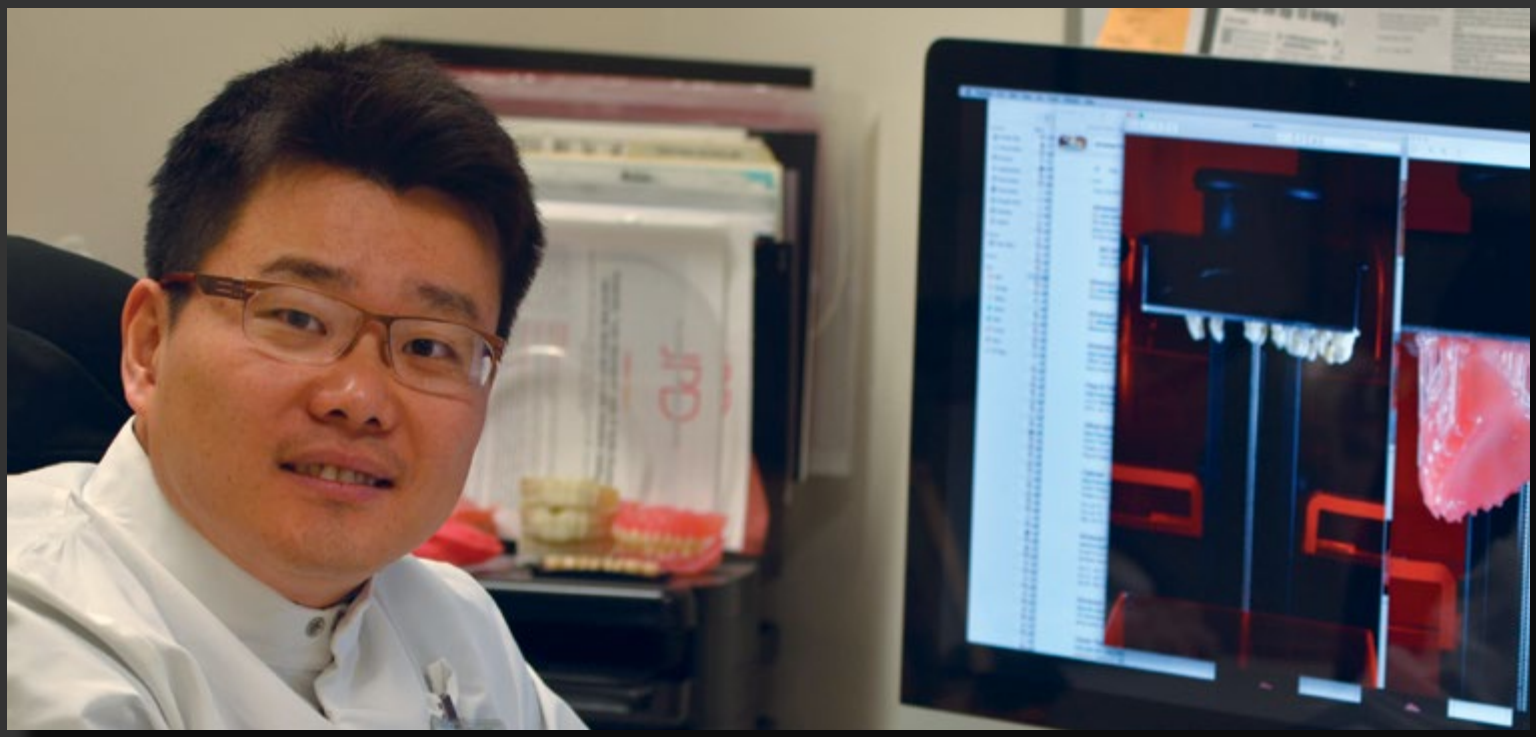
CLINICAL ADVANCEMENTS IN REMOVABLE PROSTHODONTICS

BY ANKIT KESHAV '17 AND ANTHONY PHAM '17



Dr. Tae Hyung Kim is the Chair of Removable Prosthodontics in the Division of Restorative Sciences at the Herman Ostrow School of Dentistry of USC. He received his DDS degree from Seoul National University School of Dentistry and completed his postgraduate training in Prosthodontics at USC. Dr. Kim was hired by USC immediately after graduating and has been teaching since. Dr. Kim initially became interested in research because he found it more enjoyable than solely practicing dentistry. He remarks that "one research project can help millions of people, but practicing [dentistry] can only help so many. No matter how busy or how big your practice is, you have limitations. There are only twenty-four hours in a day and you are stuck in that time frame. However in research, you can do something that others can develop and learn from that affects a much larger population."

Dr. Kim's current research was inspired by his mentor, Dr. Bernard Levin, the author of multiple books on removable prosthodontics and a former professor at USC who taught for 50 years. Dr. Kim states that Dr. Levin guided him through his residency in prosthodontics. He was also influenced by Dr. Pascal Magne's research on bonding and immediate dentin sealing as well as by Dr. Winston Chee's research on implants, specifically immediate loading. Dr. Kim recalls a significant instance that contributed to his interests transitioning to removable prosthodontics. In 2005, a patient came into his private practice and complained about an ill-fitting denture that was completed by a doctor who had recently graduated from dental school. At that point, Dr. Kim realized that there were two major problems with removable prosthodontics. First, that recent graduates did not have thorough and comprehensive training in creating and properly fitting them, and second, that the technicians were not correctly executing orders from the dentists. Dr. Kim explained that there are many reasons why students are not able to replicate exactly what they learn in school. Moreover, the typical dental school curriculum has changed in a way that disadvantages students post-graduation. Dr. Kim states, "I believe that as educators, we can't just look for efficiency only, but obviously we should deliver something that our graduates can benefit from." In previous years, students were given ten to twenty cases in which



they were called upon to create removable prosthodontics, but it has dramatically declined to three to six cases. "And that's the problem," remarks Dr. Kim. "Ninety percent of dentures are made by general practitioners." Dr. Kim also believes that due to the lack of financial opportunities in removable prosthodontics for dental technicians, technicians are being lured to more profitable areas of dentistry such as those dealing with implants and crowns. He remarks that "these young, talented technicians move away from removable prosthodontics. Once the good removable technicians retire, there is no one to replace them."

Dr. Kim further discusses the decline in removable prosthodontics as being due to the fact that there has been a lack of research in removable prosthodontics and therefore a lack of innovative techniques used in the removable lab. He states, "the removable lab is the only lab that has gotten worse over time instead of the other way around. It never had the chance to implement new techniques to enhance [removable prosthodontics]." He notes that over ten years, no money was allocated to research in removable dentistry; funds were instead directed towards other fields such as bonding and implants. This realization was a turning point for Dr. Kim and influenced him to fully invest his time in removable prosthodontics research. In 2007, Dr. Kim became a part of a pioneering team that would take removable prosthodontics to the next level by implementing new technology and advances in the field. It took four to five years to fabricate the initial prototype, which is now known as DENTCA. DENTCA uses CAD/CAM technology and 3D software to produce more accurate, comfortable dentures for patients. 3D printing is now poised to further revolutionize the field. But even with the development of 3D printing, there will still be a lot to improve upon. "Technologically, 3D printing sounds great. It has been around for more than a decade and it will continue to improve a lot," Dr. Kim opines. Currently, he notes that there are both speed and material issues with 3D printing, but he is hopeful that these issues will be addressed in the coming years.

Dr. Kim plans to continue his research in removable prosthodontics to make it easier and more efficient to produce quality prostheses. He eloquently remarks about the joys of research when he says, "there is no end in research. But there is an end in practicing. The further you go into research, the more you open it up. If you go down deeper, there are far bigger unknowns that you need to solve. It's quite interesting." At the end of the day, Dr. Kim is a talented prosthodontist who enjoys all aspects of the field. "If I do something, I need to like what I am doing. I enjoy all prosthodontics work including implants and crowns. I have great partners in periodontics, orthodontics, and endodontics, which allows me to do what I like to do while offering all specialties at my office."

Dr. Tae Kim is a distinguished educator and a biomaterials researcher who has been awarded multiple grants and awards for his research on removable prostheses and implants. He is also the author of numerous clinical and research articles on removable and implant dentistry. Dr. Kim's current research on removable prosthodontics aims to make it easier, better and more efficient for practicing dentists to make removable prostheses.

ENGINEERING THE PERIODONTIUM OF **TOMORROW**

By Shant Aharonian '17 and Sarah Rafo '17

The Postdoctoral Advanced Periodontology program at the Herman Ostrow School of Dentistry of USC is a world-renowned research institution due to its many advances in the field of periodontology. Dr. Neema Bakhshalian is one of the program's current leaders who is shaping the future of periodontology. Dr. Bakhshalian completed his periodontology training and Master's degree in Craniofacial Biology at the Ostrow School and previously earned a PhD with a focus on bone biology from the Florida State University. Currently, Dr. Bakhshalian is an instructor and a leading researcher at the Laboratory for Immunoregulation and Tissue Engineering (LITE) at USC, and is a clinician focusing on periodontics in private practice.

While earning his PhD, Dr. Bakhshalian focused his research on bone graft materials. He and his group led a research study on rabbits where they developed a protocol that allowed them to utilize dentin as a bone grafting material. "We basically extracted their teeth, removed the enamel and pulp and kept the dentin. We then demineralized the dentin. At this point we developed a protocol to freeze dry it so that resembles actual bone graft material that can be kept at room temperature." Demineralizing the dentin has several benefits for bone regeneration. According to Dr. Bakhshalian, "demineralized dentin releases all the growth factors in the graft" and during hemostasis "the body is able to resorb it and create new bone." Furthermore, "the demineralization process reduces the risk of disease transmission and antigenicity." Their research included Micro-CT scanning which allowed them to compare the control group to the experimental group. In the experimental group, calvarial bone defects were filled with demineralized dentin grafting material, as compared to the control group which did not receive any graft material. The results showed significantly more bone regeneration in the experimental group and were published in *The International Journal of Oral & Maxillofacial Implants* (Fig. 1). To date, several companies in Asia have developed dentin bone grafting materials similar to those pioneered by Dr. Bakhshalian.

In recent years Dr. Bakhshalian has worked alongside Dr. Homa Zadeh, Director of the Postdoctoral Advanced Periodontology program at the Herman Ostrow School of Dentistry, researching and developing methods for ridge preservation. Tooth extraction is usually accompanied by alveolar bone resorption which may jeopardize implant therapy. A ridge augmentation procedure can be performed to mitigate bone loss, but ridge augmentation procedures are extremely challenging. An alternate option is a ridge preservation procedure, which is not as challenging as a ridge augmentation. Under the leadership of Dr. Zadeh, Dr. Bakhshalian and his team of researchers developed two innovative devices to enhance the predictability and prognosis of ridge preservation procedures.

These appliances are known as Socket-KAP and Socket-KAGE (Fig. 2). The Socket-KAP is a non-resorbable dome shaped device that makes covering the site of the extraction a much simpler task than manipulating the collagen membranes typically used in such cases. Furthermore, the KAP allows for controlled soft tissue healing at the site of extraction. The KAP comes in four sizes, each with channels on the dome so that it can be easily sutured to the gingival margins. The Socket-KAGE is a device that is advantageous for extraction sites with a dehiscence in which the buccal plate has been lost. Grafting a site without a buccal plate will lead to soft tissue collapse. The KAGE is a rigid, ribbed cage that mimics the shape of the root. As a result, in cases of extraction at sites with no remaining buccal plate, the KAGE can be placed in the socket to hold the volume of graft material and prevent the collapse of the soft tissue. Since the Socket-KAGE is resorbable, it can be placed immediately after an extraction, eliminating the need for further surgical procedures for ridge preservation. The benefits of these devices are evident in their trailblazing results. Generally, crestal bone is critical for implant placement, and yet suffers the most atrophy following extractions. The Socket-KAP alone, without a graft, preserved over 30% of the crestal 3 mm of the ridge contour. In comparison, the KAP along with a graft preserved over 40% of the crestal 3 mm of ridge.

It is absolutely remarkable to see the ways these two innovative devices can significantly improve the prognosis of complicated ridge preservation procedures.

Currently, Dr. Bakhshalian also focuses on peri-implantitis. There are currently two schools of thought on the definition of the term peri-implantitis. Some authors believe that implant failure occurs due to technical issues such as occlusion and poor placement, and that there in fact is no pathology present. Others believe that peri-implantitis is the result of an infectious process. In contemporary peri-implantitis studies in animal models, a ligature is placed around an implant, which accumulates plaque, thereby causing peri-implantitis. This research model has limitations, such as uncertainty regarding the specific bacteria at the site of the implant. Additionally, the ligature model results in a more acute disease process, rather than the chronic pathology which is seen in patients. While the ligatures are injected with bacteria to ensure a lesion develops, these bacteria are in the planktonic phase which is quite different than the biofilm typically seen in peri-implantitis. The structure of a biofilm makes it impermeable by the host immune system or antibiotic therapy. Dr. Bakhshalian's team at LITE has developed an animal model which utilizes biofilm on implants to better resemble peri-implantitis. His team has developed a two-piece implant model (Fig. 3) that allows the benefit of having a sterile implant screw, while inoculating the healing cap with specific bacterial biofilms such as *Aggregatibacter actinomycetemcomitans* (AA). Dr. Bakhshalian now faces the challenge of successfully osseointegrating the two-piece implants, a challenge that is amplified by the fragile nature of alveolar bone in animal models such as rats. Nonetheless, Dr. Bakhshalian is optimistic and notes, "Once we successfully establish stable two-piece implants in rats and mimic peri-implantitis, then we can really understand disease progression, the etiology, and various treatment options."

Dr. Bakhshalian's passion to question and seek solutions has led to new innovative thinking in the field of periodontology. His research has focused on tissue regeneration in periodontal therapy, and he believes that "although there are various methods of regeneration, true regeneration involves bone, cementum, and PDL formation. While most procedures involve bone regeneration, few are successful in regeneration of attachment between bone and tooth. While this concept may seem remote, we can develop a predictable technique to generate true periodontal regeneration." Dr. Neema Bakhshalian represents the drive and passion that has allowed the Postdoctoral Advanced Periodontology program to continuously expand its horizons and make groundbreaking advancements in the field of periodontology.

Dr. Neema Bakhshalian

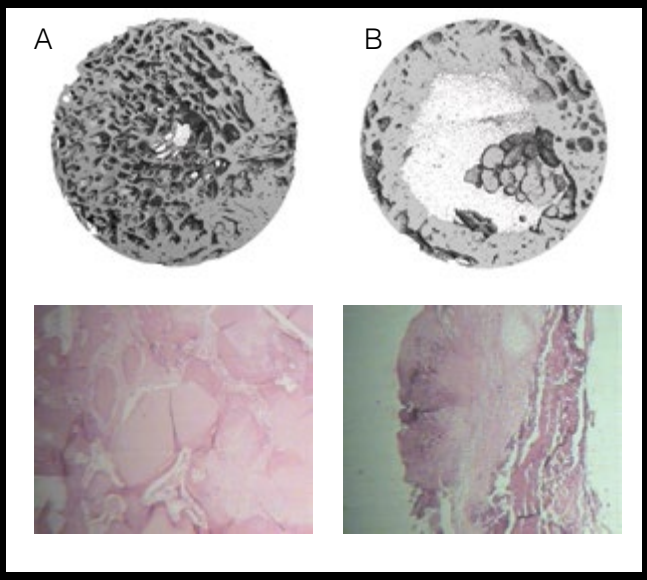


Figure 1: A) Representative Micro-CT and histological views of a defect filled with the demineralized dentin matrix; B) Representative Micro-CT and histological views of a defect without bone graft material.

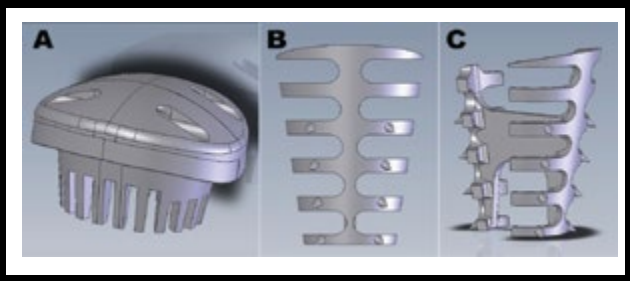


Figure 2: A) Socket-KAP used for closure of the orifice of the socket, B) and C) Socket-KAGE used to support the facial/buccal soft tissue in the extraction sockets with dehiscence.

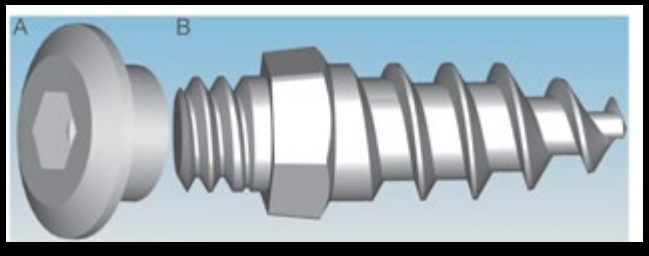


Figure 3: A) 3D drawing of the healing abutment for the latest prototype of the 2-piece implant system; B) 3D drawing of the implant for the latest prototype of the 2-piece implant system.

Dr. Santosh Sundaresan

COMMUNITY DENTISTRY:

BRIDGING THE GAP

By Danielle Goodman '17 and Leora Sheily '18

The USC Mobile Dental Clinic has been serving migrant communities in central and southern California since 1968. Over the years, the Mobile Clinic has served more than 80,000 children with limited access to care by opening about ten clinics each year that provide free dental care in both urban and rural areas. Dr. Santosh Sundaresan, who now serves as the chair of the section of Community Health Programs at USC and the director of the USC Mobile Dental Clinic, has always been involved in community dentistry. When he was a dental student in India, he jumped head first into community-based activities. As president of the Rotaract Club, he facilitated screenings and treatment of orphaned children and worked to educate the population on oral health care. When he graduated dental school, he worked in two very different types of practices: One was a high-end practice while the other catered toward the underserved community. The genuine nature of the underserved population impressed him very much. Dr. Sundaresan felt great satisfaction from the work that he did for the underserved populations in India. When applying for dental programs in the United States, USC was his first choic[l]e because of programs such as the USC Mobile Dental Clinic, which conducted such important work in the community. In 2003, Dr. Sundaresan ventured to the United States for the Advanced Standing Program for International Dentists (ASPID) at USC, where his long-term relationship with the Mobile Dental Clinic started.

As a previous Mobile Dental Clinic student and current faculty member, Dr. Sundaresan has a very unique perspective on the work that is done there. There is no question that there is a deficiency in dental care to the underserved. The USC Mobile Clinic aims to bridge that gap. Little research has been conducted on the care provided in these communities. The big question is: what kind of care can inexperienced operators provide under challenging circumstances (i.e., a mobile clinic setting and potential language barrier)? First and foremost, what is the quality of the dental care? Second, how effective is the oral hygiene instruction and education that the students are delivering to patients? In 2013-2014, Dr. Sundaresan aimed to answer these crucial questions by harvesting as much data as possible from the USC Mobile Dental Clinic dating back to 2006, focusing mainly on returning patients and their DMFT scores.

Recently published findings from this study revealed that the dental care being given is of good quality, and the rate of decay in returning patients decreased. So it seems, not only are the restorations done by minimally experienced operators under difficult circumstances lasting without any recurrent decay, but the oral hygiene instruction that the students teach the patients is effective since they are returning with less new decay on the remaining tooth structure. Dr. Sundaresan is now in the second phase of his research on the quality of the dental care provided. This new research, which he hopes to publish in the next year, shows that the success rates of the restorations done by USC students at the Mobile Dental Clinic are comparable to those of restorations done by experienced operators in a fixed clinic, averaging about 85%. This validates that the Mobile Dental Clinic model is successful. The USC Mobile Dental Clinic provides quality dentistry to communities with limited access to dental and health care. The next phase of Dr. Sundaresan's research will focus on oral hygiene instruction. The majority of the patients seen by USC Mobile Dental Clinic are Hispanic, so most of the data is reflective of that community. This leads to an important question: Is oral hygiene instruction universal? If not, how can we formulate a protocol that is specific to the populations that we are treating and, therefore, more effective within those populations?

Dr. Sundaresan has dedicated much of his dental career to the field of community dentistry. He is firmly committed to the belief that all people should receive quality dental care regardless of their ability to pay for it. The main goal of community dentistry is to provide quality care to all patients. Dr. Sundaresan hopes that the future will bring equality to community dentistry. The first challenge is changing misperceptions regarding the quality of care, as addressed in Dr. Sundaresan's research. Communities must also be educated and made aware of the importance of preventive care. In an ideal world, there should be no disparity between dentistry done in private practice and in mobile clinics or other venues treating underserved populations. All patients should be treated with the same, high standards of care. The USC Mobile Dental Clinic is leading the way towards achieving this worthy goal.

Dr. Sundaresan stands with members of the USC Dental Mobile Clinic Core Student Group.

REGENERATION
AN INTERVIEW WITH

The world of dentistry will change dramatically if enamel-like dental material can one day be used to restore teeth. For the last two decades, Prof. Janet Moradian-Oldak's research has focused on working with enamel proteins in order to understand how they behave in-vitro and to design a material with similar properties to enamel. Prof. Oldak spent her time in graduate school exploring her interest in structural chemistry while trying to make the connection between structural biology and chemistry. Prof. Oldak completed a Master's degree in structural chemistry from the Weizmann Institute of Science in Israel. She then earned her Ph.D. in structural biology from the Weizmann Institute of Science. With her continued interest in research, Dr. Oldak began her post doctorate career at the University of Southern California in enamel protein biochemistry. With her keen interest in biomineralization, Prof. Oldak decided to focus her research on the roles of proteins in biomineralization, mineralization of teeth, matrix-based strategies for enamel biomimetic and the function of matrix metalloproteinase-20 (MMP-20) during enamel formation. In addition, she has published more than one hundred peer reviewed articles on enamel protein structure and function. Dr. Oldak and her team focus their research on enamel-proteins such as enamelin, amelogenin, ameloblastin, amelotin, proteases and MMP 20.

Prof. Oldak's current research is focused on amelogenin protein and its molecular mechanism of self-assembly, configuration and interaction with other proteins and minerals. This research has been successful with increasing media attention for a proteotype in a form of gel is being developed in her lab called Auxo-Mel. 'Auxo' means regrowing in latin and 'Mel'- represents enamel. This patent pending hydrogel product has proven to be different from fluoride aided materials for it does not merely alter the surface by remineralization but rather creates an interface with natural teeth while forming a layer that resembles enamel. Amelogenin helps to regrow well-organized crystals and creates a robust interface with the tooth structure.

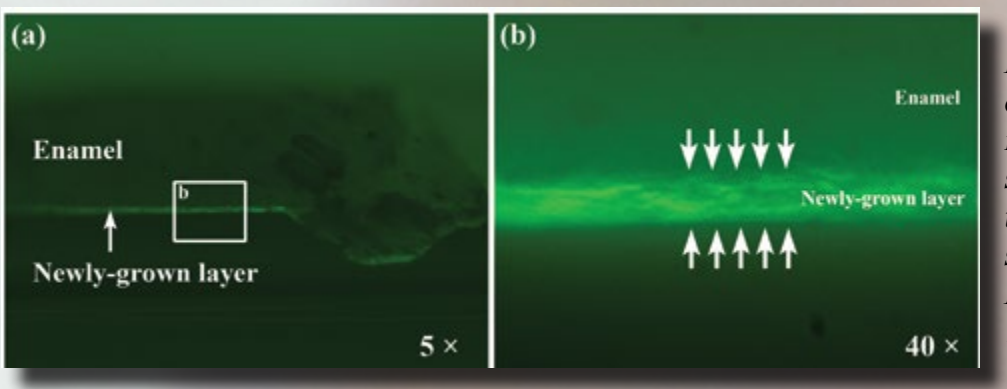
OF ENAMEL: DR. JANET OLDAK

BY PRATIK GUPTA '17 AND RADHIKA MISTRY '17

The clinical applications of this research are invaluable to dentistry today. It is suggested that the gel can be applied using an occlusal guard to superficial white spot lesions on enamel. Successful results can be obtained if multiple layers are applied overnight to allow for the regeneration of crystals. Larger lesions involving dentin pose a challenge due to the high enzymatic activity that breaks down collagen, which can lead to poor prognosis of the restoration.

The next step includes in-vivo experiments to further prove the clinical success of AuxoMel gel. Like all research investigations, Prof. Oldak and her team face a number of challenges. One of these challenges is the technical difficulty associated with isolating proteins in their natural forms. These proteins then need to be experimented under in-vivo conditions to determine the outcome in a more complex environment. Another challenge faced with the material is time since the material grows in layers and takes longer to fill larger lesions. Dr. Oldak considers these challenges not as limitations but rather as tasks that she is ready to investigate. Her future goals are to further experiment with the gel and eventually to launch the gel globally to be used conveniently for dental restorations.

The process of growing mature enamel is complex, but Prof. Oldak's multidisciplinary approach has allowed her to successfully research this topic. The FDA has not yet approved the enamel re-growing gel since it is still in pre-clinical trials.. In addition to yoga and hiking, her interest extends to learning other mineralized systems like seashells, chitin and their formation. Prof. Oldak's research will make a significant change in dentistry and a great achievement for future.



Fluorescence images of a cross section of the newly-grown layer. Rectangle in A represents the selected area corresponding to B. The arrows in B indicate the newly grown layer in the enamel surface.
Ref: Ruan et al. J Vis Exp. 2014 Jul 10;(89).

FEATURE ARTICLE

A NEW LOOK AT BISPHOSPHONATES

BY CORY NASOFF '19 AND DANIEL ADELPOUR '19

Parish P. Sedghizadeh, an Assistant Professor at the Herman Ostrow School of Dentistry of USC, is a first generation Iranian-American dentist. Dr. Sedghizadeh started his dental career by receiving his DDS degree from USC, in the first problem-based learning dental program in the United States. As a dental student, he became interested in oral and maxillofacial pathology when he first diagnosed patients with malignant lesions. After he informed one of his patients that they had squamous cell carcinoma, he decided to apply for a residency program in oral and maxillofacial pathology. In 2004 he was accepted into the Department of Oral and Maxillofacial Surgery, Pathology and Anesthesiology at the Ohio State University, where he pursued specialty training in oral and maxillofacial pathology as well as a Master's degree in oral biology.

After completing his residency and participating in research on head and neck cancer, Dr. Sedghizadeh was recruited back to USC to work with Dr. Bill Costerton, a world-renowned scientist in the field of bacterial resistance who coined the term 'biofilm.' Through his experiences with Dr. Costerton, Dr. Sedghizadeh was able to explore new research techniques and skills relevant to biofilm microbiology. Subsequently, he became interested in patients with osteonecrosis of the jaw (ONJ), which was then a new dental pathology presenting as an infected and necrotic jawbone in patients prescribed bisphosphonate (BP) medications for the treatment of osteoporosis or bone cancer. ONJ currently has few treatment options besides antimicrobial therapy to fight the infection and, in advanced cases, complete surgical removal of the affected jawbone. Remarkably, Dr. Sedghizadeh has been able to successfully use his pathology research background, along with his clinical expertise and the robust patient population at USC, to perform translational research, exploring the scientific aspects of diseases like ONJ from bedside to benchtop and back.

Currently, Dr. Sedghizadeh's research focuses on new treatment modalities for ONJ. Dr. Sedghizadeh collaborates with USC Professor of Chemistry Dr. Charles E. McKenna and his team on this research project, for which he was recently awarded a research grant from the National Institutes of Health. The aim of this collaborative research effort is to explore specific treatment options for bone infections like ONJ. These treatments are innovative in that they are non-invasive, and also allow physiologic targeting of an antibiotic to the affected site. Targeting antibiotics to bone is challenging because bone is not a natural pharmacokinetic reservoir for antibiotics. Therefore, patients with bone infections may require months of intravenous, high-dose antibiotics to control the infection, which is why many cases can be life-threatening. BP drugs, on the other hand, are very different from antibiotics and preferentially accumulate in bone, where they are retained for periods up to several years.

Dr. Sedghizadeh's team has synthesized a novel BP-antibiotic conjugate by using a pharmacologically inert BP with a carbamate chemical linkage to the antibiotic ciprofloxacin to allow it to be carried specifically to bone. This novel antibiotic compound has been named BP-Cipro for now, and its specific target sites include those traditionally targeted by BP drugs, primarily the bony areas that bear heavy loads, like the jaw and femur. Once in bone, the drug requires an acidic environment, such as the one created by an infection, to allow the antibiotic to be released. The biochemical approach is basically a 'target and release strategy' whereby the BP moiety physiologically targets the infected bone and the antibiotic is released and kills biofilm bacteria, which also reside on the targeted bony surfaces. This research and BP-Cipro are in the intermediate stages of development, with Dr. Sedghizadeh's team having completed two of three phases of the project. Phase one involved successful synthesis of the novel compound, and phase two tested the compound to establish proof of principle and efficacy in an in vitro hydroxyapatite model. Dr. Sedghizadeh and his team are currently in stage three, which will center around testing the compound in vivo using animal models. The aim is to prove the efficacy of the BP-Cipro compound in animals, which will enable the investigators to ultimately move to human clinical trials.

Dr. Sedghizadeh has said that his success as a clinician-scientist could not have been possible without the help of some of his most admired mentors, many of whom are still teaching at the Herman Ostrow School of Dentistry of USC. They have provided him with the knowledge and resources necessary to be a successful scholar. Dr. Sedghizadeh's passion for dentistry and oral pathology and his research acumen are what make him an excellent educator and clinician-scientist. His enthusiasm for education and teaching inspire dental students and residents to become the best possible clinicians and scientists in the field.

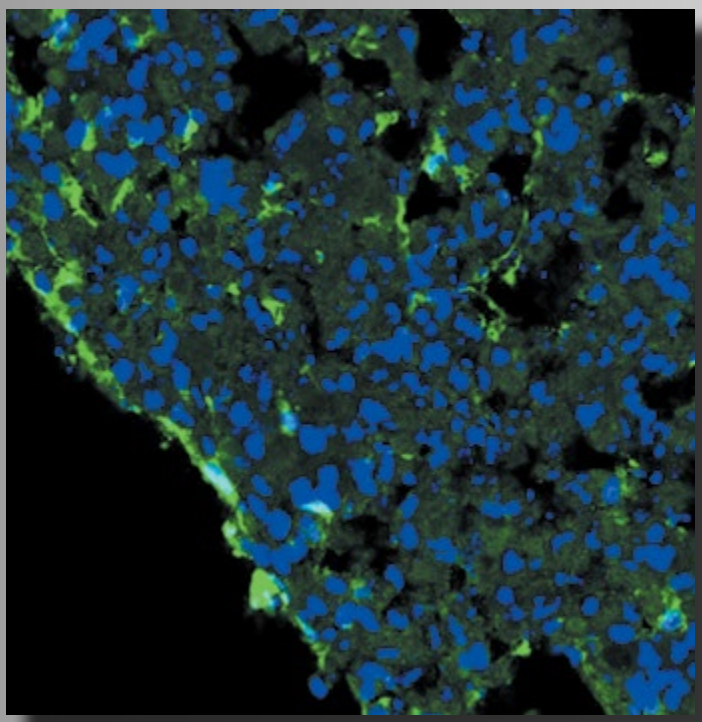
NAVIGATING THE REALM OF PROTEIN METHYLATION

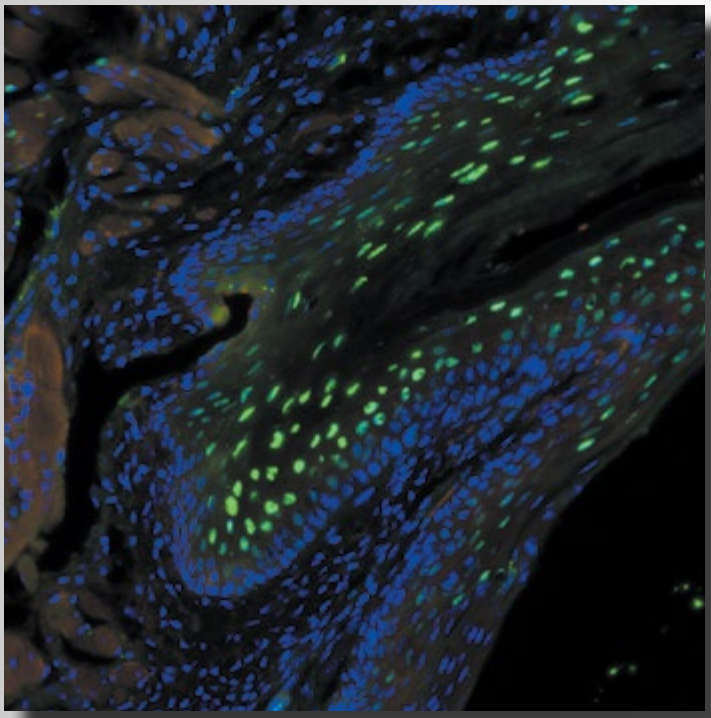
WITH DR. JIAN XU

BY LAM VUONG '18

Dr. Jian Xu initially majored in pharmacology when she attended Peking University. However, after a brieff exposure to research through her bachelor's thesis project, she quickly realized that the generation and exploration of novel ideas were the aspects of science that were most intriguing and intellectually stimulating to her. To further pursue her interests in research, Dr. Xu applied to the PhD program at the University of Cincinnati Children's Hospital, where she met her mentor, Dr. Jeffery Molkentin, an expert in the field of cardiac research. While in Cincinnati, Dr. Xu co-authored several articles on heart failure and cardiac hypertrophy. When she accepted a postdoctoral position at the University of California San Francisco (UCSF), Dr. Xu decided to approach cardiac research from a purely biochemical point of view in order to decipher mechanistically the signaling pathways that govern the pathogenesis of heart disorders. Since basic mechanistic explanations are usually indicative of how higher-level phenotypes arise, complete knowledge of the relevant signaling pathways and the ability to manipulate the individual components offer a promising avenue for future translational research and clinical applications.

In her lab at UCSF, Dr. Xu worked primarily with cardiac mesenchymal stem cells since they have the ability to regulate cardiac functions. During development, these cells differentiate into other cell types and penetrate the cardiac parenchyma to form fibroblasts, smooth muscle cells, endothelial cells, and myocytes. Following cardiac injuries, the mesenchymal stem cells can proliferate and differentiate into the appropriate cells to reorganize the structural and connective tissues of the heart. The processes that govern this type of differentiation are called mesenchymal–epithelial transition (MET) and epithelial–mesenchymal transition (EMT). EMT is a process whereby epithelial cells can downregulate epithelial characteristics and acquire mesenchymal characteristics; MET is the reversal of this process. The reprogramming of gene expression during MET and EMT is initiated and controlled by signaling pathways that respond to extracellular cues.





Dr. Xu's in vivo experiments showed that the key regulators of these pathways are transforming growth factor-β (TGFβ) and bone morphologic proteins (BMPs). TGFβ generally drives EMT while BMPs favor the MET process. Cardiac pathologies such as fibrosis and scarring of the heart are consequences of EMT. On the other hand, the MET process governs the formation of new blood vessels through the differentiation of fibroblasts into endothelial cells. Dr. Xu believes that her group's groundbreaking research involving the manipulation of the pathways involved in these processes will provide valuable insights for the treatment of cardiac pathologies.

In 2013, Dr. Xu joined the Herman Ostrow School of Dentistry of USC as an Assistant Professor. In addition to cardiac research, her lab currently focuses on protein methylation and its effects on the pathogenesis and treatment of periodontal diseases. Protein methylation refers to a post-translational modification where methyl groups are attached to amino acid residues to alter protein function and, in some cases, result in a change in the pattern of gene expression. The effects of methylation on BMPs and Toll-like receptors (TLRs) are currently being investigated in Dr. Xu's lab. BMP signaling involves the activation of downstream effector proteins called Smads, which act as transcription factors to regulate the expression of multiple subsets of genes. The methylation of BMPs allows the Smad effector proteins to "crosstalk" with other signaling pathways to regulate the genes responsible for bone cell differentiation and bone formation. TLR signaling is a pathway crucial to the initiation and maintenance of the inflammatory response. The methylation of Smads can lead to significant attenuation of this signaling pathway and its inflammatory effects. Dr. Xu's methylation experiments may lead to novel treatments for periodontitis, a condition characterized by chronic gingival inflammation and subsequent loss of the supporting periodontal structures, since the manipulation of TLR and BMP signaling through protein methylation can result in a decrease in inflammation and an increase in bone formation. Currently her lab has developed an oral topical medicament using purified methyl peptides of truncated Smad proteins for use in animal models to assess its effectiveness.

Dr. Xu is a pioneer in the relatively new field of protein methylation. The exploration of protein methylation may lead to explosive findings in protein signaling research since this process of post-translational modification may control many signaling pathways. Dr. Xu's vision for her research is to bridge the gap between the molecular mechanisms of cellular signaling pathways and their associated pathological processes. This vision may be realized with the successful development of the methyl peptide therapy. The application of Dr. Xu's protein methylation research may provide hope for 1/3 of the adult U.S. population, who are currently suffering from some form of periodontal disease.

CLINICAL RESEARCH SUPPORT: MOVING RESEARCH INTO PRACTICE

BY LORI MICHENER AND RINI VARGHESE

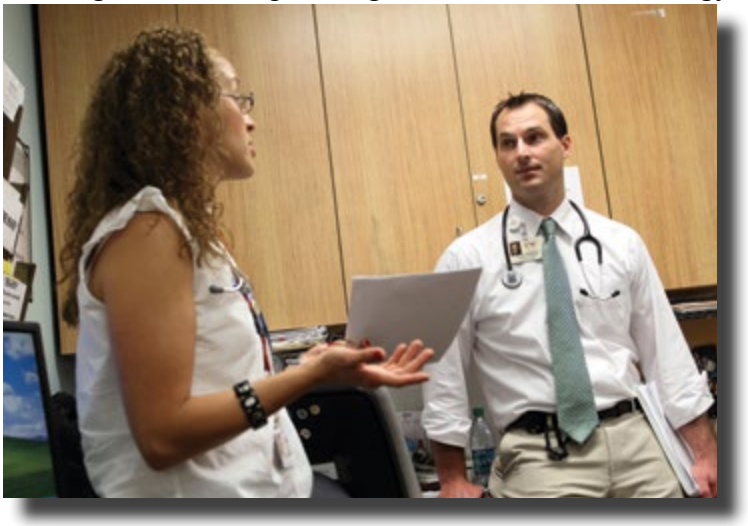
Dr. Lori Michener and her Clinical Research Support (CRS) team in the Division of Biokinesiology and Physical Therapy of the Herman Ostrow School of Dentistry of USC are committed to developing and supporting clinical research studies in the USC Physical Therapy Associates Clinics. The CRS initiative aids clinicians and research faculty in their scholarly pursuits by assisting with the development, collection, and analysis of clinically based studies. Additionally, the CRS assists in the collection of patient-centered outcomes during the process of care to assess the delivery and value of physical therapy services. Dr. Michener, the Director of Clinical Outcomes and Research, spearheads this unique initiative that integrates the Division's core values of research, education and service in the context of clinically based research.

The CRS initiative functions as a support panel for those interested in conducting clinically based investigations. Such investigations include a whole spectrum of research inquiries ranging from patient- or clinician-rated surveys and physical measures to pilot studies aimed at establishing proof-of-concept for the effectiveness of intervention protocols as well as small- and large-scale clinical trials. In an effort to build effective collaborative networks between clinicians and researchers, the CRS program also aids subject recruitment for studies of patients in the research labs. Finally, the CRS initiative also serves as a resource for clinicians interested in quality improvement projects. The end goal of any supported research is a publication and/or state- or national–level presentation, and quality improvement projects consisting of written summaries of outcomes are also supported.

An example of a quality improvement project is development of the project "Tracking patient outcomes and satisfaction of care" by the neurological clinical service team of physical therapists working at USC Physical Therapy Associates in the acute care and outpatient teams. This goal of this project is to assess the patient-rated and performance outcomes, treatment parameters and patient satisfaction throughout the continuum of care of patients undergoing inpatient physical therapy at Keck Hospital of USC as well as outpatient care at USC Physical Therapy.

Conducting such research and quality improvement projects can prove to be very useful in augmenting clinical decision-making and boosting patient management practices. However, these efforts are inevitably time and resource intensive, and thus pose an additional burden for the clinician, who is already pressed for time while juggling multiple patient care and administrative tasks. The CRS team makes the research process more manageable for the clinician to undertake by providing expert advice on study design and methodology and assistance with related activities like IRB application procedures, data collection, data entry, analyses and final production of reports and peer-reviewed publications.

The CRS initiative also acts as a bridge between USC's clinical practice and the research program in Biokinesiology (BKN). Under the supervision of Dr. Michener, the CRS team also includes a doctoral student in Biokinesiology, who completes term rotations as a Clinical Research Assistant. BKN student Rini Varghese completed her first official term as clinical research assistant in Fall 2015. Varghese, who is pursuing her PhD in Biokinesiology in the Division, has found this rotation to be especially helpful in honing her research management skills and gaining valuable out-of-the-laboratory experiences that she believes can help her form clinically meaningful research questions.



The CRS program continues to assist clinical research in the USC Physical Therapy practices in its second term with Dr. Michener and Akira Nagamori, the BKN student assigned for this Spring 2016. For more information regarding the Clinical Research Support program, please contact Lori Michener at lmichene@usc.edu.

PICTURING PREVENTION

BY BREANNE GRADY MCM '10

Dr. Shawn Roll has expertise in a specific type of "handiwork." This past September, he was awarded a $2.3-million research grant that will allow him to study the early stages of carpal tunnel syndrome (CTS) in dental hygiene students. A USC faculty member in his fifth year, Dr. Roll's research focuses primarily on the prevention, rehabilitation, and assessment of musculoskeletal disorders like CTS.

Originally interested in athletic training, Dr. Roll changed his focus to occupational therapy, earning a Bachelor's degree in occupational therapy, a Master's degree in allied health professions, and in 2011, a PhD in health and rehabilitation sciences, all from the Ohio State University.

Dr. Roll refers to adults in the workplace as "industrial athletes" — a nod to his sports background — and treats them as such, focusing on preventing work-related injuries and helping adults be functional when they do have some sort of injury. "The nice thing about occupational therapy that drew me in was its theoretical foundation," he states, explaining his shift in interest. "It allows you to understand how to holistically view an individual and understand the way that you would intervene with that individual to improve their independence and their functional performance."

According to Dr. Roll, what is known about CTS is largely from the clinical perspective, when someone already has identifiable symptoms such as numbness, tingling or weakness in the hand. "We've been studying carpal tunnel syndrome for more than 20 years, longer than that even, and we don't understand what causes it," he explains. "We have a collection of different ideas and know that repetitive motion, forceful gripping, vibration and those types of things can lead to it, but not always and in every individual. You can put five individuals in the same job with the same physical exposures and three of the five will develop it while two will not."

The four-year grant Dr. Roll was recently awarded, which is funded by the Centers for Disease Control, National Institute

Using sonographic imaging, Occupational Therapy Assistant Professor Dr. Shawn Roll and his research team seek to detect the earliest signs of carpal tunnel syndrome.

for Occupational Safety and Health, is titled "Sonographic Tissue Morphology in Early-Stage Work-Related Median Nerve Pathology." It will run from 2015 through September 2019. Dr. Roll serves as the Principal Investigator on the project. He and his team will be using sonography to examine populations of dental hygiene students at both USC and Loma Linda University. Among Dr. Roll's collaborators are Co-Investigator Dr. Jane Forrest, Professor of Clinical Dentistry at the Herman Ostrow School of Dentistry of USC, and Dr. Wendy Mack, Associate Professor of Preventative Medicine at the Keck School of Medicine of USC, who contributes expertise in statistics.

> "OUR GOAL IS TO DEVELOP SOME SORT OF PREDICTIVE MODEL TO SHOW HOW IMAGING WILL SHOW THE PROGRESSION OF CTS, SO WE CAN DEVELOP THIS MODEL AND THEN IMPLEMENT IT IN THE WORKPLACE WHERE HIGH-RISK WORKERS ARE SCREENED EVERY SIX MONTHS OR YEAR USING THE IMAGING."

Dr. Roll and his collaborators determined that dental hygiene students were an ideal target population for the study. "When students come into the program, they're young and typically don't have any problems, and less than 20 percent of them complain of any pain or discomfort in their hands," he explains. "By the end of their two-year program, Dr. Forrest has documented up to 66 percent, or two-thirds of them, having some sort of pain in hands due to repetitive activities they're doing in holding the scaling instruments. So, there is something going on there."

Moreover, Dr. Roll describes how CTS in long-term dental hygienists is a known problem. In fact, more than half of dental hygienists report having CTS at some point during their career. In his preliminary work using sonographic imaging on chronic CTS patients, he determined that the median nerve — a major peripheral nerve in the upper limb of humans and other animals — is enlarged when compared to asymptomatic individuals, where the nerve is much smaller. "Somehow, there has to be a transitional point to get from the small to the large," he explains. "Using the imaging, we've actually done other preliminary work in an animal model where we've been able to replicate that progression in the size of the nerve, due to repetitive functional activities." Determining this tipping point could help target interventions and prevent CTS specifically in early-stage individuals.

The students in the study will be measured via imaging every four to five months to see if the median nerve tissues are actually changing in size or structure. The team will also use nerve conduction testing to see if the physiology of the nerve is working properly. In addition, the team will collect symptom reports and functional reports from the student populations, comparing the imaging and changes in tissues of individuals complaining of symptoms or problems against those without symptoms. In parallel, the study will collect the same data from a cohort population. "We will collect data from a population of [occupational therapy] students, who also have a two-year professional program and very similar demographics, but do not engage in repetitive upper extremity tasks," Dr. Roll says. Using the sonographic images collected from both populations, his team will look for changes in median nerve morphology — the first signs of which could indicate the beginning of CTS.

At the end of the study, Dr. Roll hopes that the research will lead to earlier identification for individuals who might be progressing towards CTS. He stresses that research on the early stages is crucial to prevention. "If we start to see the changes, we can then intervene." At the same time, the team will video-record the dental hygienists at work and look at the actual positions and postures they are using to be able to understand if there are certain positions and postures that are potentially leading to the symptoms. "Hopefully, we can develop some sort of education program and preventive techniques," he explains. "We won't necessarily see CTS in our students across two years, but hopefully we'll be able to continue following and measuring some of these individuals as they move into their professional careers long-term."

STUDENT **SPOTLIGHTS**

By Katherine Schwartz '17

WESTON GRIMES

Weston Grimes is a member of the class of 2018 at the Herman Ostrow School of Dentistry of USC. Grimes completed his undergraduate studies at Northwestern University, where he studied American History while fulfilling the basic science requirements. When he expressed interest in becoming involved with research during his summers back home in Los Angeles, Grimes was given the recommendation by former faculty members of USC to contact Dr. Yang Chai at the Center for Craniofacial Molecular Development (CCMB). Grimes started doing research at CCMB in 2010 as a research lab technician in Dr. Chai's lab. At the time Grimes began his research, the lab had recently starting using a new software program called Avizo. Grimes was assigned to become the expert in the program, which, he remarks, actually helped him get his foot in the door and become an invaluable member of the lab. With this software Grimes was able to analyze micro-CT scans and visualize phenotypes of mice that were generated for research purposes. The software allowed him to visualize various organs and tissues over the course of embryonic and postnatal development. Using these techniques, Grimes contributed to former CCMB researcher Dr. Hu Zhao's impressive research involving the stem cells present in mouse skull sutures. Grimes performed some of the computer analysis and phenotypical visualization for this research, which was published in *Nature Cell Biology* in 2015.

Grimes' current research investigates the epigenetic control of stem cell differentiation during tooth development. Work by Dr. Zhao and colleagues has demonstrated that mesenchymal stem cells present in the tooth bud receive signals from the incisor nerve to differentiate into mesenchyme and the subsequent tooth structures. Grimes remarks that after discussing his interests with Dr. Chai, he decided to investigate the signals and pathways that direct this differentiation process. In the last five years it was discovered that epigenetic controls in the form of histone modifications decide which genes are available to be transcribed by stem cells. When a histone is acetylated, ubiquinated, or methylated, the histones are either unlocked, allowing for the transcription of genes, or locked, preventing transcription. These epigenetic control processes involve different enzymes, specifically methylases or demethylases. When activated, these enzymes can affect histones, allowing for the transcription of genes and the differentiation of stem cells. Grimes states that the nerves are likely responsible for some of the signals causing differentiation. Grimes is currently determining which epigenetic markers are involved and focusing his research on Histone-3 lysine-27 (H3K27), which can be methylated or demethylated and has been shown to be active in other areas of stem cell differentiation. Grimes states, "With epigenetic control, it is a balancing act between enzymes and histones. When one thing changes in the environment there is an imbalance causing one type of cell to grow while the amount of stem cells gradually decrease." Grimes and his team believe that the nerve is what is affecting that environment and sending signals for mesenchymal stem cell differentiation.

Grimes admits that at times it is difficult to juggle both research and dental school. He attends lab meetings when able, in order to learn about the other research going on in the lab. Grimes appreciates having the feedback and guidance from the rest of the team. He states that lab meetings inspire a lot of his ideas. "Research is not one genius sitting alone in a room but in fact research is collaborative and it is only getting more collaborative as you have more professions joining together," Grimes states. "Here we have a mouse model that can be used to study mesenchymal stem cells. Stem cells are very important to science, however getting access to them is difficult." Stem cells in the oral cavity therefore present an exciting research opportunity due to their accessibility. Grimes has presented his research at the Herman Ostrow School of Dentistry of USC Research Day, where he won first place in the basic science category in 2015. In addition, Grimes has presented at an American Dental Association conference. Grimes remarks that in the future he would like to continue to be involved with research because he thinks it is important to understand how basic sciences can lead to clinical changes. "It is important to be a part of the changes in your profession so you can be the best clinician, be up to date and know what the best science is in the field," Grimes states. For now, he hopes to continue his work with the epigenetic control of stem cells because "the clinical opportunities that come along with research in stem cells is limitless. Research takes patience. However we're discovering new exciting things in research every day."

SHANT AHARONIAN

By Emil Simanian '17

Shant Aharonian, a third year DDS student at the Herman Ostrow School of Dentistry of USC, is no stranger to the field of research. After earning his bachelor's degree in Psychobiology across town at the University of California, Los Angeles in 2013, Shant immediately set his sights on the becoming an active member of Ostrow's Student Research Group (SRG). His contributions as a member of the SRG included publishing an article in the 2014 edition of *The Explorer*, which opened his eyes to a world of research at the dental school that was unbeknownst to him. "By writing an article and participating in research day as a first-year dental student, I was able to see all of the potential and game-changing research being done research here at USC," Aharonian states.

Aharonian always knew that he was interested in the field of periodontology, as he had a keen interest to the biology behind it, and he was fortunate enough to become a student researcher in the lab of Dr. Homayoun Zadeh, the director of the Postdoctoral Advanced Periodontology program and co-director of the Laboratory for Immunoregulation and Tissue Engineering (LITE). Aharonian explains, "through showing commitment, reading publications and keeping up with the posters being presented at research day, the opportunity came up for me to become part of Dr. Zadeh's lab." The LITE lab is currently focusing on tissue regeneration and the immune response in the context of advanced periodontitis, and Aharonian's main research project centers around peri-implantits, which he notes "is heavily researched because of the controversy right now. One side believes its not inflammatory, but rather due to a poorly placed implant, while another side believes that there is more of a biological andpathological approach to the disease."

The goal of the LITE researchers is to study peri-implantitis in animal models with the goal of translating this research into better clinical practice. They place miniature dental implants that have been inoculated with pathogenic oral bacteria in the jaws of rats. By doing this, aggressive bone loss around the area, similar to peri-implantitis, is created. Unlike previous research studies in rats, the LITE researchers were able to bypass the use of a ligature and generate biofilm directly on the mini-implants, recreating the environment seen in real cases of peri-implantitis. This study, along with an additional one that uses two-piece implants, has piqued Aharonian's interest not only in the field of periodontology, but oral biology as well. He explains, "I'm really intrigued with this project, and I'm really drawn to future of tissue regeneration and grafting materials, and through more research and development I think that eventually graft materials will be very simple so that the general practitioner can use them." Throughout his two-year odyssey working in the LITE lab, Aharonian has seen his skills and knowledge in the field of periodontology grow substantially, and he credits his colleagues and mentors within the lab. "Along with Dr. Zadeh, Dr. Neema Bakhshalian has been a real mentor and someone I look up to. I see his drive and passion for his field, and although he is very knowledgeable, his humility is something that I really admire," says Aharonian. By contributing to research projects and being associated with such a highly esteemed intellectual environment,

Aharonian hopes that more dental students at Ostrow will find their niche and contribute to their profession by doing research in a field that interests them. Aharonian's long term goal is to pursue a residency in periodontology, and he eventually hopes to be an expert in the challenging situation of failed implants, peri-implantitis, and complicated cases to help other clinicians with tough scenarios. He also does not rule out a career as a researcher, and describes his hope for the future as follows: "I want to continue to be involved in research as a professional, because it is a great way to advance the field and collaborate with the brilliant minds within our community."

RESEARCH DAY

MARCH 9, 2016

SCHEDULE OF EVENTS

8:00 AM	**Registration (Presenters and Judges)**
9:00 AM -12:00 PM	**Poster Presentation Judging**
11:30 AM - 12:00 PM	**General Registration**
12:00 PM - 12:30 PM	**Lunch**
12:30 PM - 12:45 PM	**Opening Remarks**

Randolph Hall, PhD
Vice President of Research
University of Southern California

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 - 1:25 PM **Keynote Speaker: Lawrence Tabak, DDS, PhD**
Principal Deputy Director, NIH

Dr. Tabak is the Principal Deputy Director of the National Institutes of Health (NIH). He previously served as the acting principal deputy director of NIH (2009), and prior to that as director of the National Institute of Dental and Craniofacial Research from 2000-10. Dr. Tabak has provided leadership for several trans-NIH activities, including the Enhancement of Rigor and Reproducibility of Research Findings, strategic planning for health research related to sexual and gender minorities (SGM), and the NIH's implementation of the American Recovery and Reinvestment Act. Currently, he is leading efforts to develop the NIH-wide Strategic Plan, as well as a strategic pediatric environmental research program. Prior to joining NIH, Dr. Tabak was the senior associate dean for research and professor of dentistry and biochemistry & biophysics in the School of Medicine and Dentistry at the University of Rochester in New York. A former NIH MERIT recipient, Dr. Tabak's major research focus has been on

(Continued on next page)

the structure, biosynthesis and function of glycoproteins. He continues work in this area, maintaining an active research laboratory within the NIH intramural program in addition to his administrative duties. Dr. Tabak is an elected member the Institute of Medicine of the National Academies. He received his undergraduate degree from City College of New York, his DDS. from Columbia University, and a PhD. from the University of Buffalo.

1:30 PM - 2:10 PM **Keynote Speaker: Roseann Mulligan, DDS., MS**

Charles M. Goldstein Professor of Community Dentistry
Associate Dean for Community Health Programs and Hospital Affairs
Chair of the Division of Dental Public Health and Pediatric Dentistry
Herman Ostrow School of Dentistry of USC
Professor, USC Leonard Davis School of Gerontology

Dr. Mulligan received her BA degree from Arizona Sate University, her DDS degree from the UCLA School of Dentistry and her MS degree from the USC Leonard Davis School of Gerontology. She completed her general practice residency certification at Rancho Los Amigos National Rehabilitation Center. She was recruited to USC to create a geriatric dentistry program and subsequent to her arrival established the Special Patient Clinic. Dr. Mulligan is the Director of the new On-line Geriatric Dentistry Masters Degree and Certificate Programs at the Ostrow School of Dentistry of USC and is an expert in dental care for special needs patients, including the elderly and persons with disabilities. Her administrative duties include oversight of the School's Community Health programs. She holds Fellowships in the Gerontological Society of America and the Academy of Dentistry for Persons with Disabilities, is a Diplomate of the American Board of Special Care Dentistry and is past President, Academy of Dentistry for Persons with Disability, the American Society for Geriatric Dentistry, the Special Care Dentistry Association and the IADR Geriatric Oral Research Group. She previously served as the Editor of the Journal of Special Care Dentistry. Dr. Mulligan has been awarded the Harold Berk Award from the Academy of Dentistry for Persons with Disability, the Saul Kamen Award from the Special Patient Care Association and the Jack Hein Public Service Award from the American Association for Dental Research.

USC University of Southern California

2:15 PM - 2:55 PM

Keynote Speaker: Jason Kutch, PhD
USC Division of Biokinesiology and Physical Therapy

Jason J. Kutch, PhD, is an assistant professor in the Division of Biokinesiology and Physical Therapy at the University of Southern California. He received a BSE degree in Mechanical Engineering from Princeton University in 2001 and his PhD. in Applied Mathematics in 2008 from the University of Michigan. Dr. Kutch is the director of the Applied Mathematical Physiology Laboratory (AMPL) at USC, and his work focuses on revealing brain mechanisms of muscle control, engineering non-invasive systems to study human motor function, and understanding chronic pain disorders. He is a co-investigator in the NIH-funded Multidisciplinary Approach to the Study of Chronic Pelvic Pain (MAPP) Research Network, with a particular focus on understanding brain network mechanisms of altered pelvic floor muscle control in individuals with chronic pelvic pain. He teaches neuroscience in the USC Doctor of Physical Therapy program. He is also a board member of the International Pelvic Pain Society.

3:00 PM - 4:00 PM **Poster Viewing**

4:00 PM - 4:30 PM **Awards Presentation**

4:30 PM - 5:00 PM **Reception**

POSTER CATEGORY AWARDS

- Advanced Specialty Program Resident
- Biokinesiology and Physical Therapy Candidate
- Biokinesiology and Physical Therapy Student
- Dental Hygiene Student
- Graduate Post-doctoral Trainee
- Graduate Pre-doctoral Candidate
- Occupational Science and Occupational Therapy Student
- DDS Student - Basic Sciences
- DDS Student - Clinical Sciences
- Dean's Research Award - Awarded to the overall most outstanding project poster

J.A. WILSON DENTAL LIBRARY BIOINFORMATICS AWARD

Awarded to the best poster incorporating bioinformatics resources into the project. Judges will consist of the information specialist from the Wilson Dental Library, a representative of the Bioinformatics Services Program of the Health Services Libraries and a faculty representative of the Herman Ostrow School of Dentistry. The competition is open to any graduate student or young researcher who has carried out a research project centered on analysis of biological sequences, structures and processes. The candidate must be enrolled at the Herman Ostrow School of Dentistry at the time of submission. The awardee will be presented with a certificate and gift card.

USC STEVENS CENTER FOR INNOVATION MOST INNOVATIVE AWARD

Awarded to the poster with the highest likelihood of transferring into practical use. The USC Stevens Center for Innovation is a university-wide resource in the office of the Provost at the University of Southern California that helps identify, nurture, protect and transfer to the market the most exciting innovations from USC. It also provides a central connection for industry seeking cutting-edge innovations in which to invest. As part of this role, the USC Stevens Center manages the university's intellectual property portfolio stemming from its $650 million annual research program. Furthermore, the USC Stevens Center develops the innovator as well as innovations, through educational programs, community- building events and showcase opportunities.

INNOVATIVE SCIENTIFIC ACHIEVEMENT AWARD

The award was creeated to honor Herman Ostrow School of Dentistry students, researchers and post-doctoral fellows who have authored articles published in prestigious scientific publications. The purpose of the award is to recognize extremely talented and promising reseachers early in their academic careers who help our school and USC move towards an undisputed elite status in research and academics.

RESEARCH DAY

POSTER ABSTRACTS

FACULTY

Poster #: 1
Title: Microbiomes associated with pre- and post-treatment periodontitis and periodontal health
Name: Joan Beleno Sanchez

Background: The composition of the oral microbiota could be an indicator of periodontal health. **Purpose:** To identify features of subgingival and salivary microbiomes in periodontally healthy subjects, and in subjects with chronic periodontitis before and after nonsurgical periodontal therapy. **Methods:** 238 microbial samples from 6 groups (A-F) were analyzed, including (A) subgingival plaque and (B) saliva from healthy subjects/sites, (C) subgingival plaque and (D) saliva from diseased subjects/sites pre-treatment, and (E) subgingival plaque and (F) saliva from diseased subjects/sites post-treatment. The v4 region of the 16S rDNA gene was PCR-amplified and sequenced on an Illumina platform. Subsets of Group A, Group C and Group E were subjected to functional genomic analysis via HuMiChip functional gene microarray. **Results:** 1979 operational taxonomic units (OTUs) were defined across 238 samples based on 16S rDNA analysis. Twelve OTUs were overabundant in Group A, with 9 of the 12 taxa increased an average of 39% after treatment. Twenty-eight taxa were overabundant in Group C; the levels of these taxa were reduced by an average of 42% after treatment. Six taxa were overabundant in Group D. Four distinct clusters of subgingival samples were identified based on HuMiChip functional gene profiles. Clusters 1 & 2 composed primarily of diseased samples, and Clusters 3 & 4 composed primarily of healthy samples. **Conclusion:** Microbiota were distinct in subgingival sites in subjects with and without periodontitis before and after initial periodontal therapy, which suggests that analysis of oral microbiota may be used for assessment of periodontitis.

Poster #: 2
Title: Facilitating rehabilitation community engagement in patient-centered outcomes research
Name: Natalie Leland

Background: Existing suboptimal post-acute care (PAC) patient outcomes have led to growing national concerns over the quality of rehabilitation. To improve PAC, there is an urgent need to obtain patient, caregiver, and stakeholder perspectives on care priorities to inform patient-centered PAC. **Purpose:** Highlight the strategies used and lessons learned from our efforts to build a PAC community to guide PAC rehabilitation patient-centered outcomes research. **Methods:** This qualitative study leveraged existing relationships with the PAC community and developed additional relationships de novo to recruit stakeholders for focus groups and one-on-one interviews. Stakeholders included patients, caregivers, occupational and physical therapy practitioners, nurses, geriatricians, physiatrists, and orthopedic surgeons. Engagement strategies were informed by current evidence and consultations with our stakeholders. Utilizing a socio-ecological model, we systematically analyzed barriers and facilitators to recruiting, consenting, and engaging the PAC community. **Results:** Multiple methods were employed to capture diverse perspectives with respect to profession, geographic region, practice culture, and schedule demands. Participants were recruited via collaborations with healthcare systems, agencies, and national provider organizations. Perspectives were captured at national conferences, web-based conference platforms, and in-person sessions in the clinic. PAC facilities supported the recruitment of hip fracture patients and their caregivers. Challenges and facilitators to engagement emerged from these efforts at multiple levels of the socio-ecological framework, including the individual, organizational, and community levels. **Conclusion:** Establishing a sustainable, active community of engagement in PAC is challenging, but worth the considerable investment. Flexibility, transparency, shared decision-making, power sharing, and adaptations are essential components of a successful relationship.

Poster #: 3
Title: ENIGMA stroke recovery: Big data neuroimaging to predict motor impairment
Name: Sook-Lei Liew

Background: Accurate predictions of motor recovery after stroke could improve rehabilitation by personalizing treatment for each individual. "Big data" neuroimaging approaches may provide a way to identify robust predictors (Liebeskind et al., 2015). We developed the ENIGMA Stroke Recovery Working Group to collectively identify robust predictors of stroke recovery across worldwide studies of stroke survivors (http://enigma.ini.usc.edu/ongoing/enigma-stroke-recovery/). **Purpose:** Here, we present preliminary findings relating post-stroke subcortical neuroanatomy and upper limb motor impairment using harmonized approaches across multiple study sites. **Methods:** Structural T1-weighted MRIs from 121 stroke patients across 6 research samples were included in this analysis. ENIGMA protocols were used to extract subcortical volumes and quality control for accuracy. Regression analyses examined subcortical volumes as predictors of motor impairment score with covariates (e.g, age, sex, hemisphere affected). Non-parametric permutation tests with 10,000 permutations were used to assess significance. **Results:** The mega-analysis found positive associations of motor score with volumes of the left nucleus accumbens ($p=.0005$, $\beta=187.79$), left pallidum ($p=.018$, $\beta=244.76$), right nucleus accumbens ($p=.017$, $\beta=114.15$), right pallidum ($p=.0032$, $\beta=301.31$) and right thalamus ($p=.037$, $\beta=315.11$). However, individually analyzing the three largest samples (N=27, N=34, N=37) yielded weak and variable results across samples. **Conclusion:** These preliminary results demonstrate the feasibility and utility of integrating post-stroke neuroimaging data across multiple study sites to investigate the relationship between neuroanatomy and motor impairment. We demonstrate the variability of findings across individual samples and the improved ability of a combined approach to identify preliminary target regions with greater robustness.

Poster #: 4
Title: Language discordance in rehabilitation care: Implications for practice and policy
Name: Jenny Martinez

Background: Decreased health literacy results in disparate outcomes and increased healthcare costs, particularly among racial and ethnic minorities. To this end, patient-provider language discordance occurs when the patient may not fully understand oral and written health information. Thus, as the US population becomes more diverse it is essential to address language discordance within medical and rehabilitation care. **Purpose:** Investigate language discordance within rehabilitation from the perspective of the patient-caregiver-provider triad during an episode of occupational therapy. **Methods:** This qualitative case study used purposive sampling through practitioner referrals and identified Hispanic/Latino, Spanish-monolingual patients who were regularly accompanied by a caregiver to rehabil-

itation appointments. A patient, his wife, and his rehabilitation providers consented to participate (N=4). Data collection included semi-structured interviews, clinical observations, and field notes. Initial codes were developed, examined within the entirety of coded data, and compared with observation and field notes for verification. Preliminary interpretations were presented to the patient and caregiver in a member-checking session. **Results:** Stakeholders identified many barriers to high-quality, patient-centered care related to language discordance. Specifically, four themes emerged: (1) expectations for care, describing perceptions of occupational therapy services and goal-setting; (2) the therapy relationship, describing the therapeutic alliance; (3) professional identity, discussing challenges to professional identity; (4) pragmatic constraints, addressing personal- and organizational-level contexts. **Conclusion:** Difficulties caused by language discordance emerged as the primary barrier to patient-centered care within the patient-caregiver-provider triad. These findings can inform future quality initiatives. Future research is needed to develop interventions and improve rehabilitative care for patients with low health literacy.

Poster #: 5
Title: Identifying early-stage median nerve pathology: A longitudinal cohort study protocol
Name: Shawn Roll

Background: There is currently no method to detect carpal tunnel syndrome (CTS) prior to the onset of symptoms and nerve damage. Sonographic imaging can be used to observe early progressive changes in median nerve size, a precursor to an enlarged state seen in patients with CTS. **Purpose:** This study aims to establish the predictive validity of sonography as an early detection measure for CTS in high-risk workers. **Methods:** Data will be obtained from 120 dental hygiene students who are exposed to novel, high-intensity, repetitive hand tasks (i.e., dental scaling), and 60 occupational therapy students (control). Repeated measures will be obtained every 4-6 months for 2 years, including: nerve morphology (sonography), neurophysiology (nerve conduction testing), symptoms, and repetitive task exposure. Generalized estimating equations will test group differences, mixed-effects regression models will test predictive associations of morphologic/physiologic changes to symptoms, and multinomial logistic regression will identify task components associated with changes in symptoms, morphology, and physiology. **Results:** Central hypotheses are that: (1) sonographic measures will increase in the dental hygiene cohort, with no change in the control cohort; (2) morphologic measures will be predictive of an increase in symptom severity; and (3) a set of task components will be associated with changes in each outcome measure. A model will be constructed for predicting the development of CTS. **Conclusion:** Identifying the progression of median nerve pathology and tasks linked to these changes are initial steps toward developing early detection methods. These methods can shorten time to diagnosis and trigger implementation of preventive interventions for CTS.

Poster #: 6
Title: Mobile device ownership in front porch retirement communities in Los Angeles
Name: Stacey Schepens Niemiec

Background: Mobile health (mHealth) technology represents a promising yet under-researched avenue for engaging older adults in health promotion behaviors. One barrier for disseminating mHealth interventions to elders is the concern that they lack access to the necessary mobile devices. **Purpose:** This study's purpose is to describe smartphone and tablet ownership in older adults stratified by age who reside in Front Porch retirement communities within Los Angeles that offer specialized technology support services to seniors. **Methods:** A study-specific questionnaire regarding mobile device ownership was distributed to residents of seven Los Angeles Front Porch communities. Participants were asked if they owned a smartphone or tablet, and if so the brand of and length of time owning each device. Descriptive analyses were conducted. **Results:** Respondents (N=329) stratified by age (61-70; 71-80; 81-90; ≥91 years) were primarily female (62%) and 81-90 years old (60%). Device ownership (M=33±36 months) was highest in the 61-70 group (75%) and lowest in the 91+ group (13%). iPhones and the Samsung Galaxy were the most popular smartphone brands. Tablet owners primarily used iPads. **Conclusion:** This study described the prevalence of mobile device ownership in senior communities that receive specialized support for health-related technology. Compared to the national average of device ownership in elders 65+ years, mobile device penetration in our sample was high for all but the 91+ age group. Our findings suggest that communities that assist older adults in using technology to meet their health needs may foster mobile technology adoption and support the feasibility of deploying mHealth interventions in such communities.

Poster #: 7
Title: Conditioned place preference successfully established in typically-developing children
Name: Barbara Thompson

Background: Affective processing, known to influence attention, motivation and emotional regulation, is poorly understood in young children, especially for those with neurodevelopmental disorders characterized by language impairments. New strategies and tools that probe more complex internal responses, such as feelings, drives, and motivations independent from language, become necessary for populations of children with language delays and other language impairments, and even for typically developing children. **Purpose:** In this study we faithfully adapted a well-established animal paradigm used for affective processing, conditioned place preference, for use in typically developing children between the ages of 30-55 months. To our knowledge, this was the first attempt at establishing the use of CPP in children. **Methods:** The paradigm utilized Pavlovian conditioning methods in a custom-build child-friendly arena to assess whether a preference had been conditioned. **Results:** Children displayed a robust conditioned place preference, with an average 2.4 fold increase in time spent in the preferred room. Importantly, associative learning, as assessed with conditioned place preference, was not correlated with scores on the Mullen Scales of Early Learning, indicating that conditioned place preference can be used with children with a wide range of cognitive skills. **Conclusion:** The utility of this task is seen to reach far beyond the typical pediatric population, and can be a useful probe for understanding motivation and associative learning in children with neurodevelopmental disorders. We note that there are numerous studies employing animal models to study human disorders, but the reverse—adaptation of well-regarded rodent models in studies to further understand human behavior—is the exception. Translational studies like this are necessary for understanding the biological underpinnings of human behavior and disorders.

Poster #: 8 **Title:** Pressure ulcer data reconciliation in a randomized controlled trial
Name: Cheryl Vigen

Background: In order to assess incidence rates of pressure ulcers (PrUs) in community-dwelling individuals with spinal cord injury, one needs to identify all PrUs that developed only during the incidence period, counting each incident ulcer exactly once. **Purpose:** To determine which data sources are necessary to identify and assess the seriousness of PrUs occurring over a 2-year period. **Methods:** Each individual report of a PrU was carefully examined by a team of researchers to determine unique incident ulcers, their anatomical locations, and their worst stage attained. The unanimously determined incident PrU list was used as the gold standard to assess the reliability of each of the component data sources. Data sources included participant quarterly phone interviews, scheduled skin checks, incident skin checks, paper and electronic medical records from the participants' usual healthcare providers, outside provider medical records, wound surgery procedure notes, and medical billing records. **Results:** A total of 412 incident PrUs were identified. Most (56%) of these PrUs were located on the pelvic area (i.e., ischia, trochanters, buttocks, sacrum, perineum, or scrotum). The three most common data sources were usual provider medical records, quarterly phone interviews, and incident skin checks. Together these 3 sources

identified 83% of all incident ulcers. Although most serious PrUs were found in the medical records, the quarterly phone interviews and incident skin checks were necessary to identify some PrUs. **Conclusion:** No one data source can identify all incident PrUs. Extreme care needs to be taken so that bias in study results is avoided.

Poster #: 9
Title: Low Back Activity Confidence Scale: Factor analysis and psychometric properties
Name: Kimoko Yamada

Background: The Low Back Activity Confidence Scale (LoBACS) is a 15-item scale created to measure self-efficacy beliefs in patients with low back pain (LBP) related to function and symptom self-regulation. It has been validated on a population after microdiscectomy and with post-acute LBP receiving non-surgical intervention. **Purpose:** This study was a retrospective analysis to confirm the factor structure and to determine the psychometric properties of the LoBACS in subjects receiving outpatient rehabilitation for all types of LBP. **Methods:** The responsiveness was analyzed on 103 patients and all other analyses were done on a 299 assessment sample. The LoBACS, along with trunk active range, numeric pain rating scale (NPRS), Modified Oswestry Disability Index (ODI), and Fear Avoidance Behavior Questionnaire data were collected. SPSS Version 22.0 was used for all statistical analysis to confirm the factor structure and to determine the construct validity, responsiveness, and minimum detectable change (MDC95) of the LoBACS. **Results:** Principal axis factoring with varimax rotation revealed a 2 subscale structure. Weak to moderate correlations were found for the 2 subscales with all other measures and all were statistically significant. The LoBACS showed responsiveness for the total score and behavioral subscale. The repeated measures ANOVA indicated similar sensitivity to change with the ODI and NPRS. A multiple regression analysis revealed the LOBACS prediction of function (ODI) is shown by: Y=93.54+(-0.89*X). The MDC95 was calculated as 26.1. **Conclusion:** For the general patient population receiving LBP rehabilitation, the LoBACS total and 2 subscale scores are valid measures of distinct self-efficacy constructs conceptually important in clinical outcomes.

Poster #: 10
Title: Periodontal tissue regeneration mediated by leucine-rich amelogenin peptide
Name: Yan Zhou

Background: Periodontal disease is a chronic infection that results in the destruction of the periodontal ligament, cementum, alveolar bone and gingiva that anchor the tooth in the jaw. Periodontal ligament cells (PDLCs) can be differentiated to osteoblasts, fibroblasts and cementoblast-like cells in vitro and in vivo. The canonical Wnt/β-catenin signaling pathway has been demonstrated to stimulate cell proliferation and osteogenic differentiation of PDLSc. Wnt signaling is required for periodontal homeostasis. **Purpose:** A commercial product Emdogain, consisting largely of alternatively spliced and processed porcine amelogenins, was shown to induce bone, cementum and periodontal ligament regeneration in the jaws. We sought to identify the biologically active peptide(s) in Emdogain responsible for activating these differentiation pathways, anticipating that such bioactive molecules would make possible a much more targeted approach to periodontal tissue regeneration. **Methods:** PDLCs were treated with one of the amelogenin splicing isoforms, leucine-rich amelogenin peptide (LRAP). The effects of LRAP on cell proliferation, migration and differentiation were characterized. **Results:** LRAP treatment significantly reduces the expression of RANKL, a key regulator of osteoclastogenesis, in cementoblast/periodontal ligament cells. LRAP also stimulates the proliferation and migration of cementoblast/periodontal ligament cells. Furthermore, LRAP stimulates osteogenesis at the expense of adipogenesis through activating the Wnt/β-catenin signaling. **Conclusion:** The effect of LRAP on periodontal tissue regeneration is mediated by activating the canonical Wnt/β-catenin signaling pathway. Understanding the mechanism of LRAP's effects on periodontal ligament cells may afford more effective interventional strategies to clinicians for regeneration of tooth-supporting tissues lost to periodontal disease.

Poster #: 11 **Title:** Sensorimotor integration in typically developing children and those with autism
Name: Stefanie Bodison

Background: Research has shown that 80-94% of children with autism (autism spectrum disorder; ASD) have some kind of sensory abnormality and/or suffer from motor delays. As most of the research related to sensory and motor delays in children with ASD has been conducted in isolation, little is known about the link between the two, or sensorimotor integration. We define sensorimotor integration as the brain's ability to successfully transform sensory data into a motor response. **Purpose:** The current fMRI study examined the neural substrates of sensorimotor integration in typically developing children (TD; N=2) and those with ASD (N=6) between 6-8 years of age using a novel fMRI paradigm. **Methods:** The sensorimotor integration fMRI paradigm consisted of two conditions: children were asked to 1) imitate individual pictures of a left hand performing "meaningless" gestures (the imitation condition) or 2) to perform a simple motor movement (thumb or finger response) as the control condition. **Results:** After correcting for multiple comparisons, the results showed that TD children primarily recruited areas in the motor cortex during the control condition and the visual cortices, cingulate gyrus, pre-motor and pre-frontal areas during the imitation task. In contrast, the children with ASD recruited nearly the same brain regions for both tasks, including the visual cortices, right parietal cortex, bilateral pre-motor areas, and right pre-frontal cortex. **Conclusion:** These findings suggest that both a simple motor task and an imitation of a hand gesture requires extensive thinking and planning in children with ASD, when the simpler motor task comes more automatically in TD children.

DENTAL HYGIENE STUDENTS

Poster #: 12
Title: Smiles for All
Name: Sydney Dawson
Faculty Advisor: Joan Beleno-Sanchez

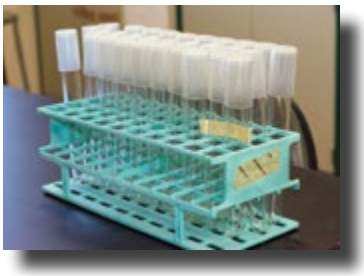
Background: According to the American Psychiatric Association, 1 in 68 children is diagnosed with autism spectrum disorder (ASD). Children diagnosed with ASD suffer from a neurological disorder that inhibits their ability to effectively communicate, express what they're thinking and feeling, and to relate to others. Unfortunately, dental care is often overlooked due to the many challenges faced by dental professionals. The consequences of the lack of care results in poor oral health and an increase in dental caries. **Purpose:** With an increase of attention to effectively treating children on the autism spectrum disorder, we intend on highlighting effective ways dental professionals can provide care to these children and how their families can be a vital component in their successful treatment. **Methods:** Information from ongoing experimental research and professional journals were extensively reviewed. **Results:** Due to the complexities of treating patients with ASD, the American Academy of Pediatric Dentistry recognizes the use of behavior guidance techniques (BGTs) such as tell-show-do (TSD), voice control, non-verbal communication, positive verbal reinforcement (PVR), distraction, parental presence/absence and nitrous oxide. Studies have found a positive correlation between the use of BGT's and parental prediction of what procedures their child would be most cooperative with while undergoing dental treatment. The most helpful parameters while treating children with ASD include the same dentist, dental staff and a parent staying with the child. In addition, because children with ASD have a strong preference for visual stimuli, the use of electronic screen media has been implemented to reduce fear and anxiety as well as any uncooperative behaviors while in the dental chair. **Conclusion:** With the increase in children being diagnosed with autism, understanding how to provide comprehensive dental care to these patients is of increasing importance. Developing various tools such as sensory equipment, procedural modifications and parental involvement in their dental care can make a complete difference in the effectiveness and completion of oral health care for these children.

Poster #: 13
Title: Pour Some Stevia On Me; Stevia effects on oral health
Name: Gabrielle de los Reyes
Faculty Advisor: Joan Beleno-Sanchez

Background: There is an ever-growing concern with health and body image and many people have chosen a sugar-free diet. Stevia rebaudiana is one of the most natural and fastest-growing sugar substitutes. Researchers have looked into potential methods of incorporating stevia extracts into various aspects of medicine, some of which include antibacterial and antiviral uses as well as diabetic therapy most popularly. **Purpose:** Considering that most people use stevia extracts as a sugar substitute, the effects it has in the oral cavity can be called into question. Various aspects in which stevia is involved in oral health were studied including pH activity, demineralization, and effects on Streptococcus mutans. **Methods:** We researched and examined various articles to determine the effects of stevia extract in the oral cavity. **Results:** Stevia-derived sugar substitutes do not drastically lower the pH of the oral cavity. They cause the least enamel hardness loss and are comparable to chlorhexidine as an anti-plaque rinse. **Conclusion:** As dental professionals, we should promote stevia-derived sugar substitutes as the ideal choice. We can encourage the use of it in products such as toothpastes and mouthwashes as a new alternative to improve oral health.

Poster #: 14
Title: Catching your breath while catching your Zzzzzzz's
Name: Amanda Maitino **Faculty Advisor:** Joan Beleno-Sanchez

Background: According to the American Academy of Dental Sleep Medicine, 18 million Americans have Obstructive Sleep Apnea (OSA) and many are not receiving treatment. **Purpose:** The clinical significance of OSA results from lack of oxygen during sleep caused by airway collapse. When left untreated, OSA can be linked to cardiovascular disease, stroke, and chronic heart failure, and is also associated with type II diabetes and depression. Because of the severity of OSA, it is important that there are alternatives to CPAP (continuous positive airway pressure), which is merely an aid/coping mechanism rather than a treatment. **Methods:** To decrease respiratory stress, two surgical interventions have proven to be effective when attempting to alleviate upper airway obstruction. Depending on patients' individual case, specific measures can be taken to relieve them of OSA. For the patient with an oversized tongue, a tongue base reduction is advised. A tongue reduction is performed in order to make more space in the pharyngeal zone and to prevent collapsibility of the tongue during sleep. For the patient with an enlarged soft palate and/or uvula, an uvulopalatopharyngoplasty is advised because it directly addresses the oropharynx, whereby the uvula and soft palate is removed. **Conclusion:** These two surgical therapies have the ability to expand the upper respiratory airway and thus increase oxygen intake to reduce the severity of or completely eliminate obstructive sleep apnea.



Poster #: 15
Title: The pressure is on
Name: Kaynaz Razipour
Faculty Advisor: Joan Beleno-Sanchez

Background: The significance of restorations while deep-sea diving is due to the different materials being used and how they can withstand Boyle's law involving pressure. **Purpose:** The test was to see the pertinence of microleakage alongside various materials to witness which works the best for people who deep-sea dive for recreational or occupational purposes. **Methods:** Various in vitro studies were used and one specifically used 120 extracted premolars that were endodontically treated with fiber posts and 6 different cementing agents: 1) resin-modified glass ionomer, 2) resin cement with etch-and-rinse adhesive, 3) resin cement with self-etching adhesive, 4) self-adhesive resin cement, 5) zinc phosphate, and 6) conventional glass ionomer. These teeth were then placed into a pressure pot, and supplied with compressed air for 3 minutes, roughly 15 cycles, which equals about 30m of diving depth at the rate of speed of 1mm/min. **Results:** Results showed that posts cemented with glass ionomer and zinc phosphate cements had a significantly lower pull out strength compared to their respective control groups. This means that under pressure, these materials lost their strength in holding the restoration tightly. **Conclusion:** Based on this study, using resin cement provides more strength for restorations in divers.

Poster #: 16
Title: Inclusion of drug-induced oral side effects in U.S. pharmacy curricula
Name: Elizabeth Trujillo
Faculty Advisor: Jane Forrest

Background: Over 250 million Americans visit a pharmacy each week and the majority take at least one drug with an oral side effect. Although the general public seeks oral health-related advice from pharmacists, little information is available on the inclusion of drug-induced oral side effects in the pharmacy curriculum. **Purpose:** To determine whether pharmacy students are prepared to counsel patients on drug-induced oral side effects, and if they participate in Interprofessional Education (IPE) with dental or dental hygiene students. **Methods:** A 26-item online survey was developed, validated and approved by the USC IRB. An invitation to participate included a link to the survey and was emailed to curriculum contacts at U.S. pharmacy programs. An email reminder was sent two weeks later. **Results:** 32% of the contacts participated (N=23). Of these, 82% reported including education on drug-induced oral side effects with the majority indicating that the content was taught across the curriculum. However, over half indicated the relationship between oral adverse effects and increased risk of dental problems was not included or only sometimes included. Although 46% have a dental and/or dental hygiene program at their institution, only 17% stated this content is taught as part of IPE. **Conclusion:** Education on drug-induced oral side effects is included in curricula, however it may not be identified as "oral health" but rather an adverse event. This content is rarely included in IPE. Opportunity exists to collaborate with the dental professions, which will enable pharmacy programs to meet their new accreditation standards and learn the value of discussing drug-induced oral side effects.

Poster #: 17
Title: Information-seeking preferences for clinical decision-making among California dental hygienists
Name: Ginger Tsai
Faculty Advisor: Jane Forrest

Background: Many journals and scientific updates are only published online, however the impact of the Internet on dental hygiene patient care is not well documented. Previous studies have grouped online resources into one category and not investigated the variety of resources or their frequency of use to answer clinical questions. **Purpose:** This study examined information-seeking behaviors of California dental hygienists (RDHs) for clinical decision-making. **Methods:** An online survey was developed, validated, and approved by the USC IRB prior to initiating the study. RDHs were invited to participate via the California Dental Hygienists' Association email list of 5542 RDH members and non-members. A link to the survey was included in the invitation. Survey questions addressed information-seeking behavior, frequency of accessing Internet and non-electronic resources, evidence-based decision making (EBDM) preparation and confidence in using these skills, and demographics. **Results:** Of the 5542 emails, only 1974 opened the invitation and 7% responded (N=386). The most frequently accessed Internet resource was Google, whereas the most frequently used non-electronic resource was consultation with a dentist at work. Use of the Internet was related to the decade in which an RDH graduated and the type of dental hygiene program attended ($p<.001$). Respondents who believed they received adequate EBDM education were likely to spend more time searching the Internet, and indicated that the Internet is the most current and relevant information source ($p<.001$). **Conclusion:** RDHs use both Internet and non-electronic resources to answer practice-related questions. However, Google may not be the best "go-to" resource for answering clinical questions.

ADVANCED SPECIALTY PROGRAM RESIDENTS

Poster #: 18
Title: Influence of a novel self-priming etchant on bond strength to glass-ceramics
Name: Abdulrahman Alshabb
Faculty Advisor: Jin-Ho Phark

Background: Combining etching and silane applications reduces the time of conditioning of glass-ceramic restorations, which makes it less technique-sensitive, and user-friendly. **Purpose:** Evaluating the influence of a self-priming ceramic etchant (Monobond Etch″ MBEP) on micro-tensile bond strength (MTBS) to leucite-reinforced (IPS Empress CAD) and lithium-disilicate reinforced glass-ceramics (IPS e.max CAD). **Methods:** Blocks were cut to 6 mm thick samples. Treatments for Empress groups were: 1) no HF (hydrofluoric) acid, no silane; 2) 60 s HF acid, no silane; 3) 60 s HF acid, silane; 4) MBEP for 20 s and left for 40 s; 5) MBEP for 20 s and left for 100 s. The e.max treatments were: 6) 20 s HF, silane; 7) MBEP for 20 s and left for 40 s. Sandblasted composite blocks (Lava Ultimate) were cemented to the samples using a dual-cure resin cement (RelyX Ultimate). All specimens were sectioned to obtain 0.64 mm2 sticks, and tested after 72 hours of water storage for MTBS, using a universal testing machine (Instron) at a crosshead speed of 0.5 mm/min. For statistical analysis a one-way ANOVA with Games-Howell post-hoc test was performed at α=0.05. **Results:**

Group MTBS (MPa± SD)	Pre-testing failure
1. 21.45 ± 12.98 a	0/62
2. 33.31 ± 11.75 b	0/56
3. 44.88 ± 14.40 c	0/75
4. 41.92 ± 10.74 c	0/66
5. 45.15 ± 11.16 c	0/74
6. 49.50 ± 11.15 c	0/60
7. 5.62 ± 8.45 d	41/62

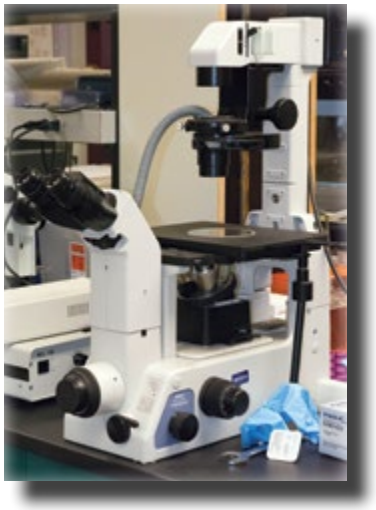
Groups with the same letter are not significantly different from each other (p>0.05). **Conclusion:** Bond strength to leucite-reinforced ceramic using a self-etching primer is comparable to using HF acid and silane. However, using the self-etching primer on lithium-disilicate reinforced ceramic might be a challenge with the given protocol.

Poster #: 19
Title: Influence of implant insertion speed on primary stability
Name: Gonçalo Caramês
Faculty Advisor: Homa Zadeh

Background: Traditionally, dental implants are placed at low speed (15-20 rpm). The influence of implant insertion speed on primary stability has not been investigated. **Purpose:** The aim of this study was to evaluate the influence of implant insertion speed on primary stability in cancellous bone, using Resonance Frequency Analysis (RFA) and Removal Torque (RT). **Methods:** In this in vitro study four groups were created, where the speed of implant insertion was varied (N=50 implants/group): Group A (control, 20 rpm), Group B (250 rpm), Group C (750 rpm) and Group D (1250 rpm). Twenty OSSEOTITE Implants (Biomet 3i, Florida, USA) were used and re-inserted following removal. Two Solid Rigid Polyurethane blocks (Sawbones™, Washington, DC, USA) were selected with a density similar to the posterior maxilla (0.32g/cm3). RFA was measured with Ostell (Gothenburg, Sweden). Removal torque was measured by adjusting the implant motor setting at 5, 10 and 15 N/cm and registering the torque setting that was required to remove the implant. **Results:** There were statistically significant differences (p <.05) in the mean values of Implant Stability Quotient (ISQ) and RT between the groups. Increasing the speed of insertion was associated with increased primary stability:
Group A, 20 rpm (ISQ: 66.07 ± 0.95; RT: 10 Ncm: 70.0%; 15 Ncm: 30.0%)
Group B, 250 rpm (ISQ: 68.24 ± 0.57; RT: 10 Ncm: 54.0%; 15 Ncm: 46.0%)
Group C, 750 rpm (ISQ: 69.31 ± 0.69; RT: 10 Ncm: 50.0%; 15 Ncm: 50.0%)
Group D, 1250 rpm (ISQ: 70.21 ± 0.71; RT: 10 Ncm: 38.0%; 15 Ncm: 62.0%).
There was a positive correlation (r = 0.308) between RT and ISQ values. Implants with a RT of 15 Ncm (69.00 ± 1.57 ISQ) had mean ISQ values significantly higher than those with a RT of 10 Ncm (67.98 ± 1.70 ISQ). **Conclusion:** Within the limitations of this in vitro study, the results suggest that in cancellous bone, an increase in implant insertion speed increased the primary stability, measured by RFA and RT. It will be important to measure the heat generated during insertion at different speeds to determine potential adverse effects of varying insertion speed.

Poster #: 20
Title: 3-D digital measuring of healing dynamics and gingival dimensions
Name: Gonçalo Caramês
Faculty Advisor: Homa Zadeh

Background: In recent years, a variety of root coverage techniques have been available for the treatment of gingival recessions, however attempts were still met with frustration. The Vestibular Incision Subperiosteal Tunnel Access (VISTA) technique has been developed in an attempt to address the aforementioned limitations of current techniques. **Purpose:** The aim of this pilot study was to evaluate the potential for root coverage and gingival biotype modification with VISTA using 3D digital measuring methods. **Methods:** Seven patients and a total of 41 teeth, with a mean initial recession of 2.55 ± 1.24 mm, were included in the present study. The patients were recalled every six months following root coverage with Connective Tissue Graft (CTG) using the VISTA technique. To that end, study casts were made from alginate impressions and poured by dental stone at pre-op baseline and at 6, 12, and 18 months after surgery. The study casts were digitized by scanning with the optical intraoral scanner iTero®. The STL files of pre- and post-op casts were imported into the reverse engineering software Geomagic® control 3D. Then, the pre- and post-treatment 3D images were superimposed to allow for the measurement of the location of the gingival zenith, outline of gingival counter and mucosa form at pre- and post-treatment intervals. The changes in gingival volume, soft tissue thickness, as well as % of root coverage were calculated. **Results:** The mean gingival volume gain after 6, 12, and 18 months was 8.6 ± 10.5 mm³; 6.6 ± 5.6 mm³ and 7.6 ± 8.6 mm³, respectively, comparing to baseline. The mean gingival thickness gain after 6, 12, and 18 months was 1.1 ± 0.4 mm, 0.9 ± 0.3 mm, and 1.0 ± 0.4 mm, comparing to baseline. The mean % of root coverage after 6, 12, and 18 months was 101.8 ± 39.8%; 92.9 ± 41.4% and 85.0 ± 35.4%, comparing to baseline. According to the initial recession (0-1, 1-2, 2-3, 3-4, 4-5 mm), the mean gingival volume gain after 18 months were 1.0 ± 0.0 mm³ at 0-1mm; 5.0 ± 4.6 mm³ at 1-2mm; 2.2 ± 1.9 mm³ at 2-3mm; 10.3 ± 8.0 mm³ at 3-4 mm and 15.6 ± 13.6 mm³ at 4-5 mm, comparing to baseline. The mean gingival thickness gain after 18 months were 0.5 ± 0.0 mm at 0-1mm; 0.8 ± 0.3 mm at 1-2mm; 0.6 ± 0.2 mm at 2-3mm; 1.2 ± 0.3 mm at 3-4 mm and 1.2 ± 0.5 mm at 4-5 mm comparing to baseline. The mean % of root coverage after 18 months was 125 ± 0.0% at 0-1mm; 117.1 ± 36.6% at 1-2mm; 46.9 ± 16.6% at 2-3mm; 78.9 ± 15.4% at 3-4 mm and 66.9 ± 20.5% at 4-5 mm, comparing to baseline. **Conclusion:** CTG + VISTA showed favorable outcomes in root coverage as well as gingival biotype modification after 18 months. The changes in soft tissue volume, gingival thickness, and root coverage were stable after 6 months. Thus, CTG + VISTA is a predictable treatment modality for gingival recession.



Poster #: 21
Title: Effectiveness of Furlow palatoplasty with islandization for cleft palate repair
Name: Christopher Chan
Faculty Advisor: Mark Urata

Background: Cleft lip and palate is one of the most common congenital deformities and affects about 1 in 700 live births in the United States. Special craniofacial teams exist at major academic medical centers that focus specifically on diagnosing and treating these patients. Surgical treatment, however, is not without its complications as negative outcomes such as velopharyngeal insufficiency (VPI) and oronasal fistulas (ORF) do occur. Previous data from Children's Hospital Los Angeles (CHLA) has demonstrated that Furlow palatoplasty with islandization of a hemipalatal flap decreases the rate of oronasal fistulas. **Purpose:** This study aims to determine the impact of Furlow palatoplasty with islandization of a hemipalatal flap on rates of VPI in cleft palate patients postoperatively. **Methods:** A ten year (2004-2014) retrospective study of medical records of all cleft palate patients undergoing Furlow palatoplasty with islandization of a hemipalatal flap at CHLA was performed (N=302).

Post-operative VPI was assessed according to whether patients had a clinical diagnosis (either by surgeon or speech therapist) or by nasopharyngoscopic exam. Further analysis was then performed to determine whether post-surgical procedures such as sphincter pharyngoplasty, palate repair revision, pharyngeal flap repair, or fat injection to the posterior pharynx were warranted after initial surgery to correct the insufficiency. The data was then statistically analyzed and compared with current reported literature rates. **Results:** Preliminary data analysis form 3 years (2004, 2009 and 2010) suggests that the rate of VPI from Furlow palatoplasty repair that required a secondary surgical procedure for correction was 15%. The rate of ORF was 24%. The average age of repair was 26 months with equal male (N=151) and female (N=151) distribution. 68% of patients (N=206) had isolated clefts and 32% (N=96) had syndromic clefts with Pierre Robin Syndrome being the most common. The racial demographic of the patients was 54% Hispanic, 19% Caucasian, 14% Asian/Pacific Islander, 3% Black, and 10% other. **Conclusion:** The data demonstrates that VPI complications necessitating a secondary surgical correction procedure from Furlow palatoplasty occurred in 15% of patients treated at CHLA. This is a higher rate of insufficiency compared to previous studies citing rates of of 5.75% and 11.4%. Further data analysis will need to be performed to determine whether these results are consistent over the 10 year period, and to evaluate the clinical significance of these findings.

Poster #: 22
Title: Effects of metallurgy and file rotation in cyclic fatigue resistance
Name: Kyung-soo Choi
Faculty Advisor: Rafael Roges

Background: Rotary nickel-titanium (NiTi) files are widely used for mechanical enlargement of the canals. However, separation of the rotary NiTi files appear to be a high concern in clinical use. Cyclic fatigue of rotary instrument occurs when the metal is subjected to repeated cycles of tension and compression in a canal with curvature, ultimately leading to the fracture and separation. Movement kinetics of rotary file is shown to influence the cyclic fatigue resistance. Dentsply recently introduced proprietary metallurgy that reportedly increases flexibility and resistance to cyclic fatigue fracture. **Purpose:** To compare the cyclic fatigue resistance of rotary instruments that have different metallurgies to different file rotational movements. **Methods:** A simulated canal model with 90° angle and 5mm radius of curvature in a stainless steel block is used to test NiTi rotary instruments. All of the selected NiTi files have 0.25mm tip diameter with progressive variable tapers from the same manufacturer. NiTi files are rotated at constant speed of 300 rpm in the canal filled with water until the fracture occurs. Time is recorded from the start of rotation to file breakage in continuous motion and reciprocation motion. **Results:** Rotary NiTi files with heat treatment showed greater cyclic fatigue resistance. Reciprocating rotation increased cyclic fatigue resistance in both heat treated and non-heat treated NiTi files. **Conclusion:** Reciprocating rotation movement increases the cyclic fatigue resistance in both heat treated and non-heat treated NiTi files in comparison to continuous rotation movement.

Poster #: 23
Title: Substantivity of 0.25% sodium hypochlorite on enamel
Name: Maria Dakessian
Faculty Advisor: Jorgen Slots

Purpose: The aim of this study is to compare the substantivity of 0.25% sodium hypochlorite and 0.12% chlorhexidine gluconate on enamel when used as a mouth rinse. **Methods:** This study includes 50 freshly extracted human teeth that will be decoronated for the crown to be used. The crowns will be sectioned mesiodistally resulting in 100 samples, which will be stored in saline. Prior to starting the experiment, all the samples will be autoclaved and then randomly assigned to 2 groups. In Group 1, all 50 of the samples will be immersed in 30mL of 0.12% chlorhexidine gluconate for 1 minute. In Group 2, all 50 samples will be immersed in 30mL of 0.25% sodium hypochlorite for 1 minute. To simulate the salivary flow in the oral environment following the 1-minute immersion in the material being tested, all of the samples in both groups will be rinsed with a continuous flow of saline whose rate of 1mL/min will be achieved using an IV drip. Samples will be plated on blood agar plates containing either Streptococcus sanguinis or Actinomyces naeslundii to measure inhibition zones. The samples from each group will be plated at different time intervals with 10 samples in each of 5 time groups: immediately after the rinse with the solution being tested, after 12 hours, after 24 hours, after 48 hours and after 1 week. Following 48 hours of incubation, the plates will be evaluated and measurements of inhibition zones will be recorded.

Poster #: 24
Title: Premolar extraction influence on third molar angulation and retromolar length
Name: Sean Gardner
Faculty Advisor: Glenn Sameshima

Background: Third molar angulation and retromolar length have been found to be contributing factors of impaction versus eruption of third molars. **Purpose:** This study will examine retromolar length and angulation changes pre- and post-orthodontic treatment in extraction and non-extraction cases. **Methods:** In this retrospective study, 90 patients were divided into 3 groups of 30 patients each. Groups were compared using one-way ANOVA by extraction pattern (nonextraction, first premolar extraction, second premolar extraction). The horizontal axes of the second and third molars were traced on initial and final panoramic radiographs; angulation changes between initial and final were measured. The retromolar length was determined by comparing the width of the 3rd molar to the space available from the distal of the 2nd molar to the ramus. The initial and final proportions were compared using chi-square analysis. **Results:** The mean third molar angulation change in the non-extraction group was 3.1 ± 11.6°, first premolar extraction group was 10.0 ± 16.7°, and second premolar extraction group was 6.3 ± 13.1°. The final retromolar length to third molar width proportion among the three groups was: non-extraction 1.88 ± 1.38, first premolar extraction group 1.26 ± 0.53, and second premolar extraction group 1.19 ± 0.37. **Conclusion:** There was not a significant difference in 3rd molar angulation changes among the three groups. There was a highly significant difference (p=.01) between the extraction groups and non-extraction group in the proportion of third molar width to retromolar length. Extraction orthodontic treatment results in mesial movement of the mandibular dentition and more space for eruption of third molars.

Poster #: 25
Title: Digital analysis of soft tissue augmentation using the VISTA technique
Name: Alfonso Gil
Faculty Advisor: Homa Zadeh

Background: VISTA consists of a subperiosteal tunnel extended towards the vestibular depth and the ridge crest, producing a tension-free method of mobilizing the mucoperiosteal complex for root coverage. **Purpose:** The aim of this study is to analyze, through digital software, the soft tissue augmentation around teeth with recession treated with the VISTA technique. **Methods:** 58 teeth with a mean initial recession of 2.2 mm were included in the present study. Study casts were made at pre-operative baseline and at 18 months after surgery. These were digitized by scanning with an intraoral scanner (i-TeroTM). The STL files of pre- and post-op casts were imported into the reverse engineering software (Geomagic-controlR) and superimposed to allow for the measurement of the changes in gingival volume, gingival thickness, and % of root coverage. **Results:** The mean % of root coverage after 18 months was 102% for Class I and 83% for Class III recession defects. The mean gingival volume gain after 18 months was 3.7 mm3 and 2.8 mm3 for Class I and III respectively. The mean gingival thickness gain after 18 months in both groups was around 1.0 mm between 1-5 mm from the final gingival margin. The teeth that showed less % of root coverage and thickness gain were molars. There was a strong negative correlation between root prominence and % of root coverage. **Conclusion:** This is the first study to examine the efficacy of VISTA on teeth with gingival recession by 3D digital measurement. VISTA showed favorable outcomes in root coverage as well as gingival biotype modification.

Poster #: 26
Title: Assessing outcomes of orthognathic surgical cases including 3D-printed splints
Name: Robert Hann
Faculty Advisor: Glenn Sameshima

Background: Precise positions of teeth and maxillofacial structures following orthognathic surgery are difficult to predict. Although there have been recent advances in 3D printing, 3D scanning, and 3D virtual planning, utilizing these rapidly developing technologies together in a surgically predictive context has not been attempted. The recent creation of a full-coverage tray-type surgical splint generated via 3D printing, combined with virtual surgical planning, has potential as a means to generate reliably precise post-surgical predictions. By color mapping and comparing virtually planned surgical positions with post-surgical computerized tomography (CT) scans of orthognathic surgical cases, the precision and reliability of virtually planned results may be assessed. **Purpose:** To assess the precision of post-surgical positions of teeth and maxillofacial structures when compared to vritually predicted outcomes of cases including 3D-printed splints. **Methods:** Prior to orthognathic surgery, all fixed appliances or clear aligner attachments were removed to provide smooth, scannable surfaces. The pre-surgical dentition and maxillofacial complex were recorded in 3D by intraoral scanning and CT. Virtual surgery was performed, and the resultant dental and maxillofacial positions were also recorded in 3D. These positions were used to generate a full-coverage tray-type splint via 3D printing. Orthognathic surgery was performed using this splint. Post-surgical CT scans were taken. Computerized overlays of the virtual surgery and post-surgical positions were generated, and the resultant color map data was analyzed. Post-surgical intraoral scans were also taken, and orthodontic treatment was completed with a series of clear aligners.

Poster #: 27
Title: Post and core restoration of nonvital incisors without ferrule
Name: Jide Johnson
Faculty Advisor: Pascal Magne

Background: Restoring endodontically-treated incisors (ETI) without ferrule is commonly undertaken using various types of posts and composite resin buildups. **Purpose:** The aim of this study is to investigate the restoration of ETI without ferrule using ceramic crowns bonded to 3 types of core buildups and two different posts. A ferrule group with post was included for comparison. **Methods:** Ninety decoronated bovine ETI were divided in 6 groups: Gr1 as control with 2-mm ferrule, a fiber post (ParaPost FiberLux) and Miris2 nanohybrid composite resin buildup; Gr2 similar to Gr1 but without ferrule. Gr3 and Gr4 similar to group 2 but with Tetric EvoCeram BulkFill resin buildup and ParaCore dual-cure resin buildup, respectively. Gr5 and Gr6 with a titanium post (ParaPost XH) and Miris2 (group 5) or EvoCeram BulkFill buildup (group 6). All teeth were prepared to receive bonded IPS e.max ceramic crowns and were subjected to accelerated fatigue testing (cyclic loading applied to the incisal edge starting at loads of 100 N ramping to a maximum of 1,000 N and 140,000 cycles). Groups were compared using the Kaplan-Meier survival analysis (Logrank test at p=.05 and pairwise post hoc comparisons). **Results:** Failure started as a gap/crack at the lingual margin between the buildup/crown assembly and the root. Gr1 showed highest survival, followed by the fiber post with BulkFill (Gr3) and then Miris2 (Gr2). The titanium post groups (Gr5, Gr6) and Fiber post with ParaCore (Gr4) had the lowest survival. **Conclusion:** The survival of nonvital incisors was mainly improved by the presence of the ferrule. Fiber post showed better results than titanium when combined with EvoCeram BulkFill.

Poster #: 28
Title: Platelet-rich plasma and human amniotic fluid for socket preservation
Name: Shantia Kazemi Esfeh
Faculty Advisor: Homa Zadeh

Background: Platelet-rich plasma (PRP) and human amniotic fluid (HAF) are used as adjunct treatments during periodontal grafting surgery because of their capability of enhancing the healing process. **Purpose:** We aimed to clinically and histologically evaluate the osteogenic effects of PRP, HAF, and their combination (PRHA) in rabbit socket preservation. **Methods:** 24 healthy male rabbits were randomly allocated into four groups: 1) PRHA, 2) HAF, 3) PRP and 4) control with no biomaterial used. Half of the rabbits were sacrificed at 4 weeks and the rest 8 weeks after surgery. In each rabbit one lower incisor tooth was extracted, sectioned and stained. 720 images were evaluated to calculate the percentage of trabecular bone area and to quantify osteocyte formation and vessel formation. Data was analyzed using ANOVA and Tukey's test. **Results:** Percentage of bone trabeculae, osteocyte formation and vessel formation in all groups were significantly higher at 8th week compared to 4th week ($p<.001$). PRHA and HAF groups had significantly higher mean percentage of trabecular bone area and numbers of osteocyte formation compared to other groups ($p<.05$) with no significant difference from each other ($p=.497$). Vessel formation was significantly enhanced in HAF group ($p<.05$) compared to other groups. PRHA group showed significantly enhanced vessel formation compared to PRP and control groups ($p< .05$). **Conclusion:** All three experimental groups showed positive effect on area of trabecular bone, number of osteocytes and vessel formation. Since there was no statistical difference between HAF and PRHA, it seems more beneficial to use HAF due to its simplicity of application.

Poster #: 29
Title: Crown-to-implant ratio and marginal bone loss: A meta-analysis
Name: Vahid Khoshkam
Faculty Advisor: Homa Zadeh

Background: Multiple systematic reviews have documented the efficacy of short implants in alveolar sites with moderate vertical height atrophy. Short implants in sites with alveolar ridge atrophy are often restored with elongated restoration, leading to relatively high crown-to-implant (C/I) ratio. It is important to determine whether the increased C/I ratio has any detrimental biological effects on peri-implant bone. **Purpose:** To that end, this systematic review sought to examine the long-term effects of C/I ratio on peri-implant marginal bone loss, as reported by prospective clinical trials. **Methods:** An electronic search of 5 databases and hand searches were performed to identify prospective human trials that had reported both crown/implant ratio and associated peri-implant marginal bone loss with a follow-up of at least 36 months. A random-effect meta-analysis was performed to analyze weighted mean difference (WMD) and confidence interval (CI) for recorded variables according to PRISMA guidelines. A weighted linear regression model was used to evaluate R2 value. **Results:** The publication search yielded 784 records and after evaluating titles, abstracts and full-texts, 7 prospective trials were included for quantitative data synthesis. Meta-analysis for the comparison of MBL among selected studies showed a WMD of 0.01 mm, with a 95% CI of -0.07-0.08 mm ($p=.90$). Results failed to detail any significant correlation between C/I ratio and marginal bone loss. The weighted linear regression model showed that when C/I ratio ranged between 1.22 and 1.84, limited MBL (<1.2 mm) could be expected. The low (0.1997) R2 value suggests a lack of correlation between MBL and C/I ratio. **Conclusion:** Based on the available evidence, there is no relationship between C/I ratio within the examined range and marginal bone loss.

Poster #: 30
Title: Influence of abutment angulation on screw fracture strength and removal torque
Name: Tiffany Lee
Faculty Advisor: Winston Chee

Background: The position of an implant is not always ideal to allow proper restorative contours and screw access. In such situations the implant screw channel needs to be corrected using custom or pre-angled abutments as prosthetic options. **Purpose:** 1) Compare the removal torque of Dynamic Abutments screws (DAS; Talladium International Implantology) in abutments with 3 different angulations before and after cyclic loading. 2) Compare the fracture strength (FS) of the DAS at different angulations. **Methods:** 28 external hex implants (3i Biomet), embedded into acrylic resin, were divided in 4 groups. Dynamic Abutments with different angulation were waxed-up, cast and torqued. In Group 1 (control group), 3i Biomet gold square screws were used and torqued at 35 Ncm; the angulation was 0°. In groups 2-4, DAS were used and torqued at 25 Ncm; the angulation was 0° for Group 2, 20° for Group 3, and 28° for Group 4. Baseline and final (after cyclic fatiguing in a dual-axis chewing-simulator for 1,200,000 cycles) screw removal torque values were recorded with a digital implant torque driver. The fracture

strength (FS) of the implant restorations was tested under compression until failure with a universal testing machine (Instron). The difference between baseline and removal torque (ΔRT) was calculated. Statistical analysis was performed using one-way ANOVA for ΔRT and FS separately with Bonferroni post-hoc test at α=0.05. **Results:** ΔRT values and FS values were not significantly different between the groups (p>0.05). The screw broke in 5 out of 28 (17.8%) samples. Remaining samples failed by damaging the implant platform while the screw bent or loosened. **Conclusion:** The removal torque and fracture strength of the Dynamic Abutment screw is comparable to the 3i Biomet gold screw. Angulation of the abutment did not have any significant influence on the screw removal torque values.

Poster #: 31
Title: Evaluation of varying thickness of zirconia around abutment cylinders
Name: Cheryl Park
Faculty Advisor: Winston Chee

Background: Zirconia is becoming increasingly used as a restorative material for implant supported restorations. However, there is a lack of information regarding the optimal wall thickness of zirconia surrounding the implant components. **Purpose:** The purpose of this study is to evaluate the resistance to fracture of different thicknesses of zirconia luted to implant components. **Methods:** Thirty cylinders of monolithic zirconia (Prettau Zirconia, Zirkonzahn) with 13 mm height, indented occlusal surface for loading, and varying wall thicknesses (0.5 mm, 1 mm, 1.5 mm; N=10/group) were designed and milled using a CAD/CAM system (Modellier software and M5, Zirkonzahn), and finally sintered. Titanium temporary cylinders (ITCS41, Biomet3i) were attached to 30 external hex implant analogs (ILA20, Biomet3i) that had been embedded into PMMA blocks (Palapress Vario Heraeus Kulzer) with dimensions of 4.5 x 2.5 x 1.5 cm). The zirconia specimens were cemented to the titanium cylinders using a self-adhesive, dual-cure resin cement (Panavia SA, Kuraray). A load-to-failure test was performed under compression until fracture using a universal testing machine (Model 5965, Instron) at a cross-head speed of 0.5 mm/min. Statistical analysis was performed using one-way ANOVA and Tukey's B test at α=0.05 (SPSS 19, IBM). **Results:** Mean load of failure was 1,060 N, 2,019 N, and 4,075 N for groups 0.5 mm, 1 mm, 1.5 mm, respectively. Thes values were significantly different between the groups (p<.05). **Conclusion:** Considering the average human bite force, this study suggests keeping a thickness of 0.5 mm to 1 mm of this particular type of zirconia around the implant cylinder to avoid fracture around this area of stress.

Poster #: 32
Title: Adhesion of soft liners to printed and heat-cured resins
Name: Cheryl Park
Faculty Advisor: Winston Chee

Background: 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 unknown. **Purpose:** The aim of this study was to evaluate the adhesion strength of soft liner materials to a 3D-printed denture base material. **Methods:** 144 (N=36/group) heat-polymerized acrylic plates were prepared (Lucitone199, Dentsply) following dimensions (25 mm x 25 mm x 3 mm) recommended by ISO10139-2:2009 (Control). 144 (N=36/group) 3D-printed plates were prepared using light-curing material (DentcaBase, Dentca) and 3D printer (Dentca Solution, Dentca). Control and experimental groups were further divided into 4 groups of soft liners (N=72/group): Group 1) Sofreliner (Tokuyama Dental America), Group 2) Mucopren (Kettenbach), Group 3) Permasoft (Dentsply), Group4) Prosoft (Perma). Printed plates were washed with isopropanol, sanded with grit p400 sandpaper and post-cured (Honle UV America). All plates were aged in water (28 days, 37C) before applying soft liner materials between 2 plates of the same material using ring-shaped collars (10 mm diameter, 3 mm thickness). Handles were bonded to each ends of the plates with cyanoacrylate to facilitate loading onto tensile machine. Tensile testing was carried out at a displacement rate of 10 mm/min (140 Universal Testing Machine, Test Resources). Maximum load (F) was recorded during debonding. Bond strength was calculated: B (bond strength, MPa) = Force(N)/Area(mm^2). Mode of failure was visually determined (adhesive or cohesive). **Results:** Tukey's HSD test showed that the differences between the soft liner groups were significant with silicone liners (Groups 1, 2) having significantly higher bonding strength to both PMMA and printed material as compared to the acrylic liners (Groups 3, 4). No statistically-significant difference was found in bond strengths between the printed groups and PMMA. Modes of failure were dominated by cohesive failure. **Conclusion:** Adhesion strength of silicone and acrylate soft liner materials seems to be comparable between the conventional PMMA and 3D-printed material.

Poster #: 33
Title: 3-D digital teeth arrangement for complete dentures
Name: Cheryl Park
Faculty Advisor: Tae Hyung Kim

Background: In rapidly-developing digital dentistry, CAD/CAM systems have been implemented in removable prosthodontics. Recently, a novel CAD software allowing digital teeth set-up has been developed by Dentca (Dentca, Inc.). **Purpose:** The aim of this study is to assess the efficacy of 3D teeth arrangement software as an educational tool. **Methods:** The subjects were 33 students enrolled in the international program at Herman Ostrow School of Dentistry of USC. The software was available as an iPad application (Dentca) and consisted of virtual edentulous arches above which denture teeth can be set up by changing the angle and linear position. Students were given one week to practice the teeth arrangement in the practice mode. The practice mode offers guidelines such as the ideal teeth positions in transparent color, occlusal plane, arch size, midline, and additional instructions. After one week, students arranged the teeth without the tranparent guidelines and deviations from ideal positions were analyzed for teeth #6, 7, 8, 9, 10, 11. The amount of linear deviation from the ideal was recorded in terms of x, y, z and the angular deviation in xr, yr, zr. **Results:** Linear and angular deviations were compared between maxillary anterior teeth using ANOVA and Tukey HSD. The results show non-significant difference between deviations for maxillary anterior teeth. However, there was a trend of increasing deviations as students moved away from the central incisors, with canines (#6, 11) resulting in the largest amount of deviations. **Conclusion:** CAD teeth arrangement software has the potential to be used as an educational tool by students to learn and successfully arrange the denture teeth in correct positions after use of the software.

Poster #: 34
Title: 3-D analysis of maxillary retromolar bone before and after distalization
Name: Tina Park
Faculty Advisor: Glenn Sameshima

Background: Current orthodontic literature shows that en-masse distalization of maxillary dentition is mechanically possible. However, the safety and efficacy of the technique must be investigated. **Purpose:** 1) To study the changes in the maxillary retromolar alveolar bone dimensions in response to Modified Palatal Anchorage Plate (MPAP) assisted maxillary en-masse dental distalization. 2) To evaluate the bone level at the distal surface of the distalized second molar. **Methods:** The pre- and post-treatment cone-beam computed tomographies (CBCTs) of 41 Class II subjects treated with the MPAP appliance were analyzed. Four landmarks for reference, five landmarks bordering the retromolar bone, and the cemento-enamel junction (CEJ) at the distal surface of the second molar were digitized. The length, height and width of the retromolar bone, and the bone level at the distal surface of the second molar were calculated. **Results:** After undergoing treatment, the width, height and length significantly decreased to 12.08 ± 2.58 mm, 6.36 ± 2.21 mm and 5.14 ± 2.71 mm, respectively. Statistical comparison between the actual post-treatment length 5.14 mm and the expected value of 4.57 mm showed significant increase in the total bone length by 0.57 mm. Bone coverage at the distal surface of the second molar did not show significant change. **Conclusion:** There is sufficient retromolar bone length to accommodate maxillary dental distalization. En-masse distalization with the MPAP appli-

ance does not lead to periodontal defect at the distal surface of the second molar. Further studies must be done to evaluate if there is active bone remodeling in all three dimensions to maintain the bony housing around the distalized second molar.

Poster #: 35
Title: Operator-determined and reoriented natural head position in three-dimensional imaging
Name: Laura Rein
Faculty Advisor: Dan Grauer

Background: The advent of cone-beam computed tomography (CBCT) imaging presents numerous advances in orthodontic diagnosis and treatment planning. To acquire an image, a patient is oriented in the CBCT unit's built-in restraints according to a horizontal reference plane. While natural head position (NHP) is a more ideal postural position due to high standardization and reproducibility, it is not regularly used by CBCT units due to the difficulty in positioning each patient. **Purpose:** The purpose of this study is to compare different patients' head positions as determined and imaged by radiologic technicians, to a reoriented position modified by the use of intracranial landmarks. **Methods:** The sample consisted of 151 orthodontic patients with current CBCT images from one practitioner's office in Los Angeles, CA. The pitch, roll, and yaw were adjusted in Dolphin 3D Imaging until intracranial landmarks were aligned and symmetrical. The pitch, roll, and yaw coordinates were recorded and statistical analysis was performed to test for significance and correlation to age and gender. **Results:** There was no statistically significant difference between the roll of the operator-determined position and the reoriented images. There was a statistical difference in pitch and yaw, in which the patient tended to look upwards and to the left within the CBCT machine. Correlation testing demonstrated a positive linear relationship between pitch and age. However, no relationship exists between pitch, roll, or yaw and gender. **Conclusion:** The results of our study demonstrate that our method of orienting the head into natural head position is a successful technique to properly position the head into NHP for pitch and yaw.

Poster #: 36
Title: Numb chin syndrome as first presentation of metastatic breast cancer
Name: Jasjot Sahni
Faculty Advisor: Parish Sedghizadeh

Background: This case is important as patient who had a history of breast cancer 20 years ago initially presented to her dentist with hypoesthesia unilaterally in left chin, jaw and lower lip. CT scan identified lytic metastatic disease involving right mandible and thoracic vertebrae along with multiple pulmonary nodules in lungs. Oncologic referral confirmed diagnosis of metastatic breast cancer. **Purpose:** Familiarity with numb chin syndrome (NCS) is important for oral health care providers in order to identify etiology and provide appropriate referral or management. **Methods:** Since this is a case report, no specific methods were used. **Results:** NCS is a condition with a broad differential diagnosis which may require further investigation to identify etiology. NCS can be the first presentation of metastatic cancer to the jaws. **Conclusion:** Familiarity with neuropathic pain presentations and evaluation is important for oral health care providers in order to accurately identify etiology and provide appropriate referral or management.

Poster #: 37
Title: Regenerative therapy for repair of peri-implantitis tissues
Name: Navid Sharifzadeh
Faculty Advisor: Homa Zadeh

Background: Along with the increased number of implants being utilized in clinical practice, there has been a rise in the incidence of biological complications, including peri-implantitis. **Purpose:** Therefore, the availability of efficacious therapy for peri-implantitis is an important area of investigation. Though many therapies have been proposed for peri-implantitis, there is a paucity of data documenting their efficacy and effectiveness. **Methods:** The present case report provides a protocol, which will include implant surface decontamination, as well as regeneration. The protocol will begin with removal of the prosthesis and mucoperiosteal flap elevation. Hard biofilms are removed by titanium brush in conjunction with air powder abrasion and hydrofluoric acid gel etching. Autogenous bone shavings are harvested within the same surgical area, combined with anorganic bovine bone minerals (ABBM) and covered with collagen membrane. Primary coverage is obtained to submerge the implants during the healing period. After 3 months, the implants are exposed and the prosthesis is reconnected. **Results:** 31 implants have been treated in 22 patients using this protocol. Clinical and radiographic outcomes have demonstrated significant regeneration of peri-implant bone and soft tissues. Radiographic outcome demonstrated gain of marginal bone of between 2.0 to 5.4 mm with a mean of 3.3 mm. In one case, two implants were reconstructed in this manner and during the second stage surgery, it was discovered that the implants were fractured. The implants were removed and histologic evaluation was performed, demonstrating significant evidence of new bone regeneration around the treated implants. **Conclusion:** The protocol for the treatment of peri-implantitis includes: 1) Aggressive surface decontamination (titanium brush, air powder abrasion and acid etching); 2) Regenerative therapy: combination of autogenous bone shavings directly on the surface of implants, with a layer of anorganic bovine bone minerals and collagen membrane; 3) Removal of prosthesis to allow primary coverage of the regenerated site for minimum of 3 months. The protocol appears to be effective in pilot case series. Randomized controlled trials will be required to investigate the efficacy of the proposed protocol.

Poster #: 38
Title: In-vitro evaluation of different implant surface decontamination protocols
Name: Navid Sharifzadeh
Faculty Advisor: Homa Zadeh

Background: A clear relationship has been established between the formation of microbial biofilms on an implant surface and an inflammatory response in the host tissues. According to recent reviews, peri-implant disease has a prevalence of 20% in patients with implants. For the surgical protocols, the primary objective of treatment is to gain access to the affected implant surface for debridement and decontamination. Various implant surface decontamination methods have been advised in the surgical treatment of peri-implantitis around titanium implants. However, a solid protocol has not been proposed yet. **Purpose:** This study evaluated different implant surface decontamination methods in vitro, and based on the results, utilized the most efficient one as a protocol for an in-vivo implant surface decontamination method. **Methods:** 5 Astra-tech dental implants (Dentsply, Germany) were chosen. The micro-thread part of the coronal portion of the dental implants was allocated to different types of surface decontamination protocols: 1) Sterile saline irrigation; 2) Air-abrasive device application; 3) Hydrofluoric acid (porcelain etchant) application; 4) Titanium brush utilization; 5) Combination of 1-4). All the implant surfaces were evaluated under the scanning electron microscope (SEM). The objective of this was to evaluate the quality and quantity of alteration in the implant surfaces in each protocol. **Results:** As expected, saline irrigation showed the least surface alteration while other protocols presented different modalities. The air-abrasive device created pits in the implant surface whereas the acid etching provided more pits with increased surface area. The titanium brush removed the peak of the threads from the implant surface, showing the capability of biofilm removal. The combination protocol presented the most solid result with potential of biofilm removal and increased surface area in the presence of superficial pits. **Conclusion:** The application of the combination implant surface decontamination protocol has the ability to remove the biofilm attached to the implant surface and provide a surface that has a potential for re-osseointegration of the lost bone around the dental implants.

Poster #: 39
Title: Volumetric analysis of vestibular incision subperiosteal tunnel access (VISTA) treatment
Name: Matt Somerville
Faculty Advisor: Homa Zadeh

Background: Gingival recession is a common manifestation in most populations and is relevant for multiple reasons. To name a few, root surface exposure resulting from gingival recession may create root

caries, dental hypersensitivity, and esthetic problems. The significance of any gingival recession may vary considerably depending on the etiology, extent and associated symptoms in each case. The technologies that have made the use of three-dimensional (3D) digital scanners an integral part of many industries for decades have been improved and refined for application to dentistry. The advantage of using the intra-oral digital scanner is superior accuracy of gingival examination compared with traditional examination with a periodontal probe. This study aimed to report the efficacy of vestibular incision subperiosteal tunnel access (VISTA) treatment of multiple recession defects using the intra-oral digital scanner (iTero). **Purpose:** The aim of this study was to evaluate the potential for measuring change in gingival thickness after VISTA surgery by superimposing optical scans over CBCT images. **Methods:** A variety of techniques are available for treatment of multiple contiguous recession defects. The available techniques have limitations , including the need for marginal incisions that compromise the blood supply. Outcome predictors have demonstrated the significance of coronal positioning at least 2 mm coronal to the CEJ in order to increase the likelihood of complete resolution of recession defects. Traditional suturing techniques are limited in their ability to fix the position of the gingival margin. The VISTA technique has been developed in an attempt to address the limitations of current techniques. VISTA involves a vestibular incision in an area remote to the defect and elevation of a subperiosteal tunnel. Once gingival margins are coronally positioned in a tension-free manner, the sutures holding gingival margins in coronal position are bonded with flowable composite. Alginate impressions were then taken at 6 months and 1 year following the surgery. All study casts were scanned by intra-oral digital scanner (iTero) to evaluate the effect on soft tissue contours. **Results:** Change in gingival thickness (#18-22 gingival recession, measured at each tooth) as a result of VISTA surgery was successfully measured by superimposing optical scan data over CBCT data. Preliminary findings show an average thickness increase of 0.73 mm. **Conclusion:** The use of optical scanners in evaluating treatment of gingival recession with VISTA is a promising tool that may allow for accuracy superior to measurement with a periodontal probe. This technique is important not only for the accuracy of evaluation, but also for the efficiency and easy of use. Further clinical trials are needed to determine the effectiveness of this technique.

Poster #: 40
Title: Histological analysis of extraction sockets grafted with anorganic bovine bone
Name: Azadeh Tavari
Faculty Advisor: Homa Zade

Background: Alveolar ridge resorption following tooth extraction has been considered an unfavorable yet expected outcome which poses negative effects on the subsequent treatment of extraction site. These effects include esthetic and functional concerns, such as inadequate dimensions of bone for implant placement. Though multiple ridge preservation procedures have been introduced to reduce this resorption, the biological and clinical outcomes of the healing process have not been adequately described. **Purpose:** The purpose of this study was to examine the histologic response of tissue in extraction sockets in anticipation of implant placement. **Methods:** The extraction socket of previously determined hopeless teeth were grafted with large particle size (1-2mm) cancellous bovine anorganic bone: ABBM (Bio-Oss, Geistlich Pharma, Switzerland) and covered with a PTFE membrane (Cytoplast GBR-200, Osteogenics, USA). Bone cores of 3.3 mm diameter were obtained at the time of implant placement, at a mean of 127 days, and ranging from 91 to 180 days following ridge preservation grafting, and evaluated by histology examination. Quantitative histomorphometric analysis was performed (NIH Image J software) to identify osteoid bone, connective tissue, and residual xenograft. **Results:** A total of 39 samples were processed for histologic examination and stained with H&E and Tricrhome, followed by histomorphometric analysis. Histologic observations revealed strongly eosinophilic osseous tissue containing round to ovoid osteocytes within lacunae demonstrating its viability. Distinct reversal lines were evident in the woven bone, and in areas of active apposition osteoblastic cells with large nuclei, occasional nucleoli and granular cytoplasm were seen rimming the bone and occasional osteoclasts were observed within Howship's lacunae or resorption pit adjacent to osteoblasts, all indicating active remodeling of the bone. Hematopoietic cells and erythrocytes were observed in the lumen of the blood vessels within the fibrovascular stroma that surrounds the bone. The mean percentage of vital bone, residual graft and connective tissue found within the core sample were 35%, 14%, and 51%, respectively. The density of bone in patients younger than 50 years old was significantly greater than those aged from 70 to 80 years old. This difference was statistically significant ($p<.05$). Although a statistical difference was not found, there was a trend that as the age of the patient increased, the percentage of vital bone decreased. **Conclusion:** This study demonstrates that age is a determining factor of bone density in a healed grafted extraction socket. Furthermore, the histologic response of extraction sites following this ridge preservation protocol demonstrated its efficacy in generating adequate vital bone to support implant osseointegration.

Poster #: 41
Title: Orthodontic rotational relapse: Incidence and prevention
Name: Katherine Wong
Faculty Advisor: Dan Grauer

Background: Relapse is an inevitable consequence of orthodontic treatment without proper retention. A better knowledge of how teeth relapse after appliance removal may help the orthodontic practitioner in choosing the most appropriate retention and relapse prevention therapy. **Purpose:** The aim of this study is to accurately assess the incidence of rotational relapse that takes place between appliance removal and retainer delivery to determine any patterns in in relapse direction. **Methods:** Dental models from 13 consecutively de-bonded patients were compared at three time points: initial malocclusion, day of appliance removal, and 6-16 days later at retainer delivery. Initial models and models from the day of appliance removal were visually assessed to determine how the teeth were rotated into their corrected positions. To observe the direction these teeth relapsed, models from appliance removal and retainer delivery were digitally scanned and superimposed to create a 3D color map showing changes that occurred between the two time points. **Results:** Overall, among the teeth that were moved orthodontically, most had no rotational relapse. The data suggests that teeth are nine times more likely to relapse in the opposite direction of orthodontic rotation than in the same direction. A large proportion of the teeth sampled were not moved orthodontically and did not relapse after appliance removal. Surprisingly, a small proportion of teeth relapsed even when not moved orthodontically from initial malocclusion. **Conclusion:** Using the described methods, it is possible to discern some trends in the direction of orthodontic rotational relapse. While most teeth will not relapse between appliance removal and retainer delivery, the orthodontic practitioner should be most aware of the potential for relapse in the opposite direction of orthodontic rotation.

Poster #: 42
Title: Three-dimensional quantification of post-surgical condylar displacement **Name:** Paula Zabalegui
Faculty Advisor: Dan Grauer

Background: Condylar displacement following orthognathic surgery has been related to post-surgical relapse. Although postoperative changes in condylar position have been reported in previous studies, no study has precisely quantified these variations in three dimensions (3D). The development of cone-beam computed tomography (CBCT) has enabled the accurate measurement of changes in condylar position in three planes of space. **Purpose:** To quantify, in 3D, the amount and direction of condylar displacement relative to the glenoid fossa after bi-maxillary surgery. **Methods:** The sample consisted of 17 patients undergoing orthognathic surgery treated consecutively by one surgeon. The pre-surgical and 2-week post-surgical CBCT DICOM files were collected for each patient. The regions of interest in the temporomandibular joint complex were segmented and the pre- and post-surgical condyles were superimposed using the glenoid fossa as the reference structure. Condylar translation and rotation were compared before and after surgery for each patient in three planes of space. **Results:** The average condylar displacement was

0.95 mm on the x plane, 2.79 mm on the y plane, and 1.26 mm on the z plane. As for rotation, the average movement was 1.22° on x, 1.46° on y, and 4.13° on z. **Conclusion:** Minimal changes in condyle position do occur immediately after bi-maxillary surgery and it is possible to accurately assess the amount and direction of this displacement in 3D.

Poster #: 43
Title: Periodontal regeneration utilizing antibody-mediated osseous regeneration (AMOR)
Name: Hamad Alqadhi
Faculty Advisor: Homa Zadeh

Background: Periodontal regeneration has been a challenging feat and requires the consideration of many factors. In order to attempt novel regenerative techniques, animal models are often used to demonstrate the efficacy and safety of these techniques. **Purpose:** Our goal is to introduce a novel treatment modality for periodontal regeneration based on endogenous osteoinductive agents. The outcome of this research is likely to have a wide impact for use as a periodontal regenerative material for treatment of severe periodontal degradation and ultimate tooth loss. **Methods:** Eight male beagle dogs (control N=4 , test N=4) had periodontal defects surgically created under general, local and inhalation anesthesia. Experimental sites (AMOR) received Anti-BMP-2 mAb (25µg/ml) immobilized on Bio-Oss Collagen and Bio-Gide, while control sites (ISO) received isotype matched control mAb immobilized on Bio-Oss Collagen and Bio-Gide. The surgeon was blinded to which site received the AMOR and which site received the ISO treatment. The sites were left to heal undisturbed and the dogs were fed a soft diet for 8 weeks under the care of a certified veterinarian. At 8 weeks the dogs were sacrificed and the defects analyzed under Micro CT. **Results:** Our preliminary results show that experimental sites healed with greater periodontal regeneration and higher bone density when compared to control using Micro CT software analysis. **Conclusion:** Surgically created defects in male beagle dogs showed greater periodontal regeneration when treated with AMOR than control sites. Antibody-mediated osseous regeneration has the potential for clinical efficacy in future studies.

Poster #: 44
Title: Frequency of MB2 detection in maxillary 1st molar
Name: Yeaseul Youn
Faculty Advisor: Rafael Roges

Background: One of the major causes of failure in endodontic treatment is the impossibility of locating and treating the entire root canal system. A high percentage of treatment failures in the maxillary molar teeth is due to the impossibility of locating, instrumenting and obturating the secondary mesiobuccal canal (MB2), located in the mesiobuccal root. With the aid of the operating microscope, selective dentin removal, and more specialty training allowed clinicians to examine the morphology of the tooth at a higher level. **Purpose:** The aim of this study was to investigate whether the combination of operating microscope and selective dentin removal and more training increased the frequency of MB2 detection in permanent maxillary first molar teeth. Null hypothesis: no difference in the prevalence of locating MB2 in the maxillary first molar between undergraduate dental student and graduate endodontic resident. **Methods:** A total of 200 maxillary first molar root canal treated teeth were randomly selected, 100 root canal treatments completed by the undergraduate dental students and 100 root canal treatments completed by the graduate endodontic residents. Patient records were reviewed retrospectively and the prevalence of MB2 in the maxillary first molars was evaluated. **Results:** The prevalence of locating the second mesiobuccal canals found by the graduate endodontic residents was significantly higher than the undergraduate dental students. **Conclusion:** The combination of operating microscope, selective dentin removal, and more specialty training increase the prevalence of locating the second mesiobuccal canals in the maxillary first molar.

GRADUATE POST-DOCTORAL TRAINEES

Poster #: 45
Title: Integration and expression of GFP 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 green fluorescent protein (GFP) construct in Aa. **Methods:** A non-functional secA pseudogene in the genome of Aa strain D7S-1 was chosen as the insertion site for GFP. The construct consisted of the upstream region of secA, the ltx promoter (JP2 or non-JP2), the mut3 GFP coding sequence, the aad9 spectinomycin resistance gene, 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 confocal microscopy. **Results:** Two GFP-expressing Aa strains were made, driven by either a non-JP2 type or a JP2 type leukotoxin promoter. Growth analysis by BioScreen showed no deleterious effects due to the insertion and replacement of secA by the construct. The construct was found to be stable after multiple passages in vitro. Under confocal microscopy, all cells were found to express GFP. As expected, the strain with the JP2-driven GFP reporter was found to be brighter than the strain with the non-JP2-driven reporter. **Conclusion:** Our results show that our genetic manipulation strategy results in a stably integrated construct and may prove useful for gene expression in Aa.

Poster #: 46
Title: BMP activity regulates mesenchymal lineage commitment and tooth root initiation
Name: Jifan Feng
Faculty Advisor: Yang Chai

Background: Postnatal tooth development occurs mainly in the apical region, which forms the tooth roots. This region was reported to contain a distinct mesenchymal stem cell (MSC) population, namely stem cells of the apical papilla (SCAPs), which is potentially associated with the specific growth of this tissue. **Purpose:** Despite their in vitro MSC characteristics, there is limited understanding of how SCAPs undergo odontogenic lineage commitment in vivo during development. Because BMP signaling is an important regulator of osteo-/odontogenic differentiation of dental mesenchymal stem cells in vitro, we hypothesize that BMP signaling may also regulate SCAPs to undergo odontogenic differentiation in vivo. **Methods:** We first investigated molecular markers to identify SCAPs in vivo. We then utilized a transgenic mouse model to disrupt BMP signaling in the apical mesenchymal cells and their derivatives in vivo, to investigate the functional requirement of BMP signaling in their fate determination. **Results:** We have identified SCAPs critical for postnatal tooth development in vivo. Loss of BMP function leads to failure of the SCAPs to activate the differentiation program. RNA-seq analysis showed a down-regulation of several transcriptional factors associated with early craniofacial development in the apical mesenchyme of mutant mice. **Conclusion:** Our result demonstrates that BMP signaling is indispensable for the in vivo odontogenic lineage commitment of MSCs during tooth morphogenesis.

Poster #: 47
Title: Contractility in palatal shelf elevation
Name: Jill Harunaga
Faculty Advisor: Yang Chai

Background: The development of the palate begins with the vertical elongation of two outgrowths from the oral side of the maxillary processes, flanking the tongue. The shelves then elevate to a horizontal position above the tongue, grow horizontally and fuse together. Although many studies have addressed the process of palatal shelf fusion, elevation is not well understood. **Purpose:** Researchers suggested decades ago that non-muscle contractility is involved in elevation, but constraints on technology limited further investigation. Here, we aim to define the role of contractility in palatal shelf elevation. **Methods:** We will analyze mice at embryonic day 14 (E14) to determine if proteins involved in the contractile machinery localize to specific areas within the palatal shelves prior to elevation. We also plan to perform whole head culture with Rho and myosin II inhibitors to examine whether contractility is necessary for shelf

elevation. Concurrently, we will also analyze cell shape changes and cell proliferation patterns after inhibitor treatment. **Results:** Increased RhoA immunostaining is detectable in the vertical palatal shelves of E14 mice on the nasal, but not the oral, side, at the epithelial-mesenchyme interface. **Conclusion:** Our findings suggest that localized cell contraction may specifically shorten the nasal side of the shelves and provide the intrinsic force needed for elevation. More experiments are necessary to explore this hypothesis.

Poster #: 48
Title: Protein methylation in epithelial-to-mesenchymal transition of epicardial cells
Name: Olan Jackson-Weaver
Faculty Advisor: Jian Xu

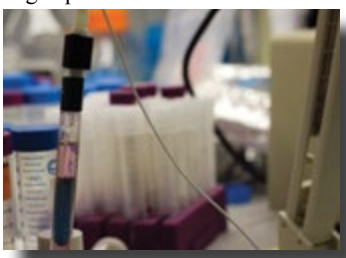
Background: The epithelial-to-mesenchymal transition (EMT) is an important cellular mechanism in diverse biological processes such as development, wound healing, cancer metastasis, and fibrosis. We focus on epicardial cells, for which EMT is a key mechanism in activation and differentiation. Epicardial cells are mesothelial cells lining the heart. They are important progenitors that give rise to cardiac fibroblasts and smooth muscles, and are a source of growth factors. Our recent work has established an important function for the protein arginine methyltransferase (PRMT1) in EMT. **Purpose:** We tested the hypothesis that PRMT1 is required for EMT in epicardial cells. **Methods:** Cell culture, western blots, real-time PCR, siRNA, embryo culture. **Results:** We found that silencing PRMT1 in epicardial cells prevented EMT protein changes and the migratory and invasive phenotypes that are characteristic functional outcomes of EMT. Silencing PRMT1 increased levels of p53 by reducing p53 turnover. Nutlin-3, which blocks p53 degradation to increase p53 expression, also blocked EMT changes, which phenocopies PRMT1 silencing effects. Decreasing p53 expression, on the contrary, increased the induction of the mesenchymal factor slug during EMT. Furthermore, silencing PRMT1 also inhibited epicardial EMT ex vivo in an embryo thorax culture model. **Conclusion:** The PRMT1-p53 pathway controls epicardial EMT. These studies establish a role for protein methylation in the EMT process, and could lead to treatments for diseases affected by EMT.

Poster #: 49
Title: Wnt signaling regulates the MSC-TA cell transition in the mouse incisor
Name: Junjun Jing
Faculty Advisor: Yang Chai

Background: The mouse incisor provides an excellent model for mesenchymal stem cell (MSC) study because it grows continuously throughout the life of the animal. Both the epithelium and mesenchyme rapidly replenish all of their cells within one month. Our previous studies have demonstrated that Gli1+ perivascular cells are typical MSCs in vivo. However, the mechanism of MSC transition into transit-amplifying (TA) cells remains unclear. **Purpose:** To address this question, we generated β-catenin conditional knockout mice because previous studies have shown that Wnt/β-catenin signaling plays a critical role in the activation of adult stem cells. **Methods:** We crossed β-catenin$^{flox/flox}$ mice with *Gli1-CreERT2* mice and *K14-rtta;tetO-Cre* mice to examine loss of β-catenin in MSCs and the epithelium, respectively. **Results:** TA cells in the mesenchyme disappeared in *Gli1-CreERT2;*β-catenin$^{flox/flox}$ mice after one week induction with tamoxifen. One month after induction, TA cells were not detectable in either the epithelium or mesenchyme of *Gli1-CreERT2;*β-catenin$^{flox/flox}$ mice and there was complete arrest of incisor growth. In contrast, TA cell number was not affected in *K14-rtta;tetO-Cre;β-catenin*$^{flox/flox}$ mice after one week of induction. However, the number of TA cells was reduced in the epithelium but not the mesenchyme after one month, indicating that β-catenin signaling in the epithelium had no effect on TA cells in the mesenchyme. **Conclusion:** Taken together, we conclude that the MSC-to-TA cell transition is regulated by the Wnt/β-catenin signaling pathway in the mouse incisor.

Poster #: 50
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, such as SHH and PTCH, have been identified as genetic risk factors for cleft palate in both humans and mice. **Purpose:** To investigate the function of Shh signaling activity in the palatal epithelium during the fusion process. **Methods:** We constitutively activated Shh signaling in the palatal epithelium by generating *K14-Cre;R26SmoM2* mice. **Results:** Previous studies have shown that specific inhibition of Shh signaling activity in the palatal epithelium does not affect palatal fusion. Here, we constitutively activated Shh signaling in the palatal epithelium by generating *K14-Cre;R26SmoM2* mice, resulting in submucous cleft, soft palate cleft and failure of the primary palate to fuse with the secondary palate. At newborn stage, a shining transparent strip was detectable on the posterior part of the midline, similar to a zona pellucida, characteristic of human submucous cleft. Detailed histological analysis revealed a persistent midline epithelial seam in the anterior part of the secondary palate. In addition, an epithelial bridge separated the palatine bone and prevented fusion in the midline. **Conclusion:** Taken together, we conclude that Shh signaling in the palatal epithelium plays a critical role during palatal fusion by regulating the fate of the medial edge epithelium.



Poster #: 51
Title: Narrative structuring of transitions in pediatric occupational therapy sessions
Name: Jennifer McCorkle Kovacs-
Faculty Advisor: Mary Lawlor

Background: A key structural element of pediatric occupational therapy sessions is the navigation of transitions between activities or ways of doing activities. However, there has been very limited attention to the work entailed in facilitating clinical action during transitions and the therapeutic and relational processes that ground such action. **Purpose:** To qualitatively determine characteristics of narrative structure in transitions during pediatric occupational therapy sessions involving family members, therapists, and children and the implications for occupational therapy practice. **Methods:** Using data from two longitudinal ethnographic studies of children with disabilities, their families, and healthcare practitioners, this analysis focused on transitions within pediatric occupational therapy sessions. Narrative, thematic, and micro-ethnographic analyses were conducted with conceptual frameworks for analysis of actions and interpersonal experiences. Specific attention was devoted to action, body position, pace, and the physical environment. **Results:** Transitions in pediatric occupational therapy sessions can be understood as shifts in narrative elements of action and temporal contours of experience. Narrative as a structuring tool in clinical action is particularly significant in the management of transitions, as narrative elements of the unexpected, child agency, and parent participation are heightened. **Conclusion:** Narrative frameworks are valuable in understanding the clinical action and progression of transitions, and should be applied to further explorations of clinical phenomena.

Poster #: 52
Title: Narrative interview and analysis with people who have autism
Name: Jennifer McCorkle Kovacs
Faculty Advisor: Mary Lawlor

Background: There has been much attention devoted to etic perspectives in autism research, but recent research points to a critical need for more participatory methods to explore emic understandings voiced by people with autism themselves. Narrative interviewing is a method that has been used to provide in-depth data, eliciting personal illness narratives which can be tools to understand emic perspectives. **Purpose:** This study aims to qualitatively investigate how narrative interviewing can be adapted to people with autism, how participants narratively structure their experiences, and what interactional or contextual factors constrain or support the sharing of rich, coherent narratives. **Methods:** Narrative interviews were conducted with people with autism aged 14-35, in addition to caregiver interviews, participant ob-

servation, and field note creation. Data was recorded, transcribed, and subjected to iterative narrative and thematic analyses. **Results:** Participant narratives included stories about early social experiences, perspectives on engagement in occupation, and changing insights related to perceptions of social self. Specific challenges of narrative interviewing with people with autism included balancing abstract with concrete wording and pacing questions and answers. Combining interviews with participant observation and caregiver interviews allowed for triangulation of findings and context for further questions. **Conclusion:** Narrative interviews and analysis can inform understandings about the experiences of people with autism, but researchers should be sensitive to differences in narratives elicited and adapt technique and analysis to fit individual needs.

Poster #: 53
Title: Collagen Sponge Functionalized with Chimeric Anti-BMP2 Monoclonal Antibody Mediates Repair of Critical-Size Mandibular Continuity Defects in a Non-Human Primate Model
Name: Seiko Min
Faculty Advisor: Homa Zadeh

Background: Previous studies have demonstrated the ability of murine anti-BMP2 monoclonal antibodies (mAbs) to capture endogenous BMP-2, -4 and -7 to mediate in vivo bone formation in critical-sized calvarial defects, a strategy termed antibody-mediated osseous regeneration (AMOR). In an effort to advance this strategy toward its translational application in repair of skeletal defects, the present study was undertaken to investigate the ability of a newly generated chimeric anti-BMP2 mAb to mediate AMOR in a clinically relevant mandibular continuity defect model in non-human primates. **Methods:** Critical-sized mandibular continuity defects were created in six Macaca fascicularis mandibular bones, and absorbable collagen sponges (ACS), functionalized with chimeric anti-BMP2 mAb or isotype control mAb, were implanted within the defects. Live animals were scanned with cone-beam computed tomography (CBCT) at 6 and 12 weeks post-operatively. 3D and 2D CBCT quantitative analyses were performed to measure new bone volume and new bone area, respectively. Histological analysis was performed on repaired specimens at 12 weeks post-operatively to evaluate bone repair. **Results:** CBCT analysis of bone volume at 6 and 12 weeks after surgery demonstrated anti-BMP2 mAb mediated more bone formation than isotype control mAb at each indicated time point. Histological analysis showed more de novo bone was regenerated in the anti-BMP2 mAb group than in the control group. **Conclusions:** Results from the present study provide evidence for the potential of ACS functionalized with anti-BMP2 mAb to mediate de novo bone formation in non-human primates, indicating a promising therapeutic approach for regenerative medicine.

Poster #: 54
Title: Stabilization of β-catenin in neural crest leads to craniofacial malformations
Name: Carolina Parada
Faculty Advisor: Yang Chai

Background: Disrupted WNT canonical signaling is associated with several developmental syndromes in humans and mice. Mutation of diverse members of the WNT canonical pathway leads to craniofacial malformations, specifically cleft palate. **Purpose:** The goal of this study is to analyze the effect of stabilization of β-catenin in the postmigratory neural crest populating the craniofacial region during mouse development, and consequently to further understand the role of the WNT pathway in craniofacial morphogenesis. **Methods:** We studied *Wnt1-Cre;Ctnn1Exon3* mice. **Results:** *Wnt1-Cre;Ctnn1Exon3* mice died at birth and exhibited cleft palate (CP) and malpositioned tongue. CP in these mutant mice was associated with delay of palatal shelf elevation. In other to determine the cause of this defect, we analyzed several aspects of mesenchymal cell behavior in the palatal shelves of E12.5. E13.5, and E14.5 control and *Wnt1-Cre;Ctnn1Exon3* embryos. Cell survival and proliferation in *Wnt1-Cre;Ctnn1Exon3* palatal shelves were comparable to those of controls at all stages analyzed. Previous studies have shown that failure in elevation of the palatal shelves could be due to malposition of the tongue. In *Wnt1-Cre;Ctnn1Exon3* mice, the tongue is highly located in between the palatal shelves at E14.5 and later stages. Thus, we analyzed the tongue phenotype. Cell survival and proliferation in *Wnt1-Cre;Ctnn1Exon3* tongues were not affected at any stage. However, myosin heavy chain immunostaining showed an alteration in the pattern of the extrinsic muscles of the tongue in *Wnt1-Cre;Ctnn1Exon3* embryos from E12.5 to E14.5. In some cases, the misorientation of the extrinsic muscles of the tongue was associated with the presence of an ectopic cartilage in the attachment site of those muscles. To determine whether the cause of cleft palate was the tongue malposition, we performed an in vitro experiment in which the tongue and mandible were removed and the upper two thirds of the head culture in a rotating system. After three days of incubation, the palatal shelves of both controls and *Wnt1-Cre;Ctnn1Exon3* embryos were elevated. This finding suggests that cleft palate in these mutant mice is secondary to the malposition of the tongue. Unlike other mouse models that mimic human Pierre-Robin sequence, *Wnt1-Cre;Ctnn1Exon3* mice did not exhibit micrognathia. Both size and shape of the mutant mandibles were comparable to those of controls, although in *Wnt1-Cre;Ctnn1Exon3* mice, minor branching of the Meckel's cartilage was detectable. **Conclusion:** Collectively, our study demonstrates that cleft palate is secondary to the malposition of the tongue in *Wnt1-Cre;Ctnn1Exon3* mice. Further analyzes are needed to determine whether the subtle phenotype found in the mandible is contributing to the tongue malposition. The phenotype of *Wnt1-Cre;Ctnn1Exon3* mice could be a variant of the human Pierre-Robin sequence.

Poster #: 55
Title: Matrix-mediated assembly of layered monetite-chitosan composite
Name: Qichao Ruan
Faculty Advisor: Janet Oldak

Background: Bioinspired synthesis of hierarchically structured calcium phosphate material (CaP) is a highly promising strategy for developing improved bone substitute materials with outstanding mechanical properties, but it still remains an ongoing challenge in the field of material science. **Purpose:** To develop a novel strategy to synthesize a CaP biomaterial with organized structures from nano- to macroscale. Our aims were 1) to prepare a monetite-based composite with a layered structure with micrometer scale, and 2) to synthesize organized hydroxyapatite (Hap)-based composite via a phase transformation of layered monetite-based composite. **Methods:** Inspired by the formation of lamellar structure in nacre, a chitosan/maleic acid (MAc) matrix was designed to control the mineralization of monetite crystals with an organized layered structure. The transformation of monetite was achieved by incubating monetite crystals in 0.1 M NaOH at 70 °C for 5 minutes. The morphology and composition of products were characterized using scanning electron microscopy (SEM), transmission electron microscopy, X-ray diffraction and energy dispersion spectroscopy. The assembly mechanism of the layered structure was investigated using SEM, atomic force microscopy, and Fourier transform infrared spectroscopy. **Results:** Chitosan and MAc could assemble into an organized complex and further guided the mineralization of monetite crystals, resulting in the formation of organized and parallel arrays of monetite platelets with a brick-and-mortar structure. Using the layered monetite-chitosan composite as a precursor, we were able to synthesize a hierarchical HAp with multi-scale ordered structure via a topotactic phase transformation process. The organized structures and composite feature afforded CaP materials with improved mechanical properties that are close to bone and dentin. **Conclusion:** Our study demonstrated a biomimetic strategy to develop novel bone substitute material and may provide inspiration for biomimetic designs of advanced, mechanically robust materials for biomedical applications.

Poster #: 56
Title: Synergism and antagonism between *Aggregatibacter actinomycetemcomitans* and other oral species
Name: Qiong Sha
Faculty Advisor: Casey Chen

Background: Gram-negative facultative *Aggregatibacter actinomycetemcomitans* (Aa) is a member of the subgingival polymicrobial community associated with periodontitis. Our recent whole genome sequence analysis of 33 Aa strains has divided the species into 5 phy-

logenetic clades. It was hypothesized that distinct strains may have different phenotypes, such as their antagonistic or synergistic relationship with other oral species. **Purpose:** To assess the synergistic or antagonistic relationship between distinct clades of Aa and other periodontal species. **Methods:** A two-species mixed biofilm formation assay was performed by co-culturing in liquid media each of 8 oral species with each of 13 to 17 Aa strains. The 8 oral species were: *Streptococcus gordonii* (Sg), *Streptococcus parasanguinis* (Sp), *Porphyromonas gingivalis* (Pg), *Dialister pneumosintes* (Dp), *Fusobacterium nucleatum* (Fn), *Eikenella corrodens* (Ec), *Filifactor alocis* (Fa), and *Actinomyces israelii* (Ai). The cultures were incubated for 3 or 7 days under anaerobic conditions at 37 °C. The amounts of biofilm were determined by a standard biofilm formation assay with crystal violet staining. **Results:** An antagonistic relationship was found between Sp and 4 of 11 Aa strains tested, and between Sg and 1 of 10 Aa strains tested. A synergistic relationship was found between Pg and all 6 Aa strains tested, between Fn and 2 of 8 Aa strains tested, between Dp and 5 of 12 Aa strains and between Ai and 2 of 5 Aa strains. **Conclusion:** Synergistic or antagonistic relationship between Aa and oral species is both species-specific and strain-specific.

Poster #: 57
Title: Ameloblastin interacts with ameloblast-cell-mimicking lipid vesicles
Name: Jingtan Su
Faculty Advisor: Janet Oldak

Background: Cell-to-matrix interaction is important for amelogenesis. As the second most abundant matrix protein in enamel, ameloblastin is suggested to act as a cell-adhesion molecule. Without ameloblastin, ameloblast cells cannot fully differentiate and lose their ability to synthesize and secrete enamel matrix proteins. **Purpose:** To investigate interactions between ameloblastin and ameloblast-cell-mimicking lipid vesicles (ACML) in order to provide insight into the function of ameloblastin during amelogenesis. **Methods:** Wild-type and Trp mutant mouse ameloblastins were expressed in E. coli with a thioredoxin tag and a 6×poly-His tag, purified using Ni-NTA-agarose. The tags were removed by enterokinase and the target protein was re-purified by reversed-phase chromatography. AMCL was prepared as a model for ameloblast cell membrane, as previously reported (SB Lokappa et al., 2015). Interactions between ameloblastin and ACML were investigated by circular dichroism (CD), fluorescence spectra, dynamic light scatting (DLS) and transmission electron microscopy (TEM). **Results:** CD showed that addition of ACML resulted in a decrease in ellipticity of the peaks at 222 nm and 208 nm and an increase of the peak at 193 nm, implying that ACML induces ameloblastin to form more a-helixes. Fluorescence spectra analysis of Trp mutant ameloblastins suggested that ameloblastin interacts with ACML through its N-terminal sequence. As observed by TEM and DLS, ACML formed particles of 50 nm diameter. DLS showed that ameloblastin may break ACML into particles with radii of ~14 nm. TEM and a vesicle leakage assay confirmed that ameloblastin can break ACML into smaller particles. **Conclusion:** Ameloblastin interacts with ACML directly through a segment at the N-terminal sequence encoded by exon 5. Ameloblastin-cell membrane interactions may be functional during matrix-mediated enamel biomineralization.

Poster #: 58
Title: IFT88 is crucial for mammalian craniofacial development
Name: Hua Tian
Faculty Advisor: Yang Chai

Background: IFT88 is a crucial component of the intraflagellar transport (IFT) machinery required for assembly and function of the primary cilium. Mutations in *IFT* genes have been linked with the cause of skeletal ciliopathies that show craniofacial, limb and rib defects. In a family of three affected siblings with cleft lip and cleft palate, we discovered that they carry a missense mutation in the *IFT88* gene following exome sequencing. **Purpose:** The functional significance of *IFT88* in regulating craniofacial development needs to be characterized. **Methods:** We generate *Wnt1-Cre;Ift88$^{fl/fl}$* mice to test the functional requirement of Ift88 in regulating the fate of cranial neural crest (CNC) cells during craniofacial morphogenesis. **Results:** Loss of Ift88 in CNC cells resulted in severe craniofacial defects including cleft lip and cleft palate, tongue agenesis and supernumerary teeth. There is no CNC cell migration defect in *Wnt1-Cre;Ift88$^{fl/fl}$* mice, highlighting the specific functional significance of *IFT88* in CNC-derived mesenchyme during lip and palate fusion. **Conclusion:** Our study shows that *IFT88* has a highly conserved function within the primary cilium of CNC-derived mesenchyme in lip and palate region in both mice and humans. A missense mutation in *IFT88* adversely affects Hh signaling and expands the clinical spectrum of ciliopathies.

Poster #: 59
Title: Biofilm-associated genes in *Aggregatibacter actinomycetemcomitans*
Name: Natalia Tjokro
Faculty Advisor: Casey Chen

Background: *Aggregatibacter actinomycetemcomitans* (Aa) is a gram-negative oral anaerobe associated with periodontitis. Whole genome sequencing of 31 Aa strains and 2 strains of the closely related Aggregatibacter aphrophilus identified 1,550 core genes found in all strains and 1,670 accessory genes found in some but not all strains. The functions of the accessory genes, many organized into genomic islands, were unknown. Some accessory genes were hypothesized to modulate Aa virulence. **Purpose:** To investigate the expression patterns of core and accessory genes of a wild type Aa strain D7S-1 during biofilm formation and an isogenic mutant strain D7SS in planktonic growth. **Methods:** Aa strains were grown in trypticase soy broth with 0.6% yeast extract at 37 °C with 5% CO2. 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 2-214 with a normal distribution pattern for both core (N=1,676) and accessory genes (N=437) in both strains. The median expression value for core genes was ~2 fold higher than that of the accessory genes. 17 accessory and 166 core genes were found to be differentially expressed in biofilm and planktonic growth states, with a 1.5 fold difference ($p<.05$ by t-test). **Conclusion:** Accessory genes share a similar expression pattern but lower expression level in comparison to core genes. Differentially expressed core and accessory genes may explain strain-to-strain variation in Aa phenotypes.

Poster #: 60
Title: Osteoprogenitor self-renewal is regulated by the epigenetic state of r-chromatin
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 this 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 regulates skeletal development from within the nucleolus where it modulates transcription of 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 resists differentiation. **Purpose:** To assess whether osteoprogenitor cell self-renewal elicited by FGFR2 is manifested by epigenetic changes at rDNA repeats (r-chromatin). **Methods:** ChIP-qPCR was utilized to determine both protein occupancy and histone modifications at rDNA repeats, RT-qPCR was used to measure RNA abundance, and polysome profiling was used to assess translation output from preosteoblasts expressing wild type and mutant FGFR2. **Results:** Proteins that mark poised-active histones are enriched at r-chromatin in preosteoblasts expressing the BBDS mutations. Consistent with

this, poised-active histone marks are enriched at rDNA repeats in these cells. The *FGFR2* mutations in BBDS activate rDNA transcription through UBF1 and subsequently increase ribosome output. Finally, reduction of elevated rRNA levels in preosteoblasts expressing the BBDS mutations with a RNA Pol I-specific inhibitor restores progression of osteoprogenitor cell differentiation. **Conclusion:** Collectively, these results demonstrate that FGFR2 promotes osteoprogenitor self-renewal by promoting an active epigenetic signature of r-chromatin.

Poster #: 61
Title: Arginine methylation of Smad6 defines bone-morphogenetic-protein (BMP) signaling properties **Name:** Jian Wu
Faculty Advisor: Jian Xu

Background: Bone-morphogenetic-protein (BMP) signaling pathway plays crucial role during bone and heart development, as well as vessel angiogenesis. Binding of BMP ligands (e.g. BMP4) to their receptors recruits and phosphorylates receptor Smads (R-Smads, eg. Smad1, 5, 8). Smad6 is an inhibitory Smad which specifically inhibits R-Smads activation. **Purpose:** Our mass spectrometry data show that arginine 81 (R81) of Smad6 is methylated. We sought out to investigate how R81 methylation affects Smad6 inhibition of BMP signaling pathway. **Results:** Our mass spectrometry data show that arginine 81 (R81) of Smad6 is methylated. Molecular biology and biochemistry data demonstrated that Smad6 R81 methylation is mediated by protein arginine methyltransferase 1 (PRMT1). We found R81 methylation is required for BMP signaling-induced recruitment of Smad6 to Smad1, and Smad6-mediated disruption of phosphor-Smad1/Smad4 complex formation and Smad1 nuclear transportation where Smad1 induces gene activation. We further demonstrated that N-terminal Smad6 (aa1-330) stabilizes interaction between C-terminal Smad6 (aa331-495) and Smad1 and enhances the inhibitory function of C-terminal Smad6. Disruption of R81 methylation results in loss of cytosolic inhibitory function because of an increase in binding between N-term and C-term that results in a "closed" conformation of Smad6. **Conclusion:** In summary, R81 methylation of Smad6 is required for its ability to control the BMP signaling pathway.

Poster #: 62
Title: miR-153 regulates endocytotic pathways during amelogenesis
Name: Kaifeng Yin
Faculty Advisor: Michael Paine

Background: Disorders in the endocytotic activities of ameloblasts is one of the main causes of amelogenesis imperfecta (AI). **Purpose:** To identify the functional role of miR-153 during maturation-stage enamel formation. **Methods:** Genome-wide microRNA and mRNA transcriptome analyses were conducted on the RNA samples obtained from both secretory- and maturation-stage enamel organ. The spreadsheets of differentially expressed microRNAs were uploaded to Ingenuity Pathway Analysis (IPA) for target prediction. The target genes, that were found to be differentially expressed during enamel formation, were subject to bioinformatic analyses (GO and KEGG). Ameloblast-like LS8 cells and ALCs were transiently transfected by miR-153 mimics. Changes in the expression of predicted gene targets were quantified after 24h and 48h, by real-time PCR and western blotting. MicroRNA expression changes induced by miR-153 transfection were also detected. Luciferase reporter assays were carried out to verify the predicted interaction between miR-153 and the 3' UTR of the target genes. **Results:** Over 200 functional categories that incorporate both microRNAs and their corresponding target genes were generated from bioinformatic analysis. The key role of miR-153 in endocytotic activities was suggested in multiple endosome/lysosome-related categories. Intracellular increase in the amount of miR-153 induced significant decrease in the expression levels of other microRNAs (miR-298, miR-135a, miR-376b, miR-346) regulating endocytosis. The expression of Cltc, Lamp1, Clcn4 and Slc4a4 were significantly reduced at mRNA and protein levels in both LS8 cells and ALCs as a result of transient transfection by miR-153. Luciferase reporter assays confirmed the predicted interaction between miR-153 and the 3` UTRs of Cltc, Lamp1, Clcn4 and Slc4a4. **Conclusion:** miR-153 regulates maturation-stage amelogenesis by targeting key genes involved in the endocytotic pathways.

Poster #: 63
Title: Prevalence of oral *Candida* colonization in patients with diabetes mellitus
Name: Peiman Mehriar
Faculty Advisor: Homa Zadeh

Background: We aimed to assess the prevalence of oral *Candida* colonization in patients with diabetes and its relationship with factors such as *Candida* species, serum glucose level, and the susceptibility rate of isolated yeasts to antifungals. **Methods:** Random samples were obtained from 113 patients with type 2 diabetes, 24 patients with type 1 diabetes, and 105 healthy controls.The samples were taken by swabbing the oral mucosa. The samples were inoculated onto CHROMagar-Candida. The growing colonies were counted, and the isolated yeasts were identified by PCR-RFLP and RapID methods. Various isolated species of *Candida* were also subjected to susceptibility testing of antibiotic drugs. Blood samples were taken to evaluate glycosylated hemoglobin (HbA1c). **Results:** Although the *Candida* carriage rate and density were statistically higher in diabetics than healthy individuals, no direct association was found between having high *Candida*-burden and glycosylated hemoglobin. The most commonly isolated species in both diabetics and controls was *Candida albicans*. Of the tested antifungal drugs, the highest rate of resistance was found against itraconazole, followed in frequency by ketoconazole and fluconazole. **Conclusion:** This study identified a significant association between the poor glycemic control and the higher prevalence rates of *Candida* carriage and density in diabetic patients. In addition, a high prevalence of *C. dubliniensis* in diabetic patients was found, which might be misdiagnosed with its morphologically related species, *C. albicans*.

Poster #: 64
Title: Small molecule screen for Charcot-Marie-Tooth disease type 1E/1A
Name: Sofya Abazyan
Faculty Advisor: Pragna Patel

Background:
Charcot-Marie-Tooth disease is the most common inherited peripheral neuropathy. CMT1A, the most common subtype, is associated with a 1.5 Mb duplication including *PMP22* while point mutations in *PMP22* underlie CMT1E. Surgical correction and braces are the only therapies for CMT currently. Mice over-expressing Pmp22 or with L16P mutation show that excessive or defective Pmp22 accumulates in cytosolic aggregates and is retained in the endoplasmic reticulum. Treatment of C22 and TrJ mouse models with rapamycin activates autophagy and improves myelination. **Purpose:** We hypothesize that a small molecule that reduces aggregate formation could allow protein to be transported to the Schwann cell membrane and have therapeutic benefit. **Methods:** We created a stable HeLa cell line expressing doxycycline-inducible human PMP22 with a missense mutation (L16P) fused to red fluorescent protein (RFP) that formed aggregates in the cytoplasm and perinuclear region, reduced upon treatment with rapamycin. **Results:** From a screen of 32,000 molecules, 19 were selected and IC50, toxicity studies and a secondary screen to rule out transcriptional or translational inhibitors resulted in three compounds, USC1, 3 and 12, that were selected for analog synthesis. 65, 49 and 26 analogs of USC1, 3 and 12, respectively have been synthesized and examined in the primary and secondary assay. **Conclusion:** We have used four different assays to determine if subsets of these analogs induce autophagy as a possible mode of action and assessed their ability to reduce aggregates and increase monomeric protein. We will next examine if these compounds increase PMP22 at the membrane using biochemical and cell biological approaches.

GRADUATE PRE-DOCTORAL CANDIDATES

Poster #: 65
Title: Saliva interactions with chitosan-amelogenin hydrogel and enamel repair protocol
Name: Rucha Bapat
Faculty Advisor: Janet Oldak

Background: Dental and materials scientists have long been interested in developing artificial materi-

als to mimic natural enamel. Ruan et al. (2013) developed a novel chitosan-amelogenin (CS-AMEL) hydrogel to regrow a new layer of enamel-like crystals on the surface of teeth. The hydrogel helped in building needle-like, well-oriented hydroxyapatite crystals with a robust interface on the surface of natural enamel. **Purpose:** In order to develop CS-AMEL hydrogel as a potential biomimetic dental material, rigorous in vitro testing in conditions similar to the oral environment is necessary. This study investigated two of those conditions: pH changes in the oral cavity and interaction of amelogenin with saliva. **Methods:** The pH changes occurring in the oral cavity were simulated using a pH cycling model (Buzalaf, et al., 2010; Ruan, et al., 2015). Effects of saliva were tested by using the hydrogel in human pooled saliva as well as by incubating amelogenin in saliva. **Results:** Applying the CS-AMEL hydrogel on the surface of etched enamel in the presence of saliva inhibited the growth of new organized crystals on the surface of enamel. HPLC and SDS PAGE analyses of amelogenin incubated with human pooled saliva showed that amelogenin was degraded after 6 hours. **Conclusion:** Human salivary enzymes adversely affect the function of CS-AMEL hydrogel by degrading amelogenin. Therefore, the recommendation for future clinical trials is to apply CS-AMEL hydrogel once daily before bedtime in a custom-made tray to prevent its direct interaction with saliva. To the best of our knowledge, this study is the first to report the interaction between saliva and amelogenin.

Poster #: 66
Title: Gingival bleeding on probing (BOP) in untreated periodontitis of adults
Name: Mona Dousti
Faculty Advisor: Jorgen Slots

Background: BOP of individual sites raises the risk of periodontal breakdown and may prompt frequent recalls. **Purpose:** This study aimed to establish the distribution of BOP in untreated periodontitis patients and if BOP of a limited number of teeth could predict BOP of the entire dentition. **Methods:** The study included 32 otherwise-healthy adults with periodontitis. No scaling was performed. A tooth was labeled BOP if at least one of six sites exhibited BOP. Statistical analysis was performed using SPSS 20.0. **Results:** BOP increased with increasing pocket depth ($p<.001$), and tended to occur symmetrically around the midline of the mouth ($p<.001$). BOP surfaces averaged 14.81 in the molar segment vs. 10.32 in the premolar and anterior segments ($p<.028$). Teeth showing most BOP, in descending order, were #2, 14, 3, 26, 10, and 12. Teeth showing least BOP, in increasing order, were #28, 21, 5, 7, 9, and 27. **Conclusion:** BOP is an attractive risk indicator for periodontal breakdown because it is a relatively simple, quick, all-or-none visual testing method that is not greatly dependent on special skills or exceptional tactile sensitivity on the part of a clinical observer. This study showed that BOP occurred most frequently in deep pockets and in molars, but was also present in many shallow pockets. Studies are in progress to determine if a limited number of teeth or a half-mouth examination can provide a reliable prediction of BOP in the entire dentition.

Poster #: 67
Title: A novel in vitro method of generating forebrain pericytes
Name: Casey Griffin
Faculty Advisor: Ruchi Bajpai

Background: Forebrain pericytes are integral players in the blood-brain barrier (BBB). Defects in or loss of functional forebrain pericytes leads to breakdown of the integrity of the BBB, causing leakage of toxins into the brain. Leakiness of the BBB has recently been found to play a part in numerous neurodegenerative diseases, most notably Alzheimer's disease. **Purpose:** Despite their importance, little is known about forebrain pericytes and what makes this population of pericytes both able to maintain the BBB and prone to damage. My project focuses on understanding what defines forebrain pericytes as a unique pericyte population, with emphasis on their developmental source as well as their gene expression and epigenomic architecture. **Methods:** I plan to incorporate experiments in frogs and mice to determine the developmental source and unique functions of forebrain pericytes, and in parallel attempt to generate pericytes from neural crest cells in vitro in order to perform high-throughput sequencing of pericyte gene expression and the pericyte epigenome. **Results:** So far, I am en route to establishing a successful method for generating pericytes in vitro from neural crest cells. This is evidence that pericytes are derived from neural crest cells, and provides a platform to begin studying the uniqueness of forebrain pericytes. **Conclusion:** These different approaches will help to gain a better understanding of the uniqueness of forebrain pericytes, as well as open the door for potential therapeutic avenues or approaches to delay or stem the onset of Alzheimer's disease and other diseases involving disruption of the BBB.

Poster #: 68
Title: Gene expression analysis in an *A. actinomycetemcomitans* oral infection model
Name: Susan Mahabady
Faculty Advisor: Parish Sedghizadeh

Background: Oral biofilm infections are the most common infections in humans and a significant public health burden. The immune system has difficulty in clearing these infections, and little is known regarding host inflammatory and immune responses. **Purpose:** *A. actinomycetemcomitans* (Aa) is one of the key pathogens involved in oral biofilm infections. The present project utilizes an animal model to study local and systemic host inflammatory and immune responses to Aa infection in oral tissues. Our hypothesis is that Aa infection will result in an increase in pro-inflammatory cytokines and immune reaction. **Methods:** Aa bacterial suspension or sterile saline suspension was injected into oral vestibular tissue of rats at t=0 and t=3 days. Local and systemic clinical responses were evaluated, and Th17 pathways were analyzed for gene expression of Aa infected and control rats. **Results:** Local clinical evaluation of Aa injected rats compared to control rats indicated inflammation in the local tissues. Systemic evaluation of drainage lymph nodes by qPCR analysis indicated an over-expression of key anti-inflammatory cytokines and transcription factors of the Th17 pathway, including IL-10 and IL-23a. **Conclusion:** These preliminary findings suggest that Aa bacterial infection in rats leads to a pro-inflammatory host immune response and increase in function of Th17 pathways. Further studies are needed to elucidate the mechanisms involved in Aa-mediated oral infection and better understand the immunopathology of oral Aa infections.

Poster #: 69
Title: Amelogenin-derived peptides for biomimetic repair of dentin
Name: Kaushik Mukherjee **Faculty Advisor:** Janet Oldak

Background: Amelogenin-derived peptides have shown a promising potential for biomimetic remineralization of dental hard tissues. **Purpose:** To design novel amelogenin-derived peptides with active domains that could regulate organized crystal regrowth on dentin and promote occlusion of the dentinal tubules. **Methods:** Based on active apatite-binding domains, we rationally designed two amelogenin-inspired peptides; P26 and P32 and examined their efficacy in dentin remineralization. Leucine-rich amelogenin peptide (LRAP) was also used in this study for comparison with the synthetic peptides. Human third molars were transversely sectioned into 2mm-thick dentin discs above the mid-coronal region of the tooth. To mimic carious lesions, the discs were immersed in a demineralising solution (pH 4.6) at 37°C for 3 days. Peptides were applied (with and without chitosan gel) on the demineralised windows and the discs were placed in a remineralizing solution (pH 7) for 3-14 days. We characterized new crystal growth, morphology, orientation and composition using SEM, XRD and EDS. **Results:** SEM revealed de novo crystallites formed on dentin sealing the exposed tubules (3-5 days) which matured to a more robust well-oriented apatitic layer with time. XRD patterns indicated characteristic apatite mineral phases in the newly grown layer. Peptide-chitosan gel application formed a homogenous layer of organized needle-like crystals on dentin discs. On direct peptide application, without chitosan, a more densely packed heterogeneous layer of crystals with high mineral density was observed. **Conclusion:** Our results suggest that rationally designed amelogenin-derived peptides are effective in mediating biomimetic mineralization of dentin and may be utilized for dental hard tissue repair and engineering.

Poster #: 70
Title: Amelogenin - amelo-blastin co-assembly at the

enamel prism boundary
Name: Saumya Prajapati
Faculty Advisor: Janet Oldak

Background: Enamel extracellular proteins and their assembly play key roles in the formation and maintenance of the hierarchical prismatic structure. **Purpose:** To investigate amelogenin-ameloblastin interactions and hetereomolecular assembly *in vivo*. **Methods:** Post-natal day 8 (P8) mandibular molars representing maturation stage of amelogenesis were used for immunofluorescence histochemistry, immunochemistry, *in vivo* co-localization and fluorescence resonance energy transfer (FRET) imaging using laser scanning confocal microscopy. The following antibodies were used in this study: full-length, the C-terminal segment and N-terminal segments against amelogenin and N-terminal segment against ameloblastin. FRET analysis was carried out using the following formula: $E_{FRET}=1-(I\ D_{pre}/I\ D_{post})$ where ID_{post} is the fluorescence intensity of the donor after photo bleaching and ID_{pre} is the fluorescence intensity of the donor before photo bleaching. **Results:** Immunochemistry showed that lower molecular weight fragments of ameloblastin and amelogenin were predominant at P8. The confocal laser microscopy and co-localization analysis of doubly labeled transverse sections showed that N- terminal ameloblastin and amelogenin co-localized around the periphery of the enamel rods in maturing rodent enamel. FRET analysis confirmed the molecular interactions between TRAP (N-terminal region of amelogenin) and N-terminal of ameloblastin in the nanometer range *in situ*. **Conclusion:** The N-terminal of ameloblastin and TRAP region of amelogenin interact around the boundaries of the enamel prisms. We suggest that amelogenin and ameloblastin interact at the maturation stage of amelogenesis to prevent inter rod crystallites to invade in the adjacent rods. We are also demonstrating a molecular mechanism to show how enamel matrix proteins cooperate to form hierarchical structure of enamel.

Poster #: 71
Title: Fgfr2 regulates attachment of tendon-to-bone in the craniofacial complex
Name: Ryan Roberts
Faculty Advisor: Amy Merrill

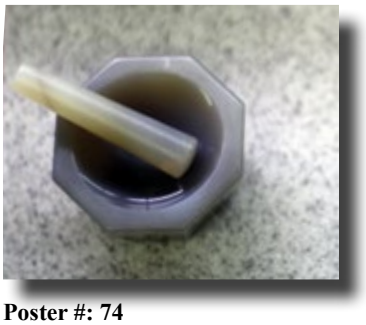
Background: Fibroblast Growth Factor (FGF) signaling plays a critical role in skeletal development, as mutations in *Fibroblast Growth Factor Receptor 2* (*FGFR2*) manifest with at least 10 distinct skeletal birth defects. Loss of function mutations in *FGFR2* causes Lacrimoauriculodentodigtal (LADD) Syndrome, which is characterized by a posterior shortening of the jaw; retro-micrognathia. **Purpose:** We hypothesized that the posterior jaw shortening in LADD indicates a role for FGFR2 in the development of the jaw processes. **Methods:** To test this hypothesis, we employed a conditional knockout mouse in which *Fgfr2* is ablated within the neural crest-derived skeletal precursors of the jaw. **Results:** We found that *Fgfr2$^{flx/flx}$; Wnt1-Cre* mice have jaw deficiencies at sites of joint interfaces on the condyle, angular process and ramus at the tendon/ligament-to-bone attachment units. Histological and molecular markers indicate that at these regions, endochondral-like bone has replaced the developing enthesis. The enthesis has been shown to differentiate into chondrocytes, tenocytes or ligamentocytes. Lineage tracing analysis in addition to a tendon specific knockout of *Fgfr2* suggest that the change in cell fate is autonomous to the enthesis progenitor cells and not caused by the ablation of *Fgfr2* in the underlying bone. **Conclusion:** Altogether, this suggests a role for Fgfr2 in cell fate determination of the enthesis progenitor cells in the jaw.

Poster #: 72
Title: Nuclear Fibroblast Growth Factor signaling in skeletal development
Name: Joanna Salva
Faculty Advisor: Amy Merrill

Background: Fibroblast Growth Factor (FGF) signaling plays crucial roles in osteochondral progenitor cell proliferation and differentiation as seen in the multiple skeletal dysplasias resulting from abnormal FGF signaling. **Purpose:** We published that the dominant *FGFR2* mutations in Bent Bone Dysplasia Syndrome (BBDS) enhance a normal, noncanonical, nuclear role for FGF signaling in osteochondroprogenitor cells. BBDS is characterized by an under-mineralized calvarium, craniosynostosis, hypoplastic clavicles, scapula and pubis as well as bent long bones. Nevertheless, the role nuclear FGFR2 signaling plays *in vivo* during skeletal development remains unclear. **Methods:** To uncover the influence of nuclear FGFR2 on skeletal development, we expressed the unique BBDS mutations in *FGFR2* to alter the localization of the receptor in embryonic chicken limb skeletogenic mesenchyme through viral induction. **Results:** We found that chicks expressing the BBDS mutations presented with phenotypes similar to BBDS patients, including bent long bones and irregularities in the pelvic girdle. Further analysis revealed changes in joint articular surfaces and attachment sites for tendons and ligaments. **Conclusion:** This data suggests that nuclear FGFR2 signaling regulates the development of joints and attachment sites in the long bones and provides a potential explanation for the angulated long bones seen in BBDS.

Poster #: 73
Title: CHARGE syndrome a CHD7 dependent nuclear reorganisation defect
Name: Kaivalya Shevade
Faculty Advisor: Ruchi Bajpai

Background: CHARGE syndrome is a autosomal dominant genetic disorder typically caused by mutations in *Chromodomain Helicase DNA binding protein 7* (*CHD7*). CHD7 is a chromatin remodeler important for formation and migration of neural crest cells from neural ectoderm of a developing embryo. Neural crest cells, ectodermal in origin, migrate and give rise to neurons and glia as well as mesechymal cells which constitute facial bones, cardiac septal muscles and cartilage. Since patients with CHARGE syndrome have malformations in all of these neural crest derived mesenchymal tissues it has been classified as a neurocristopathy. Here we describe a mechanism of neural crest mesenchymal transition, which we call nuclear reorganisation. We elucidate the importance of CHD7 for this nuclear reorganisation. We further describe that lack of nuclear reorganisation results in inability of neural crest to make mesenchymal tissues causing CHARGE. **Purpose:** We wanted to test whether the nuclear reorganisation is essential for mesenchymal transition of neural crest cells. Whether CHD7, a chromatin remodeller required for neural crest formation was also necessary for the nuclear reorganisation. **Methods:** We generate human neural crest cells *in vitro* from human embryonic stem cells using the protocol described in (Bajpai et. al. 2010). Later we induce mesenchymal transition in these neural crest cells by using mesencult, a mesenchymal stem cell media (STEMCELL technologies). We characterize the induced cells using RNAseq to reveal their identities. To check CHD7's role in this nuclear reorganisation we generated a shRNA CHD7 knockdown (KD) embryonic stem cell line and differentiated them to make neural crest cells. These neural crest were similarly induced to check their ability to make mesenchyme. **Results:** Upon mesenchymal induction we observe a expansion and contraction of neural crest nuclei (nuclear reorganisation). This is the first report describing nuclear reorganisation associated with mesenchymal transition. CHD7 KD blocks reorgnanization and the associated mesenchymal transition, suggesting the necessicity of the nuclear reorganisation for mesenchymal transition. **Conclusion:** A lack of nuclear reorganisation underlies the mesenchymal defects in CHARGE patients.



Poster #: 74
Title: No post restoration of nonvital incisors without ferrule
Name: Luciana Soares
Faculty Advisor: Pascal Magne

Background: A new simplified approach for restoring endodontically-treated incisors (ETI) without ferrule is to rely only on adhesive retention and avoid the use of posts. **Purpose:** The aim of this study is to investigate the adhesive restoration of ETI without ferrule using two type of endocrowns or ceramic crowns bonded to 3 types of resin core buildups. A ferrule group was included for comparison. **Methods:** Ninety decoronated bovine ETI were divided in 6 groups: Group 1 as a control with ferrule and Miris2 nanohybrid composite resin buildup and IPS e.max ceramic crown; Group 2 similar to Group 1 but without ferrule. Group 3 and Group 4 similar to Group 2 but with Tetric EvoCe-

ram BulkFill resin buildup (Group 3) and EverX fiber-reinforced resin buildup (Group 4), respectively. Group 5 and Group 6 with endocrowns made of E.max or Lava Ultimate nanofilled composite resin, respectively. All specimens were subjected to accelerated fatigue testing (cyclic loading applied to the incisal edge starting at loads of 100N ramping to a maximum of 1,000N and 140,000 cycles). Groups were compared using the Kaplan-Meier survival analysis (Logrank test at P=.05 pairwise post hoc comparisons). **Results:** Failure started as a gap/crack at the lingual margin between the build-up/crown assembly and the root. Group 1 showed highest survival, followed by the endocrowns and then crowns with EverX. Crowns with Miris2 and BulkFill had the lowest survival. **Conclusion:** The survival of nonvital incisors was mainly improved by the presence of the ferrule. Endocrowns provided the best results in the absence of ferrule when restoring nonvital incisors.

Poster #: 75
Title: Opposing function of *chd7* and *phf6* in zebrafish craniofacial development
Name: Yuhan Sun
Faculty Advisor: Ruchi Bajpai

Background: Our lab has identified a physical interaction between two human proteins CHD7, a chromatin remodeling protein and PHF6, a dual PHD finger protein of unknown function. Mutations in these genes result in distinct syndromes in humans with contrasting craniofacial defects. Patients with CHARGE syndrome, with CHD7 mutations have a dysmorphic faces with reduced neural crest derived structural and sensory tissues. On the other hand, patients of Borjeson Forssman Lehmann syndrome (BFLS), caused by *Plant Homeodomain Finger Protein 6* (*PHF6*) mutation, have a thick calvarium and broad jaw. **Purpose:** Using Zebrafish as a model system, in this project, we generate novel tools for understanding BFLS and CHARGE syndromes and define the function of *chd7* and *phf6* in craniofacial development. **Methods:** Clustered regularly interspaced short palindromic repeats (CRISPR) /CRISPR-associated (Cas) system is used to knockout these two gene in zebrafish embryos. PCR is be used to identify the mutants. We also observe effect of mutation or knockdown on activation of *sox10, RARG, CCND1* enhancers under the confocal microscope. In-situ will be done in future to check the expression of some markers of NCC's and craniofacial tissue. **Results:** *Chd7* mutant fish have phenotypes like developmental delay, less facial tissue, small head, small eyes and a defect on the craniofacial cartilage tissue. While *phf6* mutants have significantly smaller or often no brain with normal face. **Conclusion:** *Chd7* and *phf6* have an opposing function of craniofacial development zebrafish. The mutants of them cause similar phenotypes with patients, respectively.
Poster #: 76
Title: The plasma membrane ATPases (PMCAs) in amelogenesis
Name: Sarah Tuggy
Faculty Advisor: Michael Paine

Background: Dental enamel is primarily composed of hydroxyapatite crystals. Calcium is a major component of hydroxyapatite, and therefore proper enamel formation, or amelogenesis, depends on effective calcium transport. The two stages of amelogenesis, secretory and maturation, have vastly different ameloblast cell functions. **Purpose:** Our purpose is to understand the mechanism of calcium transport during the secretory stage of amelogenesis with a focus on the PMCA (Atp2b) transporters *in vivo* and *in vitro*. **Methods:** Previous data has shown that *Atp2b* mRNAs are expressed more highly in the secretory stage than the maturation stage in rat enamel organ. *In vivo*, we used real-time PCR and Western blot to determine the gene and protein expression, respectively, in the mouse enamel organ. Immunohistochemistry (IHC) was performed to determine the spatio-temporal localization of the PMCA transporters. In vitro, we compared the expression of the *Atp2b* genes in ALC and LS8 cells using real-time PCR analysis. **Results:** The ALC and LS8 cells express *Atp2b1* and *Atp2b3* to similar levels, but ALC expresses *Atp2b4* at a significantly higher level than LS8. IHC data confirms the presence of the PMCAs, but little difference in protein expression between secretion and maturation is observed. PMCA4 expression is observed in the maturation stage papillary layer. **Conclusion:** PMCAs are more highly expressed during secretion, but may have a role in mineralization. We will determine the effect of *Atp2b1* and *Atp2b4* knockout on mouse enamel formation.

BIOKINESIOLOGY AND PHYSICAL THERAPY STUDENTS

Poster #: 77
Title: Distinct muscle representation and functional connectivity in motor cortical areas
Name: Alaa Albishi
Faculty Advisor: Beth Fisher

Background: Postural control studies suggest that primary motor area (M1) is responsible for movement execution while supplementary motor area (SMA) plays a role in postural preparation. These areas have direct projections to the spinal cord, thus motor evoked potentials (MEPs) can be elicited from either area using transcranial magnetic stimulation (TMS). While TMS identifies muscle representation in motor cortex, resting-state functional magnetic resonance imaging (rs-fMRI) can identify muscle-specific neural circuitries. We compared whole-brain functional connectivity (FC) of SMA and M1 representational areas of external oblique (EO), to gain insight into the differential function of SMA and M1 of this postural muscle. **Purpose:** Determine the location of EO cortical representation and explore resting state (rs) FC in SMA and M1 among healthy adults. **Methods:** 13 adults participated. TMS mapping of M1 and SMA was conducted. MEP amplitudes for EO determined the Center of Gravity (CoG) in both M1 and SMA. The MNI coordinates of EO CoG in SMA and M1 were used to explore FC of these areas utilizing rs-fMRI. **Results:** MEPs were elicited consistently in M1 and SMA. MNI coordinates for EO CoG were determined for M1 and SMA. FC analysis demonstrates that anterior cingulate, basal ganglia and cerebellum are more connected to SMA; Prefrontal, precuneus, and parietal cortex are more connected to M1. **Conclusion:** While EO is represented in both SMA and M1, these representations are not functionally equivalent in their interaction with the rest of the brain. Therefore, SMA and M1 may play distinct roles in the control of this postural muscle.

Poster #: 78
Title: Is task similarity reflected in modified Reaching Performance Scale scores?
Name: Helen Bacon
Faculty Advisor: Carolee Winstein

Background: Movement after stroke is often characterised by the use of compensatory movement patterns rather than restoration of pre-stroke motor control. Factors such as task difficulty will likely affect the movement strategy chosen. The modified Reaching Performance Scale (mRPS) has been developed for two arm movement items ("lift can" and "hand to box") of the Wolf Motor Function Test (WMFT) to quantify movement quality, and thus could be used to compare strategies across different tasks and over time within task. **Purpose:** To first expand the mRPS to two additional WMFT items, the "lift pencil" and "lift paperclip" tasks. Secondly, to test the hypothesis that if tasks share a similar underlying structure, individuals with motor stroke and primarily moderate impairment will use similar movement performance strategies, compared to the strategies used to perform tasks that do not share a common structure. **Methods:** The mRPS tool was first checked against sample videos of individuals performing the additional WMFT tasks to ensure the scoring criteria and directions were appropriate for these new tasks. The tool was then applied to videos of 33 individuals with stroke from the ICARE trial (ClinicalTrials.gov ID: NCT00871715). **Results:** After testing the tool for feasibility, additional notes were added to the scoring directions for clarity but no changes to the scoring criteria were made. Preliminary data analysis suggests that mRPS scores can reflect similarities and differences in performance that are consistent with tasks sharing a common structure. **Conclusion:** Movement quality scores from the mRPS may be used as a measure to quantify task similarity.

Poster #: 79
Title: Cancer survivors' educational needs regarding exercise, physical therapy and fatigue
Name: Marie Calvet
Faculty Advisor: Jessica Curran

Background: Cancer treatments can have adverse effects on patients' physical and cognitive function. Physical therapy (PT) can mitigate the negative side effects of cancer treatment to promote recovery of

physical function. However, patients and their families may not have the information needed to feel empowered to advocate for PT during and after cancer treatment. **Purpose:** 1) Identify the knowledge gaps in current educational materials that limit patients' awareness of PT; 2) identify prevalence of cancer-related fatigue; 3) develop a larger survey to quantify the occurrence of themes identified in this pilot survey. We hypothesized respondents would report lack of awareness of side effects, including fatigue, limited their awareness of the need for PT. **Methods:** An online survey was distributed to cancer survivors belonging to three cancer support groups. Demographic data and prevalence of fatigue were obtained. Open-ended questions were asked regarding the survivors' perceptions and fears during treatment, and what advice they have for newly diagnosed patients. **Results:** 18 surveys were collected. 61% reported receiving PT for cancer-related impairments, and 100% of those reported positive PT outcomes. Of the 11 respondents who reported cancer-related fatigue, 36% stated exercise helped with fatigue management. Over 50% reported wishing they were more informed about the severity and duration of cancer-related side effects prior to treatment. **Conclusion:** Our study indicates a need for more patient educational materials on the severity and duration of cancer-related side effects. Future studies to quantify the prevalence of fatigue and perceptions of exercise and PT among cancer survivors throughout treatment stages are needed.

Poster #: 80
Title: Does vertical GRF asymmetry reflect knee loading asymmetry following ACLr?
Name: Ming-Sheng Chan
Faculty Advisor: Susan Sigward

Background: Vertical ground reaction forces (vGRF) asymmetry has been used to characterize a shift in demands to the non-surgical limb in bilateral tasks in individuals following ACLr. However, given the potential for inter- and intra-limb compensations it is possible that vGRF asymmetry does not accurately reflect knee extensor moment (kEXT) asymmetry. **Purpose:** To determine association between vGRF symmetry and kEXT symmetry during a squat in individuals following ACLr at 3 and 5 months. **Methods:** 11 subjects performed bilateral squats 3 and 5 months post-surgery. 3D kinematics, GRF, anthropometrics were used to calculate kEXT moments (inverse dynamics). Symmetry indices (SI) were calculated (surgical/ non-surgical limb) for peak vGRFs and kEXT during deceleration. Separate linear regression analyses were used to determine how well vRGF symmetry (SI_{vGRF}) predicts knee extensor moment symmetry (SI_{kext}) at 3 and 5 months. **Results:** On average, SI_{vGRF} and SI_{kext} were .86 ± .11 and .63 ± .18 at 3 months, respectively. At 3 months, SIvGRF predicted SI_{kext} (r^2=.62, p=.004). On average, SI_{vGRF} and SI_{kext} were were .89 ± .070 and .70 ± .12 at 5 months, respectively. At 5 months, SI_{vGRF} did not predict SI_{kext} (p=.28). **Conclusion:** The larger asymmetries noted in kEXT versus vGRF indicates that SI_{vGRF} underestimates SI_{kext}. SI_{vGRF} explained 62.4% of the variance in SI_{kext} at 3 months suggesting that the reduction in knee loading is accomplished largely by inter-limb compensations. However, by 5 months post ACLr, reductions kEXT appear to be accomplished through intra-limb compensation. Thus, caution should be taken when relating vGRF symmetry to knee loading during bilateral task.

Poster #: 81
Title: Improving cancer survivor wellness through community-based exercise classes
Name: Paul Chang
Faculty Advisor: Kimiko Yamada

Background: With an increasing life-expectancy and population of cancer survivors, there is a need to address the effects of oncological treatment interventions including decreased quality of life (QoL) and fatigue (Elliott 2011). Research supports the benefits of exercise in preventing cancer recurrence, enhancing treatment, and increasing mobility among survivors (Coumeya, 2003). The Adelante program was designed to promote wellness by introducing a 1-hour weekly, free, community-based exercise class for cancer survivors. **Purpose:** The present study aims to (1) investigate the efficacy of the Adelante cancer survivor exercise program and (2) determine if cancer survivors who brought a supporting partner had better outcomes. **Methods:** Data was collected using the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F) given at intake and approximately every 3 months. This questionnaire consists of subscales measuring physical, social, emotional, and functional well-being, and fatigue and a total score. Comparisons were made between the FACIT-F subscale and total scores for participants with (n=5) and without (n=9) participating partners within a 3 month period using linear regression analysis. **Results:** No significant change in the FACIT-F was found to support the efficacy of the exercise class among all participants with or without a partner. **Conclusion:** The data in this study does not support improvement in QoL and fatigue through the Adelante cancer survivor exercise program. However, no participants reported a decrease in scores. The benefit of having a partner may be greater consistency with exercise over a longer time period, therefore future analysis will include a longer time frame to capture these benefits.

Poster #: 82
Title: Relationships between patient perceptions, physical, and activity measures after stroke
Name: Siwaphorn Chanthaphun
Faculty Advisor: Carolee Winstein

Background: Patients' perceptions of physical impairments after stroke have received scant attention yet may affect activity and participation decisions and quality of life. **Purpose:** To investigate the relationship between patient perceptions and objective assessments of physical impairment and functional performance in the months following stroke. **Methods:** Individuals with mild stroke and moderate upper extremity impairment enrolled in the multi-site Phase 3 RCT (N = 361), Interdisciplinary Comprehensive Arm Rehabilitation Evaluation (ICARE) initiative (Winstein et al., 2013) completed standardized assessments of physical impairment and functional performance, as well as the Stroke Impact Scale 3.0 (SIS), a patient-reported measure, following outpatient therapy (16 weeks post-stroke) and 12 months after randomization (13.5 months post-stroke). SIS subscales (Hand, Strength, and Activities of Daily Living) were correlated with measures of maximum arm muscle torque, grip strength, digit sensation, Fugl Meyer Assessment of the Upper Extremity (FMA-UE) and the Wolf Motor Function Test (WMFT) time. **Results:** Significant (ps < .0001) mild to moderate Spearman's rho correlations were found between patient perceptions and physical impairment and activity measures across both time points: maximum arm muscle torque (rho = .224 - .460), grip strength (rho = .291 - .513), FMA-UE, (rho = . 450 - .653), and WMFT time (rho = -. 361 - -.635). Digit sensation was unrelated to other measures. **Conclusion:** Patient perceptions of impairments and activity limitations were consistent with objective assessments of these capacities after stroke. Three domains of the patient-reported SIS can provide insight into objective measures of limitations in patients' upper extremity movement and activity.

Poster #: 83
Title: Early leg movement patterns as an indicator of neuromotor development **Name:** Weiyang Deng
Faculty Advisor: Beth Smith

Background: Early diagnosis of many developmental disorders is still unavailable. Researchers have demonstrated that at-risk infants demonstrate altered kicking characteristics, but the relationship to developmental outcomes is unclear. **Purpose:** To determine whether the patterns of supine spontaneous leg movements produced from birth to sitting onset differ in infants with typical development (TD) and infants at risk (AR) for developmental delay. **Methods:** We included 24 videos from 18 infants (TD=14, AR=10) with scores of less than 8 (can be left alone in sitting) on the Alberta Infant Motor Scale. We identified 12 codes for different leg movements (Single Flexion, Single Extension, Alternative Flexion, Alternative Extension, Parallel Flexion, Parallel Extension, Leg Wave, Leg Circle, Leg Thump, Rub, Foot Flex, Foot Rotation). **Results:** The most common movement type produced by infants was Leg Wave (TD=19.3%, AR=23.3%). Notable differences between the groups included: The proportion of single movements, namely Single Flexion and Single Extension, (TD=30.5%, AR=19.4%). The alternative movements, namely Alternative Flexion and Alternative Extension

(TD=32.6% %, AR=21.4%). Foot Flexion constitutes 9.4% in TD group and 3.7% in AR group. **Conclusion:** Results showed different early leg movement patterns between AR and TD groups. Future research will focus on the relationship between the observed movement patterns and developmental outcomes of the infants.

Poster #: 84
Title: Can golf be therapeutic hip exercise?
Name: Andrea Du Bois
Faculty Advisor: George Salem

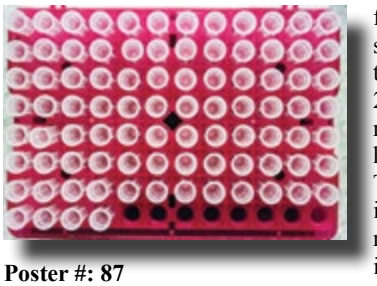
Background: Older adults demonstrate reductions in mediolateral (ML) postural control and frontal plane hip skeletal muscle performance. Older adults with superior hip abductor muscle performance have greater ML postural control. Physical activity targeting frontal plane hip musculature is likely to improve hip abductor muscle performance and ML postural control. The golf swing is initiated through near maximal activation of the proximal hip musculature and could serve as a training stimulus. **Purpose:** Investigate the frontal plane hip demands of the golf swing as compared to commonly used therapeutic hip exercises. **Methods:** Seven young, male recreational golfers completed 7 iron golf swings and therapeutic hip abductor exercises (HIPEX) including squat, quadruped hip extension, unilateral bridge, and bilateral bridge. A lower extremity marker set tracked body segments and force platforms measured ground reaction forces. Repeated Measures ANOVA assessed differences ($p<0.05$) between peak hip abductor moments (PKABD) and hip abductor impulses (IMP) for the swing lead (LEAD) and trail (TRAIL) limbs and dominant limb HIPEX. **Results:** TRAIL PKABD and IMP were significantly greater than HIPEX (except squat IMP). LEAD PKABD was only significantly greater than unilateral bridge. There were no significant differences between LEAD IMP and HIPEX. **Conclusion:** The hip abductor demands during the golf swing were 5 - 55 times greater than the demands during hip therapeutic exercises. While not all differences were significant, large effect sizes suggest with additional participants significant differences would be found. Thus, we believe the golf swing is a plausible activity to improve hip abductor muscle performance and consequently ML postural control.

Poster #: 85
Title: Can thigh and shank accelerations detect deficits after ACL reconstruction?
Name: Sarah Ebner
Faculty Advisor: Susan Sigward

Background: Sagittal plane knee loading deficits are seen after anterior cruciate ligament reconstruction (ACLr) during running and accelerometers are used to characterize running. **Purpose:** To determine if thigh and shank axial accelerations from accelerometers are related to between-limb differences (bLD) in peak knee power absorption (kPW) during running in subjects following ACLr. **Methods:** 14 individuals (7 females, 29±12 yrs) post-ACLr (20.3±7.1 wks) ran 15-meters. 3-D kinematics (340 Hz) and ground reaction forces (1360 Hz) were used to calculate sagittal plane kPW. Peak positive axial accelerations from accelerometers (128 Hz) affixed to lateral thighs (TAA) and shanks (SAA) were identified. bLD (nonsurgical-surgical) were calculated. Pearson correlations were used to determine relationships between kPW and SAA and TAA. Stepwise regression was used to determine best predictors of bLD in kPW using bLD in TAA and SAA. **Results:** TAA and SAA were positively correlated with kPW; greater kPW related to greater TAA and SAA ($r=0.74$, $p=0.001$; $r=0.45$, $p=0.017$, respectively). bLD in TAA was positively correlated with bLD in kPW ($r=0.65$, $p=0.013$) and was only variable to enter prediction model, explaining 42% of variance in kPW ($R^2=0.42$, $p=0.006$). Less kPW was related to smaller TAA in surgical when compared to non-surgical limb. **Conclusion:** The relationship between kPW and SAA and TAA suggest that they provide information about magnitude or rate of knee loading during running. bLD in TAA predicted bLD in kPW but only explained 42% of the variance in kPW suggesting it may not be sensitive enough to identify individuals with knee loading deficits during running following surgery.

Poster #: 86
Title: Between-limb differences identified by variability structure in Achilles tendinopathy
Name: Abbigail Fietzer
Faculty Advisor: Kornelia Kulig

Background: Decreased kinematic variability has been associated with overuse/recurrent injury. Prior studies only examined standard deviation magnitudes rather than the structure of variability. **Purpose:** Case study to explore if the joint-level structure of kinematic variability in the involved (IL) and uninvolved (UL) limbs differ in a subject with unilateral Achilles tendinopathy (uAT). **Methods:** 1 uAT subject (34y/o) performed unipedal hopping at 2Hz for 3D motion capture. Stance phase was divided into propulsive and absorptive sub-phases, each split into 25% time-bins. Uncontrolled manifold analysis (UCM) quantified variance structure in the space of kinematic variables (sagittal plane foot-to-floor, ankle & knee intersegmental angles) with respect to performance (vertical limb length) stabilization. Task-irrelevant (VUCM) & task-relevant (VORT) variance, and the normalized difference between them (IMA) are reported. V_{UCM}, V_{ORT} and IMA were compared across stance with paired t-tests. Averaged joint angles were compared at each time-point with paired t-tests. **Results:** V_{UCM}-UL exceeded V_{UCM}-IL ($p = 0.02$). V_{ORT}-UL did not differ from V_{ORT}-IL ($p = 0.17$). IMA-UL exceeded IMA-IL ($p= 0.002$). There were no differences in averaged joint angles between limbs at any time-point of stance ($0.07\leq p\leq 0.98$ ankle, $0.08\leq p\leq 0.89$ knee, $0.36\leq p\leq 0.78$ hip). **Conclusion:** UCM detected between-limb differences in a uAT subject missed by typical kinematic measures. Greater exploitation of joint-level variance irrelevant to performance indicates adaptive stabilization of vertical limb length across hopping trials in the UL. This promising analysis provides a window into the motor control strategies of individuals, and possible insights into why some develop tendinopathies while others do not.



Poster #: 87
Title: Survey of shoulder pain in competitive swimmers
Name: Jenna Hankard
Faculty Advisor: Jonathan Sum

Background: Swimmers have a relatively high incidence of shoulder pain, but there is currently little evidence correlating onset of shoulder pain with swimming training yardage or with age in youth competitive swimmers. **Purpose:** (1) Determine the prevalence of shoulder pain and swimming-related disability among youth competitive swimmers (2) Determine if a history of prior shoulder injury and/or subjective reports of instability relate to current pain (3) Determine if average weekly yardage and/or peak weekly yardage relate to pain/disability **Methods:** A survey of shoulder pain and swimming-related disability was given to competitive swimmers ages 9-17 years old. A survey of average and peak weekly yardage and hours trained for each age group was given to their coaches. **Results:** 190 swimmers from a competitive swim team reported on their levels of shoulder pain and disability. 4-24% reported pain at rest, 12-27% reported pain with ADLs, 27-54% reported pain with sport, and 11-15+ year olds reported 40-51% swimming-related disability. T-test analysis revealed a statistically significant difference for number of hours practiced/week ($p=.006$). No associations were found between specific age groups or between yardage swum and pain/disability. **Conclusion:** There is a high prevalence of shoulder pain/disability reported among youth competitive swimmers. This is in stark contrast to coaches' perceptions of prevalence. All of the coaches reported that additional coaching education on optimal exercises and training would reduce injury.

Poster #: 88
Title: Feasibility of a fMRI within subject fesign for attentional focus
Name: Andrew Hooyman
Faculty Advisor: Carolee Winstein

Background: Relative to an internal focus, an external attentional focus on movement effects has consistently been shown to benefit motor performance and learning (Wulf, 2013). Research to uncover the neural substrates that mediate this behavioral effect is limited. **Purpose:** This study aimed to assess feasibility of a functional magnetic resonance imaging (fMRI) paradigm for identification of neural substrates engaged in these two attentional focus conditions. **Methods:** We chose a within-participant design, to minimize signal variability between practice conditions. We scanned two right-handed young adults (female;

mean age 24 +/- .57) while they performed a complex tracking task with the dominant right hand to control movement of a cursor. Participants completed 4 scan blocks of 10 24-second task trials, interleaved with 10 12-second visual cue presentations. The cue (an "I" (internal) or "E" (external)) served as non-movement, rest blocks and allowed performers to mentally switch between attentional strategies. Cue order was randomized to minimize anticipation. **Results:** We performed whole brain analysis and between-condition subtraction. All data were free of motion artifacts and any data that had head motion correlated with the task was excluded. A group (n = 2) analysis of E-I showed E > I activation in the left post central gyrus, contralateral to the moving hand. While I-E showed I > E activation in the left frontal pole. **Conclusion:** Overall, we conclude: 1) this motor behavior-brain imaging paradigm is feasible for examining the neural substrates of attentional focus, and 2) it can be reliably implemented in a larger fully powered study.

Poster #: 89
Title: Anti-gravity treadmill training during early rehabilitation of uni-compartmental knee arthroplasty
Name: Chun-Hao Huang
Faculty Advisor: Christopher Powers

Background: The patients with uni-compartmental knee arthroplasty (UKA) have been reported to demonstrate gait impairments up to 19-25 months post-surgery. The most common gait impairment in patients who have undergone knee athroplasty is inadequate knee flexion and a corresponding decrease in the knee extensor moment during loading response (ie. quadriceps avoidance). **Purpose:** To determine whether the use of an anti-gravity treadmill can assist in the restoration of knee kinematics and kinetics during the acute rehabilitation phase following UKA. **Methods:** Four females who had undergone UKA were recruited. Participants completed anti-gravity treadmill training 3 times per week for 12 weeks in addition to their standard physical therapy program. Instrumented gait analysis was performed at baseline (3 weeks post-surgery) and at 12 weeks post-surgery. **Results:** The peak knee flexion angle and knee extensor moment during weight acceptance increased from 14.1 ± 6.48° to 20.6 ± 1.51° and 0.42 ± 0.31 to 0.74 ± 0.15 Nm/kg respectively following the intervention period. The post-intervention values were similar to published normative data for healthy adults. **Conclusion:** Anti-gravity treadmill training was effective in eliminating "quadriceps avoidance" during the early rehabilitation phase following UKA. The incorporation of anti-gravity treadmill training should be considered when designing a rehabilitation program for patients who have undergone knee arthroplasty.

Poster #: 90
Title: Difference in arm choice in right and left hemiparesis
Name: Sujin Kim
Faculty Advisor: Nicolas Schweighofer

Background: Patients with Left hemiparesis (LH) use their ipsilesional arm (right) more than patients with Right hemiparesis (RH) use their ipsilesional arm (left). Specific mechanisms of arm choice between RH and LH are not well known. **Purpose:** Here, we hypothesize that effort, probability of success, and movement duration explain arm choice in post-stroke. **Methods:** Twelve individuals with chronic right hemiparesis (RH), eleven individuals with left hemiparesis (LH), and seven age-matched non-disabled participants (Cont) were recruited. All participants were right-handed and performed the Bilateral Arm Reaching Test (BART; Han, Kim, et al. 2014). Arm choices and trajectory kinematic data (e.g., movement duration, effort, and success) were measured. We developed the arm choice models using mixed effect logistic regression with random intercepts and slopes to explain right arm choice (dependent variable). Kinematic data were predictors in the models and a Log Likelihood ratio test and BIC were used to compare models and to find the best fitted model. **Results:** For all RH, LH, and Cont groups, effort was the strong predictor of right arm choice. Success, however, selectively influenced arm choice in specific groups. While the effect of success on right arm use in RH and Cont groups was less pronounced, it was significant in the LH group. **Conclusion:** Our findings demonstrate that arm choice originates from different mechanisms: for the RH group effort is significant whereas for the LH group it is effort and success. Out results also suggest that rehabilitation to encourage use of the affected arm should be different depending on the affected side of the arm. Future studies need to examine changes in arm choice in response to therapy.

Poster #: 91
Title: Quantifying ipsilateral silent period in electromyography to measure interhemispheric inhibition
Name: Yi-Ling Kuo
Faculty Advisor: Beth Fisher

Background: The ipsilateral silent period (ISP), measured by transcranial magnetic stimulation (TMS), is considered an index of interhemispheric inhibition (IHI) during active movements. ISP is characterized as a brief disruption in EMG activity following TMS applied to the primary motor cortex during ipsilateral volitional movements. ISP can be measured by either duration or amplitude of EMG reduction to reflect the amount of IHI. However, it has not been shown which method can better quantify ISP consistently. **Purpose:** To compare different ISP quantification methods to accurately assess IHI. **Methods:** Twenty-five individuals exerted 50% maximum isometric right thumb abduction. A TMS pulse was applied to the right representational area of the abductor pollicis brevis. ISP onset and offset were determined as the periods when the processed EMG activity crossed a pre-defined threshold. Three different measurements of ISP were compared. One method quantified ISP duration in milliseconds as the time difference between onset and offset; and two methods quantified ISP amplitude: i) ISP area: area between the threshold and the depth of EMG reduction, and ii) ISP inhibition: area under the reduced EMG activity, normalized to pre-stimulus EMG area. Measurement consistency was determined by the homogeneity of variance test and by the coefficient of variation (CV). **Results:** Homogeneity of variance showed significantly different variance across three quantification methods ($p<0.01$). ISP inhibition resulted in the least measurement variability (CV = 44.45%, 83.17%, 23.18% in ISP duration, ISP area, ISP inhibition, respectively). **Conclusion:** The ISP inhibition, which generates less variability, is a better method to quantify ISP to indicate IHI.

Poster #: 92
Title: Effects of exercise on hypertension in breast cancer survivors
Name: Kyuwan Lee
Faculty Advisor: Christina Dieli-Conwright

Background: Despite improvements in survival rate, breast cancer survivors (BCS) are at elevated risk for hypertension (HTN), possibly due to pre-existing obesity-related conditions. HTN is a major risk factor for stroke and congestive heart failure. **Purpose:** The purpose of this study was to examine the effects of a 16-week aerobic and resistance exercise intervention on blood pressure (BP) in BCS with HTN. **Methods:** Twenty-six BCS with HTN were randomized to the Control (CON; n=13) or the Exercise (EX; n=13) group. The EX group underwent supervised aerobic and resistance exercise sessions 3 times a week for 16 weeks. The CON was asked to maintain their current level of activity. Resting systolic and diastolic BP were assessed before and after the 16-week study period. Paired t-test and repeated measures ANOVA were used to examine the effects of exercise training on BP. **Results:** The EX and CON did not differ by age (52.5 ± 8.2yr), body mass index (29.6 ± 5.4kg/m^2), systolic (135.9 ± 8.2 mmHg) and diastolic BP (89.9 ± 4.6) at baseline. Following 16 weeks, systolic and diastolic BP were significantly reduced (6% and 11%, respectively) in the EX group (P=0.01) when compared to the CON group. There was a significant time (pre vs post) by group (EX and CON) interaction for systolic and diastolic BP (P=0.04 and 0.01, respectively) in BCS with HTN. **Conclusion:** A 16-week combined exercise training intervention is effective to reduce BP in BCS with HTN, thus exercise is important during cancer survivorship to reduce the risk for cardiovascular disease.

Poster #: 93
Title: Heel acceleration: a predictor of falls during slip perturbations
Name: Jonathan Lee
Faculty Advisor: Christopher Powers

Background: Slips and trips account for ~60% of hip fracture causes in adults over the age of 65. Previous research has suggested that a fall may be imminent as soon as 160 ms after heel contact on a slippery surface, suggesting that heel acceleration may be a potential predictor of falls. **Purpose:** To investigate the influence of heel acceleration during slip initiation on fall outcomes. **Methods:** 4 healthy young adults participated. To quantify heel acceleration a Qualisys motion capture system (11 cameras) tracked a single reflective marker attached to the heel of the shoe. For protective purposes, participants wore a full-body safety harness that was attached to a ceiling-mounted track. Participants then walked across a slippery surface, which induced a slip event. The slip perturbation outcome (fall or recovery) was determined through visual inspection of the harnesses tension during the slip perturbation. **Results:** Individuals with heel accelerations greater than 25 m/s^2 60 ms following heel contact experienced falls (N=2), while individuals with heel accelerations less than 12 m/s^2 recovered (N=2). **Conclusion:** Heel acceleration during early stance may be an indicator of fall outcome during a slip event As such, an individual's natural heel acceleration during terminal swing may be useful for determining one's risk of falling following a slip perturbation. Future studies will be directed towards determining the cause(s) of elevated heel accelerations during terminal swing.

Poster #: 94
Title: Self-reported fatigue and physical function outcomes in prostate cancer survivors
Name: Brian Lee
Faculty Advisor: Todd Schroeder

Background: Androgen deprivation therapy (ADT) is a prevalent treatment for prostate cancer that results in reduced testosterone levels. Although ADT improves survival, prostate cancer survivors (PCS) on ADT experience increased fatigue, which has been correlated to reductions in physical function in patients with advanced stage cancer. As fatigue is a chief complaint in PCS on ADT, an understanding of the association of self-reported fatigue and physical function may be useful in a clinical setting. **Purpose:** To investigate whether self-reported fatigue is associated with physical function outcomes in PCS on ADT. **Methods:** Fourteen PCS receiving ADT were recruited from the greater Los Angeles area as part of an ongoing exercise study. Physical function was assessed using the Timed Up and Go (TUG) and 400-meter walk test (MWT). Fatigue was measured using the self-reported Brief Fatigue Inventory (BFI). Pearson correlations were used to test the association between the TUG, 400-MWT, and BFI. **Results:** No significant correlations were found between the TUG, 400-MWT, and BFI score ($p>0.05$). **Conclusion:** Self-reported fatigue is not associated with physical function outcomes in a limited sample of PCS on ADT. This finding differs from prior investigations, perhaps as a result of small sample size and different functional outcomes. Future research is warranted to determine clinical measures that are most sensitive to capturing fatigue in PCS. This may lead to more accurate clinical assessments and targeted interventions in this population.

Poster #: 95
Title: Longitudinal knee loading deficits in running in individuals post-ACL reconstruction
Name: Paige Lin
Faculty Advisor: Susan Sigward

Background: Running is initiated as early as three months post-anterior cruciate ligament reconstruction (ACLr). Early progression to running is encouraged as a mechanism for improving strength and function; as such, it is expected that knee loading deficits will improve over time following initiation of running. However, sagittal plane knee deficits can persist up to 3 years post-surgery. **Purpose:** To compare sagittal plane knee mechanics across the first three months of running post-ACLr. **Methods:** Seven individuals post-ACLr (2 males; 25±12.6 yrs) performed 3 running trials at self-selected pace during the month of running initiation (102±20.5 days), one and two months later (131±19.5; 163±25.2 days, respectively). 3D kinematics (250 Hz), ground reaction forces (1500 Hz) and anthropometrics were used along with inverse dynamics equations to calculate knee flexion excursion (kEXC), peak extensor moment (kEXT) and peak power absorption (kPOW) during deceleration in involved (INV) and uninvolved (UN) limbs. Differences in sagittal plane variables were analyzed using 3x2 (time x limb) repeated measures ANOVA; significance $\alpha\leq0.05$. **Results:** No main effects of time or significant interactions were observed. Main effects of limb were significant: kEXC ($p=0.042$; INV: 23.2±5.9; UN: 28.0±4.4 degrees) and kPOW ($p=0.045$; INV: -11.5±5.7; UN: -15.3±3.2 J/kg) with a trend toward significance in kEXT ($p=0.06$; INV: -1.87±0.60; UN: -2.45±0.26 Nm/kg). **Conclusion:** On average, knee loading deficits were present during running across time. The absence of an interaction or main effect of time suggests that deficits did not improve over 3 months following running initiation. In this sample, improvements in knee loading were limited within the first 3 months of running, suggesting that a greater focus on running mechanics during rehabilitation in some individuals may be warranted.

Poster #: 96
Title: Excessive hip adduction during running: a swing phase problem?
Name: Jia Liu
Faculty Advisor: Christopher Powers

Background: Excessive hip adduction during running is thought to contribute to various lower extremity injuries. Females have been reported to exhibit greater degrees of hip adduction during the stance phase of running compared to males. It is not clear if frontal plane hip motion prior to foot contact influences stance phase kinematics during running. **Purpose:** To compare sex differences in frontal plane hip kinematics during running and to determine if frontal plane hip kinematics during the late swing phase of running are predictive of peak stance phase kinematic values. **Methods:** Thirty five healthy recreational runners participated (18 healthy females, 17 healthy males). Hip joint kinematics during running (swing and stance phases) were collected using an 11-camera motion capture system at a sampling rate of 250 Hz. **Results:** Compared to the males, females demonstrated significant higher hip adduction angles at both initial contact ($p=0.02$) and the midstance phase of running ($p=0.01$). Hip adduction at initial contact was found to predict peak hip adduction during the stance phase of running($r=0.636$, $R^2=0.404$, $p<0.001$). **Conclusion:** Our results indicated that hip joint position at initial contact, which is a continuation of late swing, is predictive of peak stance phase kinematics. Future studies should consider potential causes of excessive hip adduction during the late swing phase of runner to better understand sex differences in stance phase hip kinematics.

Poster #: 97
Title: Lower extremity joint kinematics while picking up a golf ball
Name: Nicole Marcione
Faculty Advisor: George Salem

Background: Golf play includes intervals of walking, high velocity golf swings, and bending over to pick up a golf ball. Current research in our lab has examined the physical demands of picking up a golf ball. This report examines joint range-of-motion (ROM) while picking-up a golf ball, across several techniques. **Purpose:** To investigate the sagittal plane ankle, knee, and hip joint ROM in six healthy, young male golfers while they replaced golf ball with a ball marker. **Methods:** Participants completed 3 trials for each of the following strategies: lunge (LUNGE), squat (SQUAT), and bend at the waist (SUP) with a 7 iron; single leg with the 7 iron on the ipsilateral (SLIPS) and contralateral side (SLCON); and bend at the waist without the 7 iron (NOSUP). ROM of the ankle, knee, and hip were calculated and averaged across trials, and a Repeated Measures ANOVA assessed differences among strategies ($p\leq0.05$). **Results:** LUNGE had significantly greater ankle ROM than SQUAT, SLCON, and SUP. SQUAT had significantly greater ankle ROM than SUP. LUNGE had significantly greater knee ROM than SLIPS, SLCON, and SUP. SQUAT had significantly greater knee ROM than SLCON and SUP. NOSUP had significantly greater hip ROM than LUNGE and SLIPS. The SQUAT had the largest knee ROM. **Conclusion:** Those with knee injuries, knee pain, or knee osteoarthritis should avoid using a SQUAT strategy when picking up a golf ball. All strategies had large hip joint ROM; suggesting that flexibility of hip joint is important for picking up a golf ball.

Poster #: 98
Title: Change in motor cortical excitability with changes in postural threat
Name: Tulika Nandi
Faculty Advisor: George Salem

Background: There is growing evidence that the primary motor cortex (M1) plays an important role in maintaining balance and recent studies demonstrate that cortical excitability is modulated in response to the degree of postural threat or challenge. **Purpose:** The purpose of this study is to quantify the changes in motor cortical excitability in response to changes in postural threat (i.e. base of support, BOS). Two postural threat conditions will be compared– are standing with a wide BOS (feet shoulder width apart; Stand WB) and standing with a narrow BOS (feet together; Stand NB). **Methods:** 5 healthy adults (2 males; 27±1.73 years) were recruited for the pilot study. Fine wire electromyography (EMG) signals were recorded from the right Tibialis Anterior muscle (TA). Transcranial magnetic stimulation (TMS) was applied using a double cone coil connected to two Magstim 2002 units via a BiStim module. First, the TA hot spot in the primary motor cortex (M1) was located. This refers to the representational area within M1 in which a TMS pulse elicits the largest and most consistent response to stimulation. Short Interval Intra-Cortical Inhibition (SICI) was measured by applying a conditioning pulse at 80% MT followed by another pulse at 120% MT after 3ms. 10 single pulses at 120% MT (test MEP) and 10 paired pulses (conditioned MEP) were applied in random order. These measurements were repeated in both BOS conditions. MEP peak to peak amplitudes were computed and SICI was quantified using the formula: (100 – (conditioned MEP/ test MEP *100)), with a higher percentage indicating greater inhibition. **Results:** In 4 of the 5 participants, the test MEP amplitude was significantly higher in Stand NB compared to Stand WB. Also, in 4 of the 5 participants there was a trend for lower SICI in Stand NB compared to Stand WB. **Conclusion:** The pilot data shows a trend for higher corticospinal excitability (CSE; represented by MEP) and a decrease in cortical inhibitory activity (represented by SICI) when standing with a smaller BOS, despite similar background EMG levels. Mechanically, the vertical projection of the body's center of mass (COM) must remain within the BOS to maintain balance and prevent falling. Consequently, a smaller BOS represents a decreased margin of safety (i.e. a smaller mechanical perturbation would be required to lose balance than the wide base condition). The higher CSE may indicate an increase in the state of 'readiness to move' in the condition where it would be more difficult to maintain balance in response to perturbations. An increase in CSE could be due to changes in excitability at spinal or supra-spinal levels. Given that SICI is known to be a measure of intra-cortical processes, the concurrent decrease in SICI suggests that at least part of the change in CSE is mediated cortically. In general, these findings support the argument for involvement of the motor cortex in postural control.

Poster #: 99
Title: Anthropometric measurements and cardiorespiratory fitness in breast cancer survivors
Name: Breanna Orozco
Faculty Advisor: Christina Dieli-Conwright

Background: Cardiorespiratory fitness (CRF) refers to the ability of the circulatory and respiratory systems to supply oxygen to skeletal muscles during sustained exercise. Increased body fat mass reduces CRF, which is associated with an increased risk of cardiovascular disease (CVD) mortality. Consequently, breast cancer survivors may experience weight gain during the course of breast cancer treatments, exacerbating the risk of CVD. **Purpose:** The purpose of this study was to investigate whether anthropometric measurements were associated with cardiorespiratory fitness (CRF) in breast cancer survivors. **Methods:** Sixty-two sedentary women diagnosed with stage I-III breast cancer were included in this study. CRF was derived from the Single Stage Submaximal Treadmill Test to estimate maximal oxygen consumption (VO_2max). Body mass index (BMI), body fat (BF) %, fat-free mass (FFM) and lean mass (LM) were obtained from a whole body dual-energy X-ray absorptiometry scan. Waist girth (WG) was measured as the distance around the waist using the navel as the reference point. Pearson's correlations were used to determine the associations between anthropometrics and CRF. **Results:** BMI was significantly associated with CRF ($p<0.01$, $R = -.376$). WG ($p<0.05$, $R = -.301$) and BF % ($p<0.05$, $R = -.313$) were moderately associated with CRF. However, LM ($p>0.05$, $R = .064$) was not associated with CRF. **Conclusion:** BMI, WG, and BF percentage are anthropometric measurements significantly associated with reduced CRF in BCS. In breast cancer survivors, one's level of fitness declines as body fat and central obesity (assessed as WG) increase, which may impact risk of CVD mortality.

Poster #: 100
Title: Restoration of quadriceps strength following ACL reconstruction: allograft vs. autograft
Name: Kyungmi Park
Faculty Advisor: Christopher Powers

Background: Although patella tendon autograft is commonly used for anterior cruciate ligament reconstruction (ACL-r), disruption of the extensor mechanism has been reported to delay the recovery of quadriceps strength and may contribute to post-surgical anterior knee pain. The allograft procedure results in minimizing disruption of the extensor mechanism, and as such, may promote earlier recovery of quadriceps function. **Purpose:** To determine the influence of graft type on the restoration of quadriceps strength symmetry following ACL-r. **Methods:** 246 patients who had undergone ACL-r (99 males, 147 females) were grouped based on graft type (allograft vs. patella tendon autograft) and their post-operative time interval (3-6 months vs. 6-9 months). Quadriceps strength was measured bilaterally. Quadriceps strength symmetry was calculated as the ratio of the surgical knee to the non-surgical knee. A two-way ANOVA was used to compare the quadriceps strength symmetry between graft type and the post-operative time interval. **Results:** There was no significant interaction between graft type and post-operative time interval ($p>0.05$). In addition, there was no significant main effect for graft type or post-operative time interval. When averaged across the post-operative time intervals, quadriceps strength symmetry was similar between the allograft and patella tendon autograft groups (Mean±SD, 89.3±14.5 vs. 87.2±13.8, $p>0.05$). When averaged across graft types, the quadriceps strength symmetry was similar between the 3-6 and 6-9 month post-operative time intervals (Mean±SD, 87.9±15.0 vs. 89.4±13.4, $p>0.05$). **Conclusion:** The choice of graft for ACL-r does not appear to influence the quadriceps strength symmetry in the early and late post-operative phases of recovery.

Poster #: 101
Title: Modifying adaptive locomotor learning using body weight support **Name:** Sungwoo Park-
Faculty Advisor: James Finley

Background: The dynamics of gait result from both active neural control and passive properties of the body mechanics, and the kinematics of normal gait have been found to be selected to minimize the metabolic cost of walking. Furthermore, it was recently demonstrated that adaptation to walking on a dual-belt treadmill is associated with a reduction in the metabolic cost of walking. Though it has been proposed that energetic optimization may drive adaptive learning on a split-belt treadmill, a causal relationship between energetic cost and adaptation has not been explicitly investigated. **Purpose:** In this study, we modified the metabolic cost of walking by providing body weight support and determined if this modification affects adaptation. We hypothesized that providing body weight support would reduce the metabolic cost of asymmetry, thereby diminishing the need for step length adaptation during split-belt walking. **Methods:** Two groups of participants, Body Weight Support (BWS) (age 26±2, 4 male 3 female) and Control (age 26±2, 5 male 1 female), adapted to walking on a split-belt treadmill. BWS group performed 10-minute baseline walking without (5 minutes) and with (5 minutes) body weight support (50% of body weight) with both belts moving at 1.0m/s. During the adaptation, the left and right belt were set to 1.5m/s and 0.5m/s, respectively, for 15-minute walking. During the post-adaptation, the belt speeds were changed to the baseline condition without body weight support for 10 minutes. On the other hand, the Control group walked for 10 minutes of baseline, 15 minutes of adaptation, and 10 minutes of post-adaptation, without body weight support throughout the experiment. We collected the metabolic cost data by measuring the oxygen consumption using a met-

abolic cart. Kinematics was measured using an active marker-based motion capture system, and ground reaction forces were measured using the treadmill-mounted force plates. The step length asymmetry was calculated by computing the difference between the step length of each leg, and adaptation rate was also derived by counting number of strides for the average of step length asymmetry on 5 consecutive strides to reach lower than 0.05. Additionally, the metabolic power was calculated based on the oxygen consumption and carbon dioxide production. By subtracting the power at walking without body weight support from the power at walking without body weight support, we derived the reduction of the metabolic power of BWS when they had body weight support. **Results:** During baseline walking with body weight support, the BWS group reduced metabolic power by 10 ± 7% (2.5/2.3, 50%/100% body weight condition) relative to the no body weight support condition($P<0.05$). Additionally, the average metabolic power at early adaptation and late adaptation decreases by 11% (3.2/2.9, control/BWS) and 18% (2.9/2.4, control/BWS), respectively, when compared the half body weight support group to the control group ($P>0.05$). Furthermore, the BWS group showed decreased average step length asymmetry at early adaptation by 13% (-0.27/-0.24, control/BWS) but increased at late adaptation by 41% (-0.01/-0.03, control/BWS), respectively, when compared to the control group ($P>0.05$). The BWS support group also showed reduced adaptation rate to achieve step length symmetry less than 0.05 at both early adaptation and post-adaptation by 32% (262/179, control/BWS) and 62% (106/40, control/BWS), respectively, compared to the control group ($P<0.05$ at early post-adaptation). **Conclusion:** Therefore, our finding shows that the 50% body weight support did not significantly reduce the metabolic cost of adaptation at early and late adaptation during split-belt treadmill walking neither diminishes the step length asymmetry at early adaptation and late adaptation. However, the results demonstrated that there were significant reduces in metabolic power between 100% and 50% body weight at baseline walking, and in adaptation rate at early post-adaptation, which indicated that the body weight support enhanced washouts of learning from the split-belt adaptation.

Poster #: 102
Title: The effect of dual-tasking on trunk stiffness during dynamic tasks
Name: K. Michael Rowley
Faculty Advisor: Kornelia Kulig

Background: Trunk stiffness is an important metric for understanding how healthy persons and persons suffering from recurrent low back pain (rLBP) control posture. Increases in trunk stiffness during discrete trunk releases have been associated with recurrence of pain in those with rLBP, and changes in stiffness when a cognitive dual-task is added have offered insights into how attention is involved in altered control. **Purpose:** The purpose of this study was to evaluate effects of dual-tasking during a novel dynamic control task and an ecological lifting task in healthy adults in order to investigate and compare these tasks in persons with rLBP in the future. **Methods:** Four healthy adults with no history of LBP we recruited with IRB approval and completed two tasks with and without a cognitive dual-task: a unilateral dynamic control task compressing an unstable spring with one leg and a turning and lifting task with three weight increments. **Results:** Measures of stiffness including trunk and pelvis range of motion and variability and correlation between these two segments indicated that stiffness was greater during the dual-tasking. **Conclusion:** The findings suggest that in healthy persons, adding cognitive load increases trunk stiffness. This provides a potential mechanism for why we observe increased trunk stiffness in persons with rLBP, as they may be devoting increased cognitive attentional demands to their movement patterns out of fear of pain, a reported psychological phenomenon in this population. Future work will test trunk stiffness in these patients and investigate effects of dual-tasking and associations with fear of pain levels.

Poster #: 103
Title: Scapular muscle activity during arm elevation in subacromial impingement syndrome
Name: Sapna Sharma
Faculty Advisor: Lori Michener

Background: Subacromial Impingement Syndrome (SAIS) is associated with alterations in the trapezius and serratus anterior muscle activity. These muscles work together as a force couple to control the movement of scapula, however little information exists regarding the relative balance between these muscles in patients with SAIS. **Purpose:** The purpose of this study was to characterize the relative muscle activity of trapezius and serratus anterior muscles during active arm elevation and lowering in SAIS. **Methods:** Subjects in each group performed 5 repetitions of weighted active elevation and lowering in scapular plane, and data from the 3 middle repetitions was used for analysis. Surface electromyographic (EMG) muscle activity was recorded from upper trapezius (UT), middle trapezius (MT), lower trapezius (LT) and serratus anterior (SA) muscles. Relative muscle ratios were calculated for the UT/MT, UT/LT, UT/SA, LT/SA for the intervals of humeral elevation (30°-60°, 60°-90°, 90°-120°) and lowering (120°-90°, 90°-60°, 60°-30°). Relative ratios were compared between group separately for elevation and lowering phases. **Results:** 2x3 mixed-model ANOVAs yielded a significant main effect of group for the UT/LT and LT/SA ratios, but no significant interaction (group x angle) during elevation and lowering phases. Specifically, the UT/LT ratio in the SAIS group was higher as compared to the control group during active elevation (mean difference=0.85, $p=0.008$) and during the lowering phase (mean difference=0.56, $p=0.030$). The LT/SA ratio of the SAIS group was lower than the control group during active elevation (mean difference=0.26, $p=0.026$) and during lowering (mean difference=0.76, $p=0.032$). There were no significant differences in the UT/MT and UT/SA ratios between groups during elevation and lowering ($p>0.05$). **Conclusion:** Muscle balance of the LT with respect to UT and SA is disrupted during both arm elevation and lowering in SAIS. Even though we did not find a significant interaction, trends in the data suggest that the LT/SA ratio alteration may likely be at the lower arm angles (60°-30°). Findings from this study indicate the relationship of the LT to the other scapular muscles is important for pain-free shoulder motion. Future research should determine if therapeutic exercises can reduce or abolish these imbalances, and concurrently improve shoulder pain and disability. Clinical Relevance: There is muscle imbalance of the LT relative to the UT, and SA muscles in those with SAIS. Exercises aimed at restoring the dysfunctional force couples identified between the LT relative to the UT and SA muscles may prove beneficial to reduce shoulder pain and disability in patients with SAIS.

Poster #: 104
Title: Motor cortical representation is associated with lower extremity biomechanics
Name: Yo Shih
Faculty Advisor: Christopher Powers

Background: A landing pattern that favors use of the knee extensors over the hip extensors (i.e. knee strategy) has been linked to knee injury. Previous studies however have reported that strength of the hip and knee extensors only explains 20% of the variance in the landing patterns. This suggests that the "knee strategy" movement pattern may be a motor control issue as opposed to a strength deficit. **Purpose:** The purpose of this study was to determine whether the cortical representations of the hip and knee extensors are associated with the landing biomechanics. **Methods:** Four healthy participants (24.5±2.65 years-old) were recruited in this pilot study. Lower extremity kinematics and kinetics were collected during a drop-landing task. Hip and knee extensor muscle strength was measured during maximum voluntary isometric contractions. Transcranial magnetic stimulation (TMS) was used to quantify the cortical representation of the vastus lateralis and gluteus maximus. The variables of interest were the knee-to-hip extensor moment ratio during the drop-landing task, knee-to-hip extensor strength ratio, and knee-to-hip TMS mapping volume ratio. Pearson correlations were performed to determine the relationships between the knee-to-hip extensor moment ratio and the TMS and strength ratio data. **Results:** A strong correlation was found between the knee-to-hip extensor moment ratio and the knee-to-hip TMS mapping volume ratio

(r=0.87). A negative correlation was found between extensor moment ratio and extensor strength ratio (r=-0.59). **Conclusion:** Our preliminary findings suggest that the "knee strategy" landing pattern may be more a function of altered motor control as an opposed to diminished strength of the hip extensors relative to the knee extensors.

Poster #: 105
Title: Determining if wearable sensors affect infants' leg movements
Name: Emily Perkins
Faculty Advisor: Beth Smith

Background: Early identification of delayed infant neuromotor control is necessary for early targeted intervention to promote development. We are exploring whether wearable sensors may be used to identify impaired infant neuromotor control. **Purpose:** We aim to determine whether wearing sensors affects leg movements, and if so, whether the effects are similar in infants with typical development (TD) and at risk for developmental delay (AR). Here we focus on whether sensors increase or decrease the leg movement rate compared to no sensors being worn. **Methods:** Participants were 13 infants with TD and 13 infants with AR, ages 2 to 10 months. We recorded 4 minutes of video per infant of spontaneous supine movements with and without sensors. Trained behavior coders identified when a leg movement started and stopped. We used a Repeated Measures Analysis of Variance to test for a significant difference in number of leg movements when infants were wearing or not wearing the sensors (alpha = 0.05). **Results:** Preliminary results from seven infants supported there was not a significant difference in number of leg movements produced in 4 minutes in supine when infants were wearing or not wearing the sensors ($F1,13 = 0.01$, $p = 0.92$). **Conclusion:** Preliminary analysis supports that wearing movement sensors does not affect quantity of infant leg movements. We will continue to analyze our data and whether the effects are similar in infants with TD and AR.

Poster #: 106
Title: Infant kinematic differences: typical development vs. at risk of developmental delay
Name: Ivan Trujillo-Priego
Faculty Advisor: Beth Smith

Background: Movement disorders in infants are not completely understood and there is a lack of accurate early detection of movement impairment. A quantitative analysis method for measuring full-day infant movement will support objective assessments and a better understanding of infant development. **Purpose:** To test for group differences between infants with typical development (TD) and at risk for developmental delay (AR) in the quantity and kinematics of full-day leg movements produced. **Methods:** Inertial sensor data were collected from 12 infants with TD (1-12 months) and 24 infants AR (3-19 months, corrected age). There were 2 months between visits and a total of 3 visits per infant. We tested for group differences in each infants' average per visit: movements per hour of awake time, duration, acceleration and peak acceleration values for the left leg. **Results:** Significant differences were found between groups for average movements per hour of awake time, (TD: mean (M)=1841, Standard Error (SE) = 91; AR: M= 1377, SE = 66, $F[1,83.3]=17.17$, $p = > 0.01$), for average duration (s, TD: M=0.275 ,SE = 0.004; AR : M=0.261, SE= 0.003, $F[1,92.6]=9.33$, $p = 0.003$), for average acceleration (m/s^2, TD: M=2.583, SE=0.73; AR: M=2.330, SE=0.053, $F[1,98.9]=7.85$, $p = 0.006$) , and for average peak acceleration (m/s^2, TD: M=5.188, SE=0.173; AR: M=4.605, SE= 0.124, $F[1,100.23]=7.51$, $p = 0.01$). **Conclusion:** Significant group differences in number of movements and kinematic characteristics were found. Infants AR moved less and, on average, produced movements that were shorter in duration with smaller average and peak accelerations than infants with TD.

Poster #: 107
Title: Influence of humanoid robot on infant engagement and movement rate
Name: Joyce de Armendi
Faculty Advisor: Beth Smith

Background: Current evidence supports that humanoid robots are uniquely able to engage children in intervention. We are interested in developing an intervention for infants, a population which has not yet been explored. **Purpose:** Determine whether a humanoid robot engages infants (visual attention) and/or encourages movement (leg movement rate). **Methods:** Infants with typical development (n=3), 4 ½ - 5 months old, participated. Infants were secured in a seat that allowed free limb movement. A humanoid robot was placed directly in front of the infant. The robot iterated randomly through 2 cycles of 4 different stimulus conditions, alternating on and off throughout each condition (1. Eyes flashing, voice "kick" 2. Eyes flashing, voice "yay" 3. Robot leg movement, voice "kick" 4. Robot arm movement voice "yay"). Engagement was measured using visual attention from an eye tracker and annotations in Elan software. Movement rate was measured using wearable sensors on the legs and MatLab to calculate leg movement quantity. **Results:** Preliminary engagement analysis shows that infants spent a larger percentage of time looking at the robot when the robot was active than when it was inactive (Active M 72.48%, SD 7.31%; Inactive M 50.25%, SD 8.46 %). Preliminary movement rate analysis shows that infants produced more leg movements when the robot was inactive compared to active (Inactive M 27.3, SD 7.4; Active M 16.56, SD 6.85). **Conclusion:** Preliminary results support that the robot engaged infants and influenced movement rate. We will continue to collect data to complete our sample and proceed with statistical analyses.

Poster #: 108
Title: Infant behavioral state during interaction with a humanoid robot
Name: Jeongah Kim
Faculty Advisor: Linda Fetters

Background: Socially-assistive, humanoid robots have been investigated as an intervention tool for children with autism spectrum disorders and other developmental disorders. Infants are routinely screened for autism at well-baby checks. Our humanoid robot might be developed as an intervention during infancy. This is a preliminary step in the research for this intervention. We are interested in developing an early intervention using a humanoid robot, but it is unknown how infants will respond to the sound and movement of a robot. **Purpose:** Determine if there is a difference in an infant's behavioral state in response to the sounds and movement of a humanoid robot. **Methods:** Three typically-developing infants at 4½ months participated in one 8-minute session of robot interaction. The infant and robot were positioned facing each other in seats which allowed their arms and legs to move freely. The robot performed 2 cycles of four 1-minute conditions in random order, alternating between active and inactive intervals: 1) arm movement with voice saying "yay," 2) leg movement with voice saying "kick," 3) eyes flashing with voice saying "yay," 4) eyes flashing with voice saying "kick." Behavioral state of each infant was coded from videotapes and dichotomized into alert and fussy/crying. **Results:** Preliminary analyses suggest infants were alert (no fussy or crying) for a greater percent of time when the robot vocalized and moved (M 86.75%, SD 9.19), as compared to when it vocalized and eyes flashed (M 68.95%, SD 21.86), or the robot was inactive (M 54.17%, SD 27.49). **Conclusion:** Preliminary results support that infants were alert during a greater percentage of time when the robot was moving and speaking. Next step is to complete data collection.

BIOKINESIOLOGY AND PHYSICAL THERAPY CANDIDATES

Poster #: 109
Title: Impact of social-cognitive factors on paretic hand use after stroke
Name: Yi-An Chen
Faculty Advisor: Carolee Winstein

Background: Limited use of the paretic hand after stroke can severely constrain an individual's daily function. The presence of the non-use phenomenon, which describes the discrepancy between motor capability and daily hand use, underscores the fact that motor capability, while a necessary factor, may not be the only influence on paretic hand use. Recent studies demonstrate that social-cognitive factors (SCFs), which characterize an individual's psychological needs and perceptions, play an essential role in functioning after stroke. However, a significant knowledge gap exists in understanding the relationship of self-efficacy, affect, and social environment to paretic hand use. **Purpose:** Our goal is to investigate the impact of SCFs on paretic hand use in stroke survivors' daily environment, by employing an innovative application

of a well-established mobile-based prompt methodology – Ecological Momentary Assessment (EMA). **Methods:** EMA smartphone-based prompts include questions capturing participants' real-time responses of SCFs and paretic hand use. In this 5-day community study, participants received 6 EMA prompts/day and were encouraged to self-initiate one anytime. **Results:** On average, 12 individuals with chronic stroke (Fugl-Meyer [FM] motor score range, 21-66) responded to 81.6% of the 30 total prompts and self-triggered an additional 6.9 prompts during participation. Preliminary analysis using hierarchical linear regression revealed that self-efficacy was a critical factor ($p < 0.001$) in paretic hand use in addition to motor capability. Between individuals with the same FM score, those who reported one point higher in self-efficacy showed a 4% greater probability to use their paretic hand in daily activities. The statistical model with both self-efficacy and FM scores explained an additional 9% of the variance in paretic hand use over the model with FM scores alone ($p = 0.0006$). **Conclusion:** Further analyses with a larger sample size and objective hand use measures (e.g., accelerometers) will be conducted to provide a more robust perspective of the association between SCFs and paretic hand use post-stroke.

Poster #: 110
Title: Dynamics of self-efficacy and balance performance change in Parkinson's disease
Name: Yu-Chen Chung
Faculty Advisor: Beth Fisher

Background: Reduced balance self-efficacy has been demonstrated as an independent predictor of postural control and gait deficits for individuals with Parkinson's disease (PD), leading to the assumption that self-efficacy may be a potential target for motor performance improvement in PD. Although boosting individuals' performance expectations has been shown to enhance motor performance and learning in non-disabled adults, this positive effect remains to be determined in PD. This is important because PD is associated with disruptions in cognitive and motivational functioning as well as balance and movement. **Purpose:** We investigated the relationships and dynamics of self-efficacy and movement performance in the acquisition of a novel and challenging balance task. **Methods:** Ten individuals with PD practiced balancing on a stability platform. Participants received feedback after each trial in the form of time in balance. Individuals' self-efficacy (SE) for stabilometer performance was assessed at 3 times: baseline, after 14 practice trials, and immediately before a 24-hr delayed retention test. **Results:** Performance at the end of practice, as well as retention performance, was significantly better than baseline, indicating the potential for change in balance performance in PD. Mean self-efficacy scores changed concomitantly with an average of 1.2 on a 10-cm VAS scale. Early and late performance reflected primacy and recency influences on post-practice SE. **Conclusion:** These results suggest that individuals with PD with mild disease severity experience performance and self-efficacy changes with practice in a manner consistent with that of non-disabled older adults. Therefore, confidence-building components may be potentially useful in balance and movement skill interventions for this population.

Poster #: 111
Title: Are CST microstructural changes associated with motor recovery in stroke?
Name: Bokkyu Kim
Faculty Advisor: Carolee Winstein

Background: Diffusion MRI (dMRI) measure of brain can capture the microstructural characteristics of sensorimotor pathways. dMRI measure of corticospinal tract (CST) are associated with motor performance in individuals after stroke. Less well understood is whether changes in dMRI measures of CST are associated with improvement in upper extremity (UE) motor performance. **Purpose:** This study aims to determine whether the changes in fractional anisotropy (FA) of ipsilesional CST (CST_ipsi) are associated with improvement in affected UE motor performance. This study is part of a longitudinal Phase-I clinical trial of rehabilitation in chronic stroke (ClinicalTrials.gov ID: NCT01749358). **Methods:** Those with mild-to-moderate motor impairment and stroke chronicity participated (N=28, average chronicity=3 years). MRI scans and clinical assessments were acquired before and after 12 sessions (over 3 months) of a structured UE therapy program. Imaging data were processed using BrainSuite14a (http://brainsuite.org/). CST FA was quantified from each hemisphere. Wolf Motor Function Test (WMFT) time score was acquired as a primary clinical outcome of motor performance. Linear regression was used to determine the relationship between neuroimaging and behavioral variables. **Results:** There was a significant improvement in motor performance after intervention ($p<0.05$), while there was no change in the FA of CST_ipsi ($p=0.82$). 33% of the variance in changes in WMFT time score was explained by changes in FA of CST_ipsi ($p<0.0001$). **Conclusion:** With these longitudinal data, we demonstrated that there is a significant relationship between changes in dMRI-derived FA of the CST_ipsi and improvements in UE motor performance in individuals with mild-to-moderate motor impairment in the long-term phase of stroke.

Poster #: 112
Title: Immersive Virtual Reality: Feasibility test for individuals with Parkinson's disease
Name: Aram Kim
Faculty Advisor: James Finley

Background: Virtual Reality (VR) has the potential to be used as an effective addition to conventional rehabilitation for patients with Parkinson's disease (PD) providing more challenging and interactive real-world environments. However, there is a concern that VR may induce adverse effects. **Purpose:** Thus, feasibility of using immersive VR in PD needs to be evaluated. **Methods:** A VR environment consisting of a cityscape with buildings and an approximately 800 meter sidewalk was specifically developed in the laboratory. A total of 33 participants (11 healthy young, 11 healthy older adults, and 11 individuals with PD) was recruited. Participants first completed a simulator sickness questionnaire and a stress arousal checklist. Then, their pre-test clinical assessments (miniBEST, 10m walk test) and static postural stability (center of pressure) were measured. After the pre-test evaluation, participants wore a head-mounted display that projected the VR scene, and walked on a treadmill for 20 minutes in 5-minute intervals. After VR exposure, a series of questionnaires were given measuring symptoms of simulator sickness, stress, arousal levels and the sense of presence within VR. Lastly, post-static postural stability was measured. **Results:** There were no significant effects of time in any groups for the level of simulator sickness post-exposure. Moreover, the static and dynamic postural equilibrium were not affected after exposure. **Conclusion:** Our results demonstrate that immersive VR does not induce adverse physiological and physical effects and there was no interference in participant's walking task. This will provide evidence of safe VR use and implementation of VR-based rehabilitation and assessment tools for individuals with PD.

Poster #: 113
Title: Energy balance components and body fat in prostate cancer survivors
Name: Jackie Kiwata
Faculty Advisor: Todd Schroeder

Background: For prostate cancer survivors (PCS) on androgen deprivation therapy (ADT), increases in body fat % (BF%) are a common adverse effect. High caloric intake (CI) and a sedentary lifestyle contribute to BF% increases in the general population, but it is unclear if these modifiable factors are related to BF% in PCS on ADT. **Purpose:** To investigate the relationship between BF% and energy balance components in PCS on ADT. **Methods:** Twenty-one PCS (66.3±9.1 yr) on ADT were recruited from the USC Norris Comprehensive Cancer Center as part of a larger ongoing exercise trial. CI was determined from a 3-day dietary recall using registered dietician guidelines. Self-reported physical activity (PA) was assessed through the International PA Questionnaire and BF% was measured by DEXA. Energy balance was calculated as CI – (PA + estimated resting energy expenditure). Relationships were analyzed using Spearman's rank correlation with significance set at $p<0.05$. **Results:** The majority of PCS (71%) reported moderate-to-vigorous PA. On average, CI was 1643±291 kcal/day, energy balance was -577±860 kcal/day and BF% was 33.6±5%. A moderate negative correlation was

found between BF% and energy balance (r=-0.5, p<.05) and BF% and CI (r=-0.5, p<.05), with no relationship between BF% and PA (p>.05). **Conclusion:** Among this limited sample, our findings indicate that a higher BF% is related to a reduced CI, suggesting that ADT may influence BF% through mechanisms other than simple energy balance. As no relationship was observed between BF% and PA, future work is needed to ascertain the effect of exercise on adiposity changes due to ADT in PCS.

Poster #: 114
Title: Modulation of the ipsilateral primary motor cortex by dexterity demands
Name: Na-hyeon Ko
Faculty Advisor: Francisco Valero-Cuevas

Background: Dexterity-demanding tasks have been associated with an expansion of the neural network underlying unimanual control. These tasks involve bilateral neural structures, which may evoke changes in the excitability of the ipsilateral M1 and/or spinal cord associated with the active muscles. **Purpose:** To determine the degree to which the dexterity demands influence ipsilateral corticospinal excitability. **Methods:** Ten participants (29.5±3.5yrs, 4M 6F, right-dominant) performed unimanual precision pinch tasks requiring different degrees of sensorimotor integration (unstable spring, stable spring, dowel, and rest). Single-pulse TMS was delivered over the ipsilateral M1 for the first dorsal interosseous (FDI) to record motor evoked potentials (MEPs) in the left FDI. MEP amplitudes were compared across tasks and related to changes in left and right FDI EMG activity (mirror movement). **Results:** The average corticospinal excitability in the left FDI during unstable spring task, when dexterity demands were highest, was significantly greater than the other conditions ($p < 0.001$). Pinching of the stable spring and solid dowel elicited similar MEP amplitudes to each other, but their MEPs were greater than the rest condition ($p< 0.05$). The mirror activity in the left FDI was very low during all tasks, and was not well correlated with MEP amplitudes. **Conclusion:** Unimanual tasks requiring a high degree of dexterity increase ipsilateral corticospinal excitability. Our data suggest that MEP amplitudes in the rest hand may serve as an index of the neural control demand in tasks with varying degrees of dexterity. Therefore, unimanual tasks have the potential to prime bilateral M1 corticospinal excitability, which may be relevant for neurorehabilitation of hemiparesis within, for example, the context of stroke.

Poster #: 115
Title: Patellofemoral joint stress in recreational runners with patellofemoral pain
Name: Tzu Liao
Faculty Advisor: Christopher Powers

Background: Patellofemoral pain (PFP) is a common condition seen in orthopedic practice. A commonly cited hypothesis as to the cause of PFP is elevated patellofemoral joint (PFJ) stress. Previous studies have reported that persons with PFP exhibit elevated PFJ stress during walking and squatting. To date, no studies have examined PFJ stress in persons with PFP during running using subject-specific lower extremity kinematics. **Purpose:** To determine PFJ stress in persons with and without PFP during running. A secondary purpose was to determine the cause of elevated PFJ stress (i.e. decreased contact area and/or increased PFJ forces). **Methods:** Eight females with PFP and 7 pain-free matched controls have participated in this study thus far. Patella cartilage stress profiles were obtained utilizing subject-specific finite element (FE) models that were created to simulate PFJ loading during the mid-stance phase of running (peak knee flexion). Input parameters of the FE model included: lower extremity kinematics, PFJ geometry, weight-bearing PFJ kinematics, and quadriceps muscle forces. Using a nonlinear FE solver, quasi-static loading simulations were performed to quantify patella cartilage stress. **Results:** Compared to the pain-free controls, persons with PFP demonstrated a trend of elevated peak hydrostatic pressure (15.9 MPa vs. 11.84 MPa) and peak shear stress (8.51 MPa vs. 7.43 MPa). In addition, a trend of decreased contact area was noted whereas contact forces were similar across groups. **Conclusion:** Persons with PFP exhibit a trend of elevated PFJ stress during running. Consistent with previous studies, elevated PFJ stress appears to be a function of decreased contact area as opposed to increased PFJ forces.

Poster #: 116
Title: Does ankle flexor proprioception modulate muscle recruitment in chick embryos?
Name: Soo Yeon Sun
Faculty Advisor: Nina Bradley

Background: Prior to hatching, chick embryos produce repetitive limb movements (RLMs) in ovo, activating flexor and extensor muscles alternately, characteristic of stepping. Our work in progress indicates that during RLMs, leg flexors are more commonly recruited compared to extensors. **Purpose:** In this study, we asked if proprioceptive inputs from an ankle flexor muscle contribute to the differential recruitment of ankle flexor and extensor muscles during RLMs. **Methods:** Electromyographic (EMG) and kinematic recordings were performed during spontaneous RLMs at embryonic day 20. After recording control data for ≥ 2 hrs, the left ankle flexor was tenotomized, and the recording continued for another ≥ 2 hrs. Employing a within-subject design, left ankle flexor and extensor recruitment parameters were compared pre- and post-tenotomy (N=10). The recruitment parameters analyzed were number of bursts, burst duration, cycle duration and integrated burst amplitude. **Results:** Preliminary results indicated that the recruitment parameters pre- and post-tenotomy were similar. Flexor bursts outnumbered extensor bursts pre-tenotomy (10 of 10 embryos) and post-tenotomy (9 of 10). Flexor and extensor burst durations and cycle durations were similar pre- and post-tenotomy. Flexor and extensor integrated amplitudes were also similar pre- and post-tenotomy. **Conclusion:** Our preliminary analyses suggest that ankle flexor proprioception does not contribute to the differential recruitment of flexor and extensor muscles during RLMs. Eliminating ankle flexor proprioceptive inputs does not alter the prevalence of flexor bursting compared to the extensor bursting. Our findings also indicate that recruitment attributes of flexor and extensor bursts are not modulated by ankle flexor proprioceptive inputs during self-generated movement in ovo.

Poster #: 117
Title: Cortical activation associated with automatic control of pelvic floor muscles
Name: Moheb Yani
Faculty Advisor: Jason Kutch

Background: The human central nervous system automatically coactivates pelvic floor muscles with trunk and lower limb muscles. Improving our understanding of the neural centers underlying this control could improve physical therapy for pelvic floor muscle pain and dysfunction. **Purpose:** We have recently shown in healthy men that automatic pelvic floor muscle coactivation with gluteal muscles involves specific medial wall motor cortical regions, and we also recently discovered markers of dysfunction in these motor cortical regions in both women and men with chronic pelvic pain. Here, to link these lines of evidence, we aimed to determine if automatic pelvic floor muscle coactivation also involves motor cortical activation in healthy women. **Methods:** A cross-sectional study. We used functional magnetic resonance imaging (fMRI) to measure brain activity, and electromyography (EMG) to measure muscle activity, during voluntary motor tasks involving pelvic floor muscles, gluteal muscles, and finger muscles. **Results:** Using fMRI we support our hypothesis that the medial wall motor cortical regions activate in women when pelvic floor muscles automatically coactivate with gluteal muscles. These motor cortical regions strongly overlap with those we previously identified are altered in women with chronic pelvic pain. Using EMG recordings, we extend our previous findings to provide evidence of coupled neural drive between these muscle groups. **Conclusion:** This cross-sectional study does not address therapeutic effects on the motor cortical regions we have identified. Our findings underscore the importance of the motor cortex in automatic pelvic floor muscle control in both sexes, and now allow functional brain changes in women with chronic pelvic pain to be interpreted in the context of potential pelvic motor control dysfunction at the cortical level.

OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY STUDENTS

Poster #: 118
Title: Families' experiences of "fighting" for their children's autism services **Name:** Amber Angell
Faculty Advisor: Olga Solomon

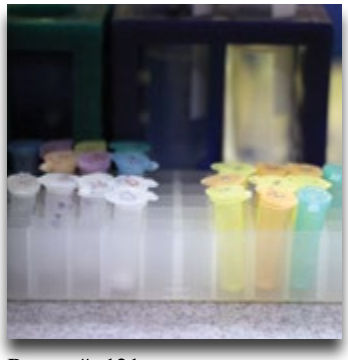
Background: African American and Latino children experience disparities in ASD diagnosis and services. The "autism parent," a cultural model of parenting in which parents "fight" systems of care to "win" services for their children, is rooted in White middle-class ideals, resources, and capital. **Purpose:** The purposes of these studies were to explore African American and Latino families' experiences of their children's autism spectrum disorder (ASD) diagnosis and services. **Methods:** This analysis combined data from: 1) A 3-year, mixed methods, urban ethnographic study of the experiences of African American families of children with ASD in LA County; 2) A 1-year, urban ethnographic study of the experiences of bilingual Latino families of children with ASD in LA County. We do not contrast the groups but look for patterns across families' experiences. We utilized thematic and narrative analysis to understand narratives within a broader sociocultural, political economic context. **Results:** Although parents in our studies experienced their children's services as a "fight," their narratives departed from middle-class White families;' despite engaging in long, exhausting "battles," many were still denied services. Some parents chose not to "fight" because they feared their children would be treated badly by professionals in retaliation. **Conclusion:** African American and Latino parents face a double standard in trying to obtain ASD services for their children: Those who "fight" may be more likely to obtain services but at great cost, including being labeled 'greedy' by professionals; while those who choose not to fight in fear that their children will be mistreated, do not "win" needed services and risk being labeled 'passive.'

Poster #: 119
Title: Challenges of service members with persistent symptoms following mTBI
Name: Alison Cogan
Faculty Advisor: Florence Clark

Background: Over 80% of traumatic brain injuries among active duty military service members in the United States are classified as mild. Approximately 10 to 20% report cognitive, physical, and emotional symptoms that persistent several months, or even years, later. There is little occupational therapy research to describe how such symptoms impact daily life. **Purpose:** The purpose of this qualitative study is to describe the occupational challenges of active duty military service members who experience persistent symptoms following mild traumatic brain injury (mTBI). **Methods:** Data were collected through semi-structured interviews. **Results:** Participants (n=10) were recruited from a concussion care clinic at a Marine base and had received occupational therapy for their symptoms. Four main themes emerged. First, "warrior culture", describes how participants delayed care after injury because of their commitment to duty and resistance to asking for help. The second theme is "breaking point", which refers to the extreme impairment in daily functioning that service members reached before seeking care. Third, "loss of interest in activities" describes how participants greatly reduced activities that had previously been important because of their symptoms. Finally, "advice to others" describes how participants would advise others to seek care immediately after becoming aware of symptoms and recognize any head injury as potentially serious. **Conclusion:** The findings indicate several areas in which occupational therapy intervention could benefit service members with chronic symptoms after mTBI. Further research is warranted to identify appropriate interventions. Disclaimer: The views expressed in this article are those of the author(s) and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, or the United States Government.

Poster #: 120
Title: Systematic review of interventions to prevent pressure ulcers
Name: Alison Cogan
Faculty Advisor: Florence Clark

Background: Medically serious pressure ulcers are a costly and difficult to treat complication among community-dwelling adults with spinal cord injury (SCI). **Purpose:** The purpose of this paper is to systematically review evidence of behavioral interventions for their efficacy in preventing pressure ulcers in adults with SCI. **Methods:** CINAHL, Cochrane, Clinical Trials, PubMed, and Web of Science databases were searched. No limitations were set for years of publication or study design. Inclusion criteria were that studies: 1) were published in a peer-reviewed journal in English, 2) evaluated an intervention aimed at preventing pressure ulcers through education and behavior change, 3) included community-dwelling adults with SCI, and 4) measured pressure ulcer occurrence, recurrence, or objective skin breakdown as a study outcome. Titles and abstracts of 367 unique articles were evaluated. 6 articles met full inclusion criteria. **Results:** Several methodological issues were noted in 5 of the 6 studies, including challenges with participant recruitment, poor intervention fidelity, and low adherence. In the single study that was adequately powered, pressure ulcer outcomes were not significantly different between groups. **Conclusion:** Very few behavioral interventions have been evaluated for their efficacy in preventing pressure ulcers among community-dwelling adults with SCI. The few studies that have been conducted reported nonsignificant results. Issues with recruitment, fidelity, and adherence further limit their applicability. Exploration of the hypothetical active ingredients of such interventions and feasibility testing prior to clinical trials are recommended.



Poster #: 121
Title: Oral health interventions for individuals with autism: a systematic review
Name: Lucia Florindez
Faculty Advisor: Leah Stein Duker

Background: Oral health contributes to physical and psychological health. Individuals with autism spectrum disorders (ASD) often experience oral care challenges, suggesting the need for innovative and efficacious interventions to facilitate care. Currently, little research exists examining oral interventions for individuals with ASD. **Purpose:** To systematically review interventions designed to improve oral health in individuals with ASD. **Methods:** Six electronic databases were searched, including: PubMed, CINAHL, Web of Science, Clinical Trials, COCHRANE, and PsycINFO using the keywords "oral/dental health/care," "intervention," and "autism." Studies investigating home and/or dental-office non-pharmacological interventions to impact oral care health in individuals with ASD published in English, Spanish, Korean, and/or Portuguese were included. Methodological quality of studies was assessed by two reviewers using Reichow, Volkmar, & Cicchetti's (2008) Evaluative Method for Determining Evidence Based Practice (EBP) in Autism; disagreements were resolved by a third reviewer. **Results:** The search produced 325 articles, with only seven studies meeting all inclusion criteria. Two studies were scored as strong indicators of evidence, two as adequate, and three as weak. Three studies examined caregiver education programs to improve in-home oral care; the remainder evaluated strategies to reduce behavioral difficulties that impeded care in the dental office. Only one study included adults; all others examined pediatric ASD populations. **Conclusion:** These findings suggest that preliminary evidence exists supporting the use of behavioral interventions to improve the dental experience of individuals with ASD. This review highlights the dearth of oral care interventions for adolescents and adults with ASD, and the need for further large-scale studies investigating the efficacy and effectiveness of oral interventions in individuals with ASD across the lifespan.

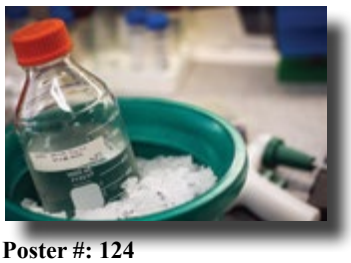
Poster #: 122
Title: Retrospective analysis of sensory integration therapy in children with ASD
Name: Elizabeth Franco
Faculty Advisor: Barbara Thompson

Background: Up to 90% of children with ASD have concomitant sensory abnormalities. In fact, the DSM-5 now lists sensory processing abnormalities as a core feature of ASD. Sensory Integration intervention (SI) is a specialty area of occupational therapy that amalgamates a clinical and play-based approach to ameliorate sensory processing deficits and improve daily life engagement of children with ASD. Innovative tools that monitor change during and following SI sessions are necessary for characterizing the effects of SI in children with ASD. **Purpose:** The goal of this study was to develop a

new approach for measuring both immediate and permanent changes in ASD related behaviors following sensory integration intervention. **Methods:** In this retrospective study, we utilized Observer XT (Noldus), a specialty behavioral coding software to quantify duration and amount of elicited behaviors during previously recorded SI sessions for 10 children ages 18-60 months with a diagnosis of ASD. Changes in the rate and frequency of these behaviors was calculated. **Results:** A total of 146 behaviors were coded, and these were grouped into 9 categories including: social, behavior, play, tactile, vestibular, proprioception, fine motor, movement in space and activity-related (adaptive response). Analyses revealed changes in several ASD relevant behaviors including specific sensory, motor, and social-communication behaviors. **Conclusion:** Our data revealed statistically significant changes in both sensory and autism relevant behaviors in children with ASD following administration of SI. This study provides an exhaustive list of behaviors analyzed and new insight into behaviors sensitive to change during SI sessions.

Poster #: 123
Title: Effects of mind-body interventions in hand therapy: a pilot study **Name:** Mark Hardison
Faculty Advisor: Shawn Roll

Background: Mind-body techniques can improve patient awareness and engagement and are being increasingly implemented as part of integrative health programs to improve patient outcomes. No research has investigated the integration of mind-body interventions into hand therapy. **Purpose:** This pilot study explored the acute effects of two mind-body techniques on stress, anxiety, and pain in patients receiving hand therapy, to guide exploration and development of integrative hand therapy practices. **Methods:** Nineteen patients with an upper extremity musculoskeletal injury were recruited. Data were collected across 4 visits using a randomized, repeated-measures, cross-over design. Participants received either standard care or a mind-body intervention plus standard care. Mind-body interventions included an audio-guided mindfulness meditation and visual biofeedback using musculoskeletal sonography. Outcome measures for stress, anxiety, and pain were obtained every 20-min. Trends across sessions and change scores from start to end of each session were analyzed. **Results:** Anxiety and stress significantly decreased across the sessions regardless of intervention type ($p < 0.01$), and stress showed a trend toward larger decreases when either mind-body intervention was provided prior to standard care. Descriptive evaluation of trend graphs showed larger immediate decrease for anxiety in the first 20-min following the mindfulness intervention versus the other intervention session types, which showed a gradual decrease. **Conclusion:** This pilot study provides valuable feasibility data regarding the direct, acute effects of two mind-body interventions as an integrative approach to hand therapy. The trends identified support further investigation of long-term effects on patient outcomes with integration of mind-body techniques across an entire treatment plan.



Poster #: 124
Title: Synthesizing perspectives on developmentally appropriate occupational therapy for transition-age youth
Name: Carol Haywood & Kristine Carandang
Faculty Advisor: Mary Lawlor & Beth Pyalak

Background: Healthcare providers are increasingly aware of the need to tailor interventions to address the unique challenges and opportunities that accompany developmental trajectories of transition-age youth (TAY, 16-26 years old). TAY typically experience a disruption within their previously established social roles and physical environments, while simultaneously exploring autonomy and developing interests in career pursuits. **Purpose:** Drawing from perspectives of TAY, we will discuss implications of psychosocial development for occupational therapy intervention across diverse practice areas: physical rehabilitation, mental health, and chronic disease management. **Methods:** Data are generated from three projects involving primarily low-income, racial/ethnic minority TAY: 1) narrative data focusing on everyday experiences for TAY with spinal cord injuries, 2) survey responses and field notes recorded from clinical conversations at a community-based mental health setting, and 3) qualitative data and treatment notes from a diabetes management intervention. **Results:** There is often a disconnect between the priorities, goals, and preferences of TAY, their developmental needs, and existing models of healthcare. Emic perspectives illustrate complex negotiations that must occur for TAY to integrate recommendations from healthcare providers into their daily lives. For example, health management occupations often conflict with other valued activities, especially in a context of limited social and environmental resources. Perspectives from TAY illustrate varying preferences for healthcare delivery, including preferred treatments, modes of communication, and desired autonomy within healthcare encounters. **Conclusion:** Narratives of TAY illustrate discrepancies between their everyday realities and current health-related services. Obtaining various stakeholder perspectives can contribute to developing collaborative models, which promote long-term health.

Poster #: 125
Title: Lateralization of action observation network activity after stroke
Name: Kaori Ito
Faculty Advisor: Sook-Lei Liew

Background: Previously, Garrison et al. (2013) found that participants with chronic stroke to the left hemisphere showed greater brain activity in the left action observation network (AON) during observation of the paretic hand, suggesting that the AON is specialized for the ipsilesional hemisphere (Garrison et al., 2013). **Purpose:** Here we examined whether the lateralized effect of AON activity is specific to the lesioned hemisphere or if it is inherent to the dominant hemisphere. **Methods:** We compared fMRI data from right-handed individuals with left hemisphere stroke (Garrison et al., 2013; n=12) and right hemisphere stroke (n=12). All participants observed hand actions (left, right) during the scan. Preprocessing and group-level statistical analyses were carried out in FSL (Jenkinson et al., 2002; Woolrich et al., 2001). Laterality indices for a priori regions of interest in the AON were calculated as LI = (L-R)/(L+R), where L and R represent surviving active voxels in the left/right hemisphere. **Results:** We found similar laterality patterns for all participants regardless of the side of lesion, suggesting AON activity is lateralized to the dominant, rather than ipsilesional, hemisphere. For all participants, activity was left-lateralized in the AON areas during right hand action observation. **Conclusion:** Our results suggest that the lateralized effect of AON activity in the left hemisphere after stroke is due to a property of the dominant hemisphere rather than an effect of the ipsilesional hemisphere. Future research may examine whether and how lesion laterality impacts stroke recovery.

Poster #: 126
Title: Evaluation of new emotional and non-emotional video stimuli database
Name: Emily Kilroy
Faculty Advisor: Lisa Aziz-Zadeh

Background: To date, social and affective neuroscientific research largely relies on static images, yet people are rarely perceived in a static-state. A database that provides a spectrum of emotional and non-emotional videos is ideal for conducting a wide range of neuroscientific studies that control for processing of facial and non-facial movement. **Purpose:** Here we present such a database: EmStim. EmStim consists of three distinct sets of video stimuli: emotional expressions (i.e., happy), non-emotional expressions (i.e., puffed-cheeks) and hand actions (i.e., cutting paper). This database is useful for investigating dissociations between emotional and motor perception and embodiment. **Methods:** Seven Caucasian actors (4 female; 29-39 years) were recorded making thirty-five expressions against a black background. The hands of one male and female actor were also recorded interacting with 100 everyday objects. To enable fMRI research, all videos were edited to 3.75 seconds and controlled for low-level visual properties. Psychometeric evaluations of emotional face stimuli were collected. Additionally, functional Magnetic Resonance Imaging (fMRI) study was conducted to investigate neural differences in processing the three stimulus sets during three tasks. The three stimulus sets were displayed in a pseudo-random block design consisting of 15 (5 or each type) 15-second video blocks (3 videos/block), with each block followed by 15-seconds of rest. Neurotypical adult and child participants observed, imitated, and

mentalized to each set of videos in separate scans. Standard preprocessing and whole-brain BOLD analyses were performed. **Results:** The emotional expression stimulus set results show high recognition of intended facial expression and consistent valence and arousal ratings. The three fmri tasks produced significant ($p<.05$) overlapping and non-overlapping activation in the Action Observation Network (i.e., Pars opercularis). **Conclusion:** Taken together, our results suggest that EmStim is a flexible and valuable resource for social, cognitive, and affective research. Ongoing work will continue to quantify relationships among individual differences in social and motor functioning and measurements of brain function associated with the three classes of EmStim stimuli.

Poster #: 127
Title: Occupational therapy's role in facilitating a successful community discharge
Name: Kruti Shah
Faculty Advisor: Natalie Leland

Background: Readmissions within 30 days of hospital discharge are a common adverse outcome that can be prevented with the delivery of high quality community transition interventions. Yet, the majority of these interventions studies have excluded post-acute care (PAC) patients, thereby leaving PAC patients, caregivers, and practitioners ill-equipped to minimize this poor outcome. **Purpose:** To identify effective community care transition interventions that are within the scope of occupational therapy (OT) in order to develop a research agenda for PAC rehabilitation community care transitions. **Methods:** A comprehensive review of the literature was conducted using the search terms "care transitions", "readmission", and "community transition" in PubMed, OTseeker, and CINAHL databases. Included articles were published in English, in peer-reviewed journals, assessed the effectiveness of an intervention, and evaluated readmission as a primary outcome. Interventions that were outside the scope of OT and did not evaluate community care transitions were excluded. **Results:** Thirty-five articles were included in this study. Thirteen effective care transition practices that fell within the scope of OT were identified, including identifying high-risk patients, comprehensive patient assessment, multi-disciplinary discharge planning, education, medical self-management, training, teach back, self-management, connecting to community resources, scheduling follow-up, patient-centered record, telephone follow-up and home visits. **Conclusion:** Delivering high quality community transition interventions require the integration of the patient's abilities, support system, context and environment. Guided by the findings of this study, there is a need for occupational therapy research examining the effect of occupation-based interventions on PAC community care transitions.

Poster #: 128
Title: Supportive care and occupation-related needs of Latina breast cancer survivors
Name: Alix Sleight
Faculty Advisor: Florence Clark

Background: Latina breast cancer survivors are disproportionately at risk for poor health outcomes. Supportive care services can promote well-being during cancer survivorship and reduce health disparities. However, little is known about the unique supportive care needs of low-income Latina breast cancer survivors. **Purpose:** This pilot study investigates the needs of low-income Latina breast cancer survivors in order to elucidate the potential for occupational therapy in supportive care for this population. **Methods:** Breast cancer survivors (n = 15) who had completed surgery, chemotherapy, and radiation were recruited from an oncology clinic. All eligible participants completed three self-report questionnaires. The questionnaires included: 1) The Supportive Care Needs Survey (SCNS-SF34), a standardized, 34-item survey designed to capture the supportive care needs of cancer survivors. 2) The Lifestyle and Occupation Needs Survey (LONS), a 31-item measure developed for this study to gather supplemental data about lifestyle and occupation-related needs. 3) A standard demographics questionnaire. **Results:** All participants self-identified as Latina and reported Spanish (n=14) or English (n=1) as their primary language. 93% disclosed an annual income of $15,000 or less. 80% of participants indicated having at least one co-morbidity. Respondents reported, on average, 17 unmet supportive care needs. They indicated the highest level of unmet need in the domain of "health systems and information." The most frequently reported occupation-related need (60% of respondents) was "help with everyday management of another health condition." **Conclusion:** These findings suggest that low-income Latina breast cancer survivors may require more health-related information and increased support in self-management of co-morbidities.

Poster #: 129
Title: Comparisons between virtual reality and conventional motor training in adults
Name: Taisei Sugiyama
Faculty Advisor: Sook-Lei Liew

Background: Virtual reality (VR) can be a novel tool to modify the context of stroke rehabilitation and enhance therapeutic gains. However, whether VR training produces comparable effects with conventional training in "real reality" (RR) is currently unclear. **Purpose:** Here we examined whether a VR environment produces similar motor training effects as a previously established visuomotor adaptation paradigm in RR (Taylor et al., 2014). **Methods:** 18 healthy adults performed a task either in RR or VR (n=9/group). The VR environment was made visually similar to the actual room with identical paradigms. Subjects made horizontal reaching movements with a stylus pen on a digitizing tablet to hit a target and had to adapt to a 45-degree perturbation. Endpoint feedback was provided on a monitor or a head-mounted virtual reality display. As the target was flanked with numbers, participants reported aiming direction before moving, enabling us to measure target error along with explicit and implicit learning (hand position minus aiming). **Results:** T-tests revealed no significant group differences on the average target error during rotation training, normalized to baseline ($t(13) = 1.80$, $p = .10$). They revealed a significant effect on aiming ($t(15) = 2.86$, $p = .01$), but not on implicit learning ($t(12) = 1.29$, $p = .22$). **Conclusion:** Our preliminary results suggest that VR training produces comparable motor learning outcomes as RR. However, there may be differences in the ratios of implicit to explicit learning used. VR may provide unique opportunities to study and enhance motor learning and rehabilitation.

Poster #: 130
Title: Application of the Person-Environment-Occupation model to improve dementia care
Name: Carin Wong
Faculty Advisor: Natalie Leland

Background: Patient-centered care is an important component to providing quality dementia care in nursing homes. Dementia care is multifaceted and individuals with dementia are affected by their personal capacities and environmental factors. In order to understand and identify the best interventions to inform a patient-centered approach to dementia care in nursing homes, the Person-Environment-Occupation (P-E-O) model is presented. **Purpose:** To examine dementia care nursing home intervention literature in the context of the P-E-O model. **Methods:** A review of literature was done to identify effective interventions for residents with dementia. The intervention studies were classified within the P-E-O model to identify the extent to which the interventions addressed the inter-connected relationship between the person, the environment, and the occupation. Each intervention was categorized as either an illustration of the interaction between person-environment, person-occupation, environment-occupation, or all three components. **Results:** The relationship between the person and environment showed that the environment encompasses physical and social factors that can influence the person's abilities and functional level. The person-occupation relationship demonstrated the benefits of engaging in appropriate and meaningful activities. Similarly, the environment-occupation interaction illustrates how changes in the environment can both facilitate and hinder participation in occupations. Interventions that integrated all three components demonstrated how engaging in individually tailored and meaningful activities were effective in enhancing outcomes for residents with dementia. **Conclusion:** The P-E-O model can be used to understand and develop person-centered interventions for nursing home residents with dementia. Future research is needed to examine interventions that inte-

grate the P-E-O model into dementia care.

Poster #: 131
Title: Obesity prevention for low-income families: preliminary outcomes **Name:** Sharon Sin
Faculty Advisor: Sarah-Jeanne Salvy

Background: Extant obesity programs have had a limited impact among underserved low-income families due to their inherent structural and conceptual limitations. To address these gaps, we have integrated an obesity prevention module as part of the services already delivered by our home visitation partner, Healthy Families America, with the long-term goal to deploy these efforts to HVPs nationwide. **Purpose:** Report preliminary findings of a 6-month pilot intervention assessing the feasibility and preliminary efficacy of delivering obesity prevention as part of the HVP services on maternal and infant outcomes. **Methods:** Participants were 50 mothers (M age = 25 years) and their infants (1-6 mo) enrolled in our HVP partner in Antelope Valley, CA. Mothers/infants were randomly assigned to receiving the HVP core curriculum only or the HVP curriculum + COPE enhancement module for six months. Assessments of mothers' energy intake and soda consumption, and measurements of infants' weight velocity were conducted at baseline and post-intervention. **Results:** Children's weight velocity was 18% lower in COPE than in the control group (0.61 +- 0.1 kg/month vs 0.75 +- 0.1 kg/month). Furthermore, COPE mothers consumed an average of 400 less kilocalories than mothers in HVP only post intervention. Only 20% of mothers receiving COPE were consuming sugar-sweetened beverages (vs. 70% in HVP only) at the conclusion of the intervention. **Conclusion:** Interim findings support the feasibility and preliminary efficacy of integrating COPE into the services provided by HVP on mothers/infants obesity risks.

DDS STUDENTS BASIC SCIENCES

Poster #: 132
Title: A novel biofilm mediated osteolytic infection model
Name: Shant Aharonian
Faculty Advisor: Homa Zadeh

Background: Bacteria can occur in either planktonic or biofilm state. The behavior of bacteria in biofilm state varies from that of the planktonic state. Bacteria in biofilm state are more resistant to clearance by immune components or antimicrobial agents. Currently, there is a lack of information about the immune response to biofilm bacteria. One of the obstacles is the lack of appropriate animal models to study biofilms. **Purpose:** The purpose of this study was to establish a novel animal model to study the host immune response to *Aggregatebacter actinomycetemcomitans* biofilm. **Methods:** Customized one-piece titanium implants (1.2 x 4.0mm) were fabricated and their surfaces were micro textured by grit blasting with Aluminum oxide particle and acid-etched with hydrofluoric acid. The heads of the implants were inoculated in vitro with Wild type *A. actinomycetemcomitans* D7S-1. Sham-inoculated implants served as negative control. The implants were transmucosally inserted into rat maxillary alveolar ridge and were followed up for 6 weeks. Peri-implant tissues of animals were evaluated clinically. Micro-CT imaging was performed at 1-day after implant placement and 4-weeks after implant placement intervals to examine peri-implant bone volume. **Results:** Results are in the process of being finalized and are not ready at the moment. However, the results will be ready by research day. Furthermore, we anticipate to see significant difference in the amount of bone loss taking place around the implants inoculated with Wild type *A. actinomycetemcomitans* compared to the implants that are sham-inoculated. In other words, the implants inoculated with *A. actinomycetemcomitans* will have more bone loss than the sham-inoculated implants. **Conclusion:** These experiment describes a novel animal model where *A. actinomycetemcomitans* biofilm was established in vitro on titanium implant abutments prior to installation in rat oral cavity, leading to an inflammatory response, osteolysis, and tissue destruction. This model may have potential utility for investigation of persistent bacterial infection, the host responses to biofilm pathogens, anti-biofilm treatment modalities, and understanding/treating peri-implant diseases.

Poster #: 133
Title: Curcumin modulates *Candida albicans* proteolytic enzymes and inflammatory host response
Name: Emily Chen
Faculty Advisor: Ramiro Murata

Background: *Candida albicans* is the most prevalent opportunistic human fungal pathogen and has presented increased antimicrobial resistance. The restricted number of available antifungal drugs emphasizes the need for a new and more effective antifungal agent. Studies show that natural polyphenols, like curcumin can be an attractive solution. **Purpose:** The objective of this *in vitro* study is to evaluate the modulatory effects of curcumin, on major virulence factors associated with the pathogenicity of *C. albicans*, including proteolytic enzymes activity and host immune response. **Methods:** Serial dilutions of curcumin (1.5-400 μM) were tested in a susceptibility assay to determine the MIC against *C. albicans* (ATCC: SC5314/MYA2876). Proteolytic enzyme activity assays were used to detect proteinase and phospholipase activities. Co-culture models were performed to study genes expression of inflammatory host cytokines: IL-1β, IL-1α, IL-6, SAP-1 and PLB-1, using RT-PCR. Cytotoxicity assays were performed; in addition to antifungal biofilm assays, testing curcumin (62.5 and 125 μM) in comparison to a vehicle (1% ethanol), and positive (fluconazole) group. **Results:** MIC of curcumin was found to be between 6.25-12.5 μM. Proteinase enzyme activities were significantly decreased in the curcumin treated biofilms. Proteinase gene expression was not down-regulated. Gene expressions of IL-1β and IL-1α were significantly down-regulated in the curcumin group. In the antifungal biofilm assay, at 62.5 and 125 μM of curcumin, there was no significant reduction in CFU/g of dry weight of biofilms. **Conclusion:** Strong evidence supports that curcumin modulates the virulence factors of *C. albicans*, such the reduction of proteolytic enzyme activities and down-regulation of the host's pro-inflammatory response. Curcumin exhibits some antifungal activity against *C. albicans*, although not completely inhibiting biofilm formation.

Poster #: 134
Title: Numeric simulation of interferences in molars with ultrathin occlusal veneers
Name: Raymond Cheung
Faculty Advisor: Pascal Magne

Background: The finite element method (FEM) allows for the visual demonstration of the effect of occlusion on stress distribution in tooth restorations. **Purpose:** The purpose of this study was to investigate stress distribution within a maxillary molar restored with ultrathin occlusal veneers and subjected to clenching, working, and nonworking movements by an antagonistic mandibular molar. **Methods:** A maxillary first molar was modeled from micro-CT data using a medical image processing software (Mimics), a stereolithography editing/optimizing software (3-Matic) and a finite element software (Marc/Mentat). The simulated ultrathin occlusal veneer materials were Filtek MZ100 (3M ESPE) or e.max CAD (Ivoclar). The mandibular molar antagonist was a solid non-deformable geometric entity. Load cases simulated clenching, working, and nonworking movements with loading of 500N. Values of the maximum principal stress were recorded. **Results:** In the clenching load case, maximum tensile stress were located at the occlusal occlusal veneer (52 MPa for composite versus 47 MPa for ceramic). In the working movement, significant additional tensile stresses were found on the palatal root (87 MPa for composite and 85 MPa for ceramic). In the non-working movement, tensile stress on the ultrathin occlusal veneer increased to 118 MPa and 143 MPa for composite and ceramic veneers, respectively. Tensile stress peaks shifted to the mesiobuccal root (75 MPa for composite and 74 MPa for ceramic). **Conclusion:** The study clearly identified the topography of stresses generated by the various occlusal interferences. Significant tensile stress concentrations were found within the restoration's occlusal topography and root, with the nonworking interference being the most harmful and also the most revealing of the difference between the composite and ceramic ultrathin occlusal veneers.

Poster #: 135
Title: Flavonoids for CMV-induced salivary gland tumor therapy
Name: Mark Choe
Faculty Advisor: Tina Jaskoll

Background: Mucoepidermoid carcinoma (MEC) is the most common malignant tumor in major and minor salivary glands. However, there are presently no effective treatments for MEC. Our labora-

tory has shown cytomegalovirus (CMV) infection to be an important component of human MEC tumorigenesis. Since current anti-CMV drugs are limited due to toxicity and drug resistance, there is an urgent need for new anti-CMV treatments. **Purpose:** Our strategy for developing new anti-CMV therapeutics is to focus on the flavonoid family of phytochemicals, natural "anti-viral/anti-cell signaling" agents extensively used in Chinese herbal medicine, and determine their effects on CMV-host interactions. **Methods:** Embryonic day 15 (E15) and newborn ex vivo 3D submandibular gland (SMG) organs were incubated with 1x105 PFU/ml of lacZ-tagged mCMV RM427+ on day 0 for 24 hours and then cultured in virus-free media for 10 days. The flavonoid baicalein was added to culture media daily on days 6-10. SMG phenotypes and viral distribution were analyzed using H&E staining protocol and immunohistochemistry. **Results:** Baicalein treatment induces a marked decrease in tissue pathology, aberrant cell proliferation and viral infection, and a substantial increase in cell death in abnormal stroma in ex vivo mCMV-infected 3D SG organs. **Conclusion:** Our results suggest that baicalein is an effective anti-CMV treatment due to its differential toxicity, targeting the CMV-infected and affected cells while leaving the non-infected cells intact. What remains to be discovered is the molecular mechanism of flavonoid inhibition of viral infection and tissue pathology.

Poster #: 136
Title: Epigenetic control of mesenchymal stem cells in adult mouse incisor **Name:** Weston Grimes
Faculty Advisor: Yang Chai

Background: Lineage tracing in a mouse incisor model identified the neurovascular bundle (NVB) as a mesenchymal stem cell (MSC) niche. It has been shown that the methyltransferase EZH2 trimethylates H3K27me3 on chromatin. EZH2 affect regulatory genes involved in an epigenetic switch, centered on H3K27me3, which dictates MSC lineage determination. **Purpose:** We hypothesized that the MSC niche identified in the incisor will also express H3K27me3. Furthermore, the epigenetic "switch" on H3K27me3 governed by EZH2 as well as the H3K4 and SETD7 "switch" will be identifiable around this niche and demonstrate potential ways the NVB dictates MSC differentiation. **Methods:** Immunofluorescence direct tissue staining was used with antibodies to identify the location of gene expression. The antibodies used include: Tri-Methyl-Histone H3 (Lys27) (C36B11) Rabbit mAb #9733—Cell Signaling; EZH2 (D2C9) XP Rabbit mAb #5246. Staining was performed according to standard procedures. **Results:** Our data shows H3K27me3, H3K4, and EZH2 activity within the MSC niche of the cervical loop near the NVB. Additionally, our data shows the presence and activity of these MSC gene expression factors from embryonic age until adulthood. **Conclusion:** Our data validates research establishing the cervical loop of the incisor as a MSC niche. Additionally, we have shown that the epigenetic switch pathway of stem cell differentiation involving H3K27me3 and EZH2 is active within the incisor stem cell niche. Further research must be conducted to find the "off" switch of this pathway and the molecular signals secreted by the NVB to initiate stem cell differentiation.

Poster #: 137
Title: Investigating growth and differential factor 11 (Gdf11) in regulating palate development
Name: Janice Lee
Faculty Advisor: Yang Chai

Background: Growth and differential factor 11 (Gdf11) is a member of the Activin-receptor binding growth factor family and is a key regulator in development and stem cell biology. Recent studies have shown that high levels of GDF11 can reverse age-related muscle function decline. Moreover, loss of Gdf11 results in a defect in palate development, similar to loss of other Activin family members, However, the molecular and cellular mechanism of Gdf11 in regulating palatogenesis is still unknown. **Purpose:** We hypothesize that Gdf11 regulates palate development via the Activin receptor mediated pathway. **Methods:** We performed in-situ hybridization to analyze the *Gdf11* mRNA expression pattern in the palate region during embryonic development. We are generating *Wnt1-Cre;Acvr1b* $^{fl/fl}$ and *K14-Cre;Acvr1b* $^{fl/fl}$ mice to test the functional requirement for Activin signaling in palate formation. **Results:** Our preliminary data shows that Gdf11 is widely expressed in the developing craniofacial region, including the palatal shelves, at different embryonic stages. **Conclusion:** Our results demonstrate that Gdf11 is expressed in the developing palate, suggesting that the Gdf11-mediated Activin pathway may play a critical role in regulating palatogenesis.

Poster #: 138
Title: Expression of an *A. actinomycetemcomitans* catalase gene in *A. aphrophilus*
Name: Yuting Alice Yang
Faculty Advisor: Casey Chen

Background: *Aggregatibacter actinomycetemcomitans* (*Aa*) and *Aggregatibacter aphrophilus* (*A.aphr*) share 76-85% of their gene content. It was hypothesized that *Aa* genes can be expressed in *A.aphr*. This may be a novel approach to examine the role of putative virulence determinants of *Aa* in the closely related but nonpathogenic *A.aphr*. **Purpose:** As a proof of principle to insert and express a catalase gene of *Aa* (*kat*) in the genome of *A.aphr*. **Methods:** The gene *kat* of *Aa* is flanked by *gdhA* and *dnaE*. The comparable locus *gdhA-gat-dnaE* was found in the genome of *A.aphr*. Four fragments (*gdhA, kat, gat,* and a *loxP/Spe*^{r}*/loxP*) were each constructed by PCR and/or standard cloning methods. The fragments were made with restriction sites, after in vitro digestion and ligation, to generate the product *gdhA-kat-loxP/Spe*^{r}*/loxP-gat* for cloning. The fragment was then used as donor DNA to transform wildtype *A.aphr* via natural transformation. A *kat*-expressing *A.aphr* transformant was identified and the *Spe*^{r} was removed via Cre-mediated recombination of the *loxP* sites. A *kat*-deleted mutant and a *kat*-restored mutant of *Aa* were constructed. The bacteria were subjected to bactericidal assays by incubation with 0.03% hydrogen peroxide for 30 minutes. **Results:** Wildtype and the *kat*-restored mutant of *Aa* each exhibited a survival rate of 8% in the bactericidal assays. Wildtype *A.aphr* and the *kat*-deleted mutant of *Aa* exhibited a survival rate of <0.005%. The *kat*-expressing *A.aphr* mutant exhibited a survival rate of 13.2%. **Conclusion:** The *Aa* catalase gene can be inserted and expressed, and confers protection of *A. aphr* against the bactericidal effect of hydrogen peroxide.

DDS STUDENTS CLINICAL SCIENCES

Poster #: 139
Title: A patient's perspective- enhancing your practice with compassionate care
Name: Neelab Anwar
Faculty Advisor: Dennis Tartakow

Background: Twentieth century orthodontists were often active in the community, supporting social causes such as controlling caries through fluoride treatment. Orthodontists treat patients over several years, and often play a pivotal role in their lives. Later, when patients are asked about their experience, they are likely to remember details of their orthodontic treatment as well as the doctor's manner and attitude. However, today some patients have become increasingly critical of orthodontists. Through social media and word of mouth, negative comments can circulate at a rapid rate. It is critical for orthodontists to render the highest level of professional care to their patients. **Purpose:** Getting braces is a monumental step for any individual, but especially for young children and teens. However, is today's standard of care in orthodontics on par with the increasingly informed and aware patient? Can compassion improve the patient's experience? Is there a need for the orthodontist to convey increased compassion and awareness? **Methods:** A survey was administered to 21 randomly selected patients who completed full orthodontic treatment. For this survey, full orthodontic treatment consisted of those who had brackets placed on their maxillary and mandibular teeth for at least 12 months. The 21 participants were 18 years or older located in Los Angeles, California. The survey participants involved 12 girls and 9 boys and the questions were used to assess whether orthodontists had made a positive impact on the 21 survey individuals. In addition, the survey was used to gauge his or her overall orthodontic experience. Participants were asked to rank answers to questions on a scale of 1-5 that corresponded with their level of agreement. Five was the highest score, indicating that their orthodontist demonstrated the qualities listed, were thoughtful, skillful, compassionate, and empathetic. One was the worst score, indicating that their orthodontist

did not demonstrate any of the qualities stated, was rushed, unappreciative, unresponsive, and lacking in gentleness and understanding. **Results:** One of the questions asked: Did the orthodontist gain his or her trust at the initial appointment? This question judged whether patients felt comfortable speaking to orthodontists and if orthodontists were interested in speaking to patients. A majority of the participants scored in the 2-3 range, indicating that his or her respective orthodontist did not demonstrate a majority of qualities listed. Also, when asked if the monthly orthodontic experience was stressful, the majority of participants marked scores below 3. In response to questions of orthodontist thoughtfulness and attentiveness to patients' needs, the majority of patients were neutral. When ranking orthodontists' quality of time spent with patients, most participants were neutral or responded with a score of 2. Interestingly, when patients asked about their overall experience on a scale of 1-5, the majority of interviewers marked 3, indicating a neutral viewpoint. **Conclusion:** When speaking to survey participants, several words were consistent with regard to what qualities orthodontists should have. These qualities included compassion, empathy, and being present in the moment. These traits may sound simplified, but many health practitioners tend to overlook them, especially in today's modern, fast-paced society. However, these qualities may be easily achieved through minor changes in behavior, attitude, and perspective. Orthodontists must show empathy and compassion, and be mentally present with their patients so that the orthodontic experience is more pleasant and meaningful. Having braces is a milestone in one's life. Orthodontists must have a passion to provide the best treatment and highest experience for their patients. They should value and get to know each patient to make important contributions to the quality of their patients' lives.

Poster #: 140
Title: The mylohyoid nerve block in failed mandibular anesthesia
Name: Omar Kholaki
Faculty Advisor: Natalie Tung

Background: The failed inferior alveolar nerve (IAN) block can be a frustrating experience, for both the practitioner and the patient. The standard technique widely taught and utilized by many is the Halstead approach, yet it boasts a success rate ranging between 71-87%. **Purpose:** The mylohyoid nerve, once thought to be a purely motor nerve, has since been identified as an accessory sensory nerve innervating the mandibular teeth. The incidence of accessory innervation of the mandibular teeth has been described to be as high as 60% and may cause inadequate mandibular anesthesia. This project aims to summarize leading theories in accessory innervation and ways to combat a failed mandibular block. **Methods:** Literature review was conducted using the phrases: mylohyoid accessory innervation, failed inferior alveolar nerve block, incomplete mandibular anesthesia, and mandibular accessory innervation. **Results:** Literature discussing the use of the mylohyoid nerve block were reviewed, summarized and discussed. **Conclusion:** The division of Oral and Maxillofacial Surgery at the Herman Ostrow School of Dentistry of USC has been advocating the use of the mylohyoid nerve block, as described by Dr. Malamed, in its pre-doctoral clinic to combat the failed IAN bock. The mylohyoid nerve block is an easily learned technique that can give be given by dental students, who are usually inexperienced. To date, a total of 18 successful cases with no reported failures have been described with the use of 4% articaine with 1:100k epinephrine, as well as 2% Lidocaine with 1:100k epinephrine.

Poster #: 141
Title: Biodentine as a primary molar pulpotomy medicament
Name: Saman Mostajabian
Faculty Advisor: Thomas Tanbonliong

Background: Biodentine is a calcium-silicate based material that has been advocated to be used in various clinical applications, such as root perforations, apexification, pulp capping procedures, and dentine replacement. **Purpose:** To determine the success rate compared to other medicaments currently used for pulpotomies in primary teeth. **Methods:** Two patients, both with severe early childhood caries, were treated under general anesthesia for complete oral rehabilitation due to the extent of their dental needs and apprehensive behavior. Biodentine was placed after pulpotomies were performed on their primary first and second molars. The teeth were restored with stainless steel crowns. A clinical and radiographic examination was performed at the patients' recall visits. The average follow up was 9 months. **Results:** The teeth exhibited no evidence of clinical and radiographic pathology. Biodentine appears to be an effective medicament for pulpotomies on primary molars. Longer follow up is necessary to determine its success compared to other medicaments currently used for pulpotomies in primary teeth. **Conclusion:** Biodentine can be an effective medicament for pulpotomies on primary molars.

Poster #: 142
Title: Facebow transfer and jaw relations
Name: Bin Na **Faculty Advisor:** Dennis Tartakow

Background: The evaluation of how teeth fit and function together in relation to the temporomandibular joints (TMJ) is often overlooked. Purpose: The purpose of this research centered upon current scientific literature involving facebow transfer and gnathology for understanding jaw relations and the significance of properly articulating a patient's dental casts. Its intention was to contribute to improved diagnosis and treatment planning, especially for prosthodontic and orthodontic treatment. **Method:** The research method used in this study included and addressed the historical and contemporary prosthodontic and orthodontic perspectives of facebow transfer and jaw relations. **Results:** This exhibit demonstrates the principles, significance and applications of facebow transfer and jaw related records. It includes the reasons for accurately recording jaw relationships and bite registration, providing the mechanical environment for mounting opposing dental casts accurately on an articulator. The principles of facebow transfer employed when used with a fully adjustable articulator allow for accurate, mechanical replication of the paths of movement of the mandibular condylar and anterior guidance determinants. The facebow choice, purpose and materials for jaw relation recording are discussed. **Conclusion:** Facebow transfer and dental cast articulation are important diagnostic records for new patients and are valuable keys to providing high quality patient treatment.

Poster #: 143
Title: Dental students' perceptions of LGBTQ patient care and HIV testing
Name: Jonathan Nguyen
Faculty Advisor: Piedad Suarez

Background: With increasing visibility of patients who identify as lesbian, gay, bisexual, transgender, and queer (LGBTQ) and increasing number of new annual HIV infections, there is a need for cultural competency of dental providers. **Purpose:** This study aims to assess the LGBTQ cultural sensitivity perceived by dental students and assess their attitudes towards Rapid Oral HIV testing in the dental environment and general HIV testing. **Methods:** During the Cultural Sensitivity module in the beginning of their clinical year, D3 students (n=165) were given an anonymous and voluntary 9-item survey. **Results:** It was found that while a majority of students (75.8%) would not ask their patients for their sexual orientation and gender identities (SOGI), they feel comfortable discussing SOGI information to LGBTQ patients (62.4%). Although 67.3% students believe that their academic institution has not prepared them to address issues experienced by LGBTQ patients, they feel comfortable treating LGBTQ patients (98.2%). In regards to HIV testing, a majority of respondents (79.4%) reported that they would offer an oral Rapid HIV test in their dental practice. Despite this interest, 52.1% of respondents report never having an HIV test before and 33.9% did not know of a place to comfortably and willingly take an HIV test. **Conclusion:** Dental students have interest and willingness for LGBTQ patient care

and HIV testing. More exposure and training during the clinical years would improve the comfort level of the students in LGBTQ patient care and HIV testing.

Poster #: 144
Title: Long-term adhesive performance of a novel CAD/CAM zirconia-reinforced lithium-silicate glass-ceramic
Name: Esra Salihoglu Yener
Faculty Advisor: Sillas Duarte

Background: Dental materials are normally introduced to the market without enough research to support their clinic use. **Purpose:** Evaluating the effect of different etching times and silane coupling agents on long-term micro tensile bond strength (μTBS) to zirconia-reinforced lithium-silicate glass-ceramic. **Methods:** 24 CAD/CAM blocks (14.0x14.0x4.0mm) of Celtra Duo (Dentsply) were divided into 4 groups (not-etched, etched with 5% hydrofluoric acid for 20s, 60s, and 120s). Each group was divided into 3 subgroups, according to the type of silane [no silane, RelyX Ceramic Primer (3M ESPE), Clearfil Ceramic Primer (Kuraray)]. Composite disks (5.0mm of thickness, 14mm diameter; Paradigm MZ100, 3M ESPE) were cemented to the blocks using a dual-cure resin cement (RelyX Ultimate, 3M ESPE). The samples were artificially aged by thermal cycling (20,000cycles), sectioned into sticks with a cross sectional area of 0.8±0.2mm2 and then tested for μTBS at a crosshead speed of 1 mm/min. Data was subjected to two-way ANOVA followed by Tukey HSD post hoc tests (α=0.05). **Results:** μTBS means (in MPa±SD), and statistical results

Etching Time	Silane		
	No	RelyX	Clearfil
No	8.05±4.6^{aA}	12.23±6.1^{aA}	19.65±8.5^{aB}
20s	28.83±8.1^{bA}	35.08±8.7^{bB}	38.28±7.8^{bB}
60s	37.78±8.3^{cA}	37.45±8.6^{bA}	41.85±8.3^{bcA}
120s	32.76±7.7^{bA}	38.61±9.2^{bB}	45.24±5.7^{cC}

Within the same column, means with same superscript lower-case letters are not statistically different (P>0.05). Within the same row, means with the same superscript upper-case letters are not statistically different (P>0.05).

Conclusion: For stable long-term bond strength of a dual-cure resin cement to zirconia-reinforced lithium-silicate glass ceramic blocks etching with HF acid and application of a ceramic coupling agent are essential.

Poster #: 145
Title: Comfort of graduating dental students with pediatric dentistry
Name: Mona Dousti
Faculty Advisor: Julie Jenks

Background: The aim of this study was to determine how fourth-year dental students at USC perceived their level of competence related to Pediatric dentistry. **Purpose:** The survey seeks information across a comprehensive range of pediatric dentistry training including behavior management and clinical procedures such as treatment planning, Prophylaxis, operative treatment. **Methods:** A 25 question written survey was administered to senior dental students when they signed out of pediatric dentistry. Comparison between Mobile clinic Vs non-Moblie clinic and Advanced education Vs non-advanced education, and Pedo study club/selective Vs non-Pedo study club/selective, and involved in community service Vs not involved in community service were made and analyzed. **Results:** Behavior management of patients during the dental examination and treatment plan: student doctors who are Pedo selective, Pedo study club, and had Mobile clinic and community service experiences are more comfortable with treating pediatric patients. Regarding behavior management of patients during operative procedures, a majority of respondents were uncomfortable with treating infants from 0 to 5. Mostly students involved in Mobile clinic, Advanced education, and in community service are more comfortable to treat pediatric patients than other classmates. **Conclusion:** Students who attended mobile clinic and other community rotations responded that they were comfortable with treating infants and toddlers. Most of senior dental students with pediatric dentistry experience upon graduation were proficient with providing an initial dental examination and treatment plan, but reported having difficulty with operative dental procedures with infants and toddlers.

Poster#: 146
Title: Invisalign: past and present
Name: Benjamin Garai
Faculty Advisor: Dennis Tartakow

Background: Invisalign is manufactured by Align Technology, a multinational medical-device company headquartered in San Jose, California (Phulari, 2013). The company was founded in 1997 by Zia Chishti, a Stanford MBA. A background in computer science gave Chishti the insight that it was possible to design and manufacture an entire series of clear orthodontic devices similar to the retainer he wore, using 3-D computer graphics technology to straighten teeth (Feder, 2000). The process has now evolved to make extensive use of 3D printing for creating a series of braces to apply gentle pressure to straighten teeth over several months. In 2000 Align Technology planned a $31 million television advertising campaign (Phulari, 2013). By 2001, 75% of the 8,500 orthodontists in North America had been trained on the Invisalign system. That same year, Align Technology made Invisalign available to general dentists following a class-action lawsuit that alleged making the system available only to orthodontists resulted in unfair competition for dentists (Jewel, 2001). In 2012 alone, the company printed 17 million aligners for patients (Kuncio, 2014). **Purpose:** The purpose of this research centered upon current scientific literature involving Invisalign for understanding how the system functions to produce orthodontic tooth movement, how the Invisalign aligners are manufactured, and discuss Invisalign's key benefits, drawbacks, and limitations. **Methods:** The research method used in this study included and addressed the historical development and contemporary use of Invisalign as orthodontic treatment. Source material came mainly from a review of the scientific literature of the past 12+ years. **Results:** Invisalign can be used in some orthodontic cases involving crowding, spacing, underbite, overbite, crossbite, and openbite (Kuncio, 2014). Aligners can be left out for up to four hours each day, making eating, brushing, taking photos, attending big events, or intimacy easier (Kuncio, 2014). Patients experience less pain, have easier care of the aligners and with oral hygiene, and there are fewer dietary restrictions as compared to traditional braces (Kuncio, 2014). The treatment planning software, ClinCheck, is an excellent tool for visualizing and analyzing potential treatment outcomes, especially when preparing for future restorative work (Kuncio, 2014). There is also the esthetic or "invisibility" factor, though lingual braces are probably more undetectable to laypeople than Invisalign, and have been around for decades (Kuncio, 2014). Disadvantages of Invisalign includes limited control over root movement, limited intermaxillary correction (limited anteroposterior changes) without the use of elastics between the aligners, and cost (Mitchell, 2013). Fixed appliance (braces) therapy is more effective and efficient for three-dimensional tooth position and alignment (Harpenau, Sanz, & Lundergan, 2013). There are numerous cases in which Invisalign is contraindicated. Computer assisted therapy (ie. Invisalign) is unsuitable when teeth are still erupting, when extractions are required, when a correction will be greater than 4 mm, an overbite greater than 50%, crowding greater than 6 mm to be corrected to ideal, impacted teeth that need to erupt (Goldstein, 2002). It is also unsuitable when severely tipped teeth must be uprighted, when severely rotated cuspids and bicuspids

require correction, when tooth extrusion or intrusion greater than 3 mm is required, when cuspids or molars require more than 3 mm to achieve a Class 1 occlusion, surgical-orthodontic cases, treatment of temporomandibular joint problems (Goldstein, 2002). **Conclusion:** Though the Invisalign system may be a useful tool for clinicians and patients looking for a relatively esthetic alternative to traditional braces, the system does have numerous limitations that are critically important for any clinician utilizing Invisalign to be thoroughly knowledgeable of and to clearly communicate to patients as part of the consent process.

OTHER AFFILIATED RESEARCHERS

Poster #: 147
Title: Comparison of palatal expansion in children with and without cleft
Name: Ibtesam Alyazeedy
Faculty Advisor: Stephen Yen

Background: Rapid palatal expansion is a common method for expanding the maxillary arch in non-cleft patients. Different methods are being used and evaluated. **Purpose:** The purpose of this study was to evaluate the dentoalveolar effects of rapid maxillary expansion (RME) in children with unilateral complete cleft lip and palate (UCLP) in comparison with non-cleft patients. **Methods:** The experimental group (EG) was composed of 24 patients with unilateral and complete cleft lip and palate (9 males and 15 females) with a mean age of 10.6 years. The control group (CG) comprised 27 patients without cleft lip and palate (14 males and 13 females) with a mean age of 9.1 years. Dental models of the maxillary dental arch were obtained immediately pre-expansion (T1) and 6 months post-expansion (T2) at the time of appliance removal. Digital dental models were obtained using the 3Shape R700 3D laser scanner (3Shape A/S, Copenhagen, Denmark). Transversal widths, arch perimeter, arch length, palatal depth, palatal volume, canine and posterior tooth inclination were digitally measured. Paired t-tests were used to perform interphase comparisons and independent t-tests to perform intergroup comparisons ($p<.05$). **Results:** In the experimental group, the expansion produced a significant increase of all maxillary transverse measurements, palatal volume, arch perimeter and palatal depth, while there was a decrease in the arch length. RME caused a buccal tip of posterior teeth in patients with UCLP. No differences were observed between experimental and control groups for any of the measurements performed except for the intermolar distance (6-6), which showed a greater increase in patients with cleft. **Conclusion:** Rapid maxillary expansion showed similar dentoalveolar effects in children with UCLP and without oral clefts.

Poster #: 148
Title: PRMT4 regulates Runx2 methylation and osteogenic differentiation
Name: Yongchao Gou
Faculty Advisor: Jian Xu

Background: Runx2 plays an important role in osteoblast differentiation and skeletal development. Runx2 determines the lineage of osteoblastic cells from multipotent mesenchymal cells, enhances osteoblast differentiation at an early stage, and inhibits osteoblast differentiation at a late stage. In addition, Runx2 is involved in the production of bone matrix proteins. Post-translational modification of Runx2 regulates its function in osteogenic differentiation. We identified a novel modification of Runx2, arginine methylation by the protein arginine methyltransferase PRMT4. Our work aims to understand the molecular mechanism and biological significance of PRMT4-mediated Runx2 methylation in osteogenic differentiation. **Purpose:** We hypothesized that PRMT4 regulates osteogenic differentiation through methylation of Runx2. **Methods:** MC3T3E1.4 preosteoblast cell culture, western blots, in vivo methylation and in vitro methylation. **Results:** We found that knockdown of PRMT4 in MC3T3E1.4 cells attenuates osteogenic differentiation. PRMT4 binds to Runx2 in 293T cells. Furthermore, PRMT4 methylates Runx2 both in vivo and in vitro. **Conclusion:** PRMT4 plays an important role in osteogenic differentiation and this role is potentially associated with a regulatory function on Runx2 activity via Runx2 methylation. Our future work will define the molecular mechanisms and biological function of PRMT4-mediated Runx2 methylation in osteogenic differentiation. Findings from this work will potentially provide novel targets for enhancing bone formation through manipulating PRMT4-Runx2 pathway.

Poster#: 149
Title: What's new in FaceBase 2.0?
Name: Thach-Vu Ho
Faculty Advisor: Yang Chai

Background: Since its establishment in 2009 by the National Institute of Dental and Craniofacial Research (NIDCR), the aim of the FaceBase consortium has been to generate a comprehensive resource of datasets on craniofacial development to support the craniofacial research community. Craniofacial abnormalities such as mandibular dysmorphogenesis and orofacial clefting are observed in multiple syndromes. However, the relevant mechanisms of regulating craniofacial bone development remain unknown. **Purpose:** To generate genetically engineered animal models for understanding cellular mechanisms underlying the etiology and pathogenesis of craniofacial abnormalities in humans. We are interested in investigating the functional genomics, analyzing cell lineages and performing dynamic imaging of mandible and maxilla development. **Methods:** *Wnt1-Cre;Tgfbr2$^{fl/fl}$, Wnt1-Cre;Alk5$^{fl/fl}$, Msx1-/-*, and control mice were generated at different embryonic stages, E10.5 to E18.5, and post-natal day 0 (P0). All mutant strains were maintained in a C57BL/6J background. **Results:** For FaceBase 2.0, we have generated 36 microCT scans of E16.5, E18.5, and P0 littermate controls for *Wnt1-Cre;Tgfbr2$^{fl/fl}$* and *Wnt1-Cre;Alk5$^{fl/fl}$* mice. We also have generated microarray data of the wild types at E11.5-E14.5 comparing the gene expression patterns in the distal versus proximal regions of the maxilla and mandible. **Conclusion:** The availability of these datasets and datasets from other spoke projects through the FaceBase Consortium allows the craniofacial research community to study the underlying mechanisms of craniofacial abnormalities. The aim of FaceBase Consortium is to integrate all these datasets and create innovative, interactive visualization and interactive tools for the cranio-

facial research community.

Poster #: 150
Title: Rehabilitation practitioners' prioritized care processes in hip fracture post-acute care
Name: Lauren Kim
Faculty Advisor: Natalie Leland

Background: Poor post-acute care (PAC) outcomes are pervasive among hip fracture patients, raising concerns about the quality of care. To enhance patient outcomes and guide clinical practice, stakeholder-driven evidence-based care processes must be defined. **Purpose:** The objective was to quantify rehabilitation providers' perceptions of best practices in hip fracture PAC by ranking current evidence-based processes. **Methods:** Purposive sampling of PAC facilities in Los Angeles County was conducted to ensure variation in organizations, staff, and patients. The sample included occupational and physical therapy practitioners from 11 participating facilities. Participants selected the top five care processes for each of the seven clinical domains, including 12 care processes in assessment (N=12), intervention (N=21), caregiver training (N=28), patient education (N=27), discharge planning (N=19), patient-centered care (N=34), and communication (N=29). The frequency of endorsement for each process was calculated and ranked. **Results:** The most frequently endorsed care process in the assessment domain was developing meaningful goals with patient input (75%). The use of assistive devices was the most frequently endorsed in the intervention (68%) and patient education (59%) domain. Information on purchasing assistive devices was prioritized in discharge planning (50%). Fall prevention was endorsed in patient/family-centered approach (43%) and caregiver education (43%). Being informed of patients' precautions was the most frequently endorsed in the communication domain (58%). **Conclusion:** Evidence-based processes that reflect best practices for hip fracture PAC were identified. These findings lay the foundation for future work evaluating the extent to which these care processes are delivered in clinical practice, associated with patient outcomes, and valued by other stakeholders.

Poster #: 151
Title: 3D micro-CT analysis of tooth development
Name: Esmeralda Lugo
Faculty Advisor: Yang Chai

Background: Throughout the years, the standard form of imaging for soft tissue has been Magnetic Resonance Imaging (MRI). This process of non-invasive imaging poses a problem for scientists that wish to examine the craniofacial muscles that relate to the development of the palate and teeth formation. Fortunately, micro-computed tomography (micro-CT) has allowed for the generation of proper images of the palatal area, as it provides increased resolution and 3D reconstructed images. **Purpose:** This project focuses on the generation of CT images of mice mandibles at the age of 2 weeks. We are studying the role of the *EZH2* gene, which is involved in tooth development in adult mice. **Methods:** We used two models, *Osr2-Cre;EZH-2$^{fl/fl}$* mutants, where *EZH2* is knocked out in the mesenchymal cells, and *K14-Cre;EZH2$^{fl/fl}$* mutants, where *EZH2* expression is compromised in the epithelial cells. We generate and analyzed micro-CT images of 2-week-old mice from *Osr2-Cre;EZH2$^{fl/fl}$* and *K14-Cre;EZH2$^{fl/fl}$* mice as well as their normal littermates as controls. **Results:** It appears that the mice with the mesenchymal (*Osr2-Cre*) *EZH2* knockout experienced abnormal tooth root development compared to the control and epithelial (*K14-Cre*) *EZH2* knockout groups. This suggests that mesenchymal stem cells are involved in regulation of tooth development. **Conclusion:** As micro-CT becomes more widely used, it helps expand our understanding of different mouse models of tooth development. It is a useful tool for visualizing phenotypes that occur due to altered genetic expression in mutant mouse models.

Poster #: 152
Title: FGFR2 regulates ribosome biogenesis during osteoprogenitor cell differentiation
Name: Xiaojing Mao
Faculty Advisor: Amy Merrill

Background: Ribosome biogenesis is a defining element in cell growth, proliferation and differentiation. It is striking that disruption in ribosome biogenesis leads to specific, overlapping skeletal phenotypes. The regulatory mechanism for ribosome biogenesis largely depends on the transcription of the 200 tandem repeats of rDNAs. *Fibroblast Growth Factor Receptor 2* (*FGFR2*) is important in skeletal development. Our lab has recently identified two *FGFR2* mutations from the congenital skeletal disorder Bent Bone Dysplasia Syndrome (BBDS). By studying these mutations, we discovered that FGFR2 activates rDNA transcription directly from within the nucleolus. This nucleolar FGFR2 pathway enhances osteoprogenitor cells' proliferation over differentiation, but the molecular mechanism is unclear. **Purpose:** To characterize the normal progression of ribosome biogenesis during osteoblast proliferation and differentiation, and to understand the role of FGFR2 in activating rDNA transcription in osteoprogenitor cells. **Methods:** We performed in vitro differentiation assays in mouse calvarial preosteoblasts MC3T3-E1. The levels of 45s rRNA and osteoblast differentiation genes are detected by RT-qPCR. We performed fluorescent O-Propargly-puromycin assay to detect the global protein synthesis. We applied Methylation-Sensitive Restriction Enzyme (MSRE) assay to detect the methylation states of ribosome DNA promoters in osteoprogenitor cells. Chromatin remodeling was detected via Chromatin Immunoprecipitation (ChIP). **Results:** During the in vitro osteoinduction, we found that the levels of 45s pre-rRNAs, ribosomes, and protein synthesis were downregulated at differentiation day 3. However, the rDNA promoter methylation states didn't have a significant change. Chromatin remodeling complexes are recruited during osteoblast differentiation. **Conclusion:** Ribosome biogenesis changes over osteoinduction in vitro. In osteoprogenitor cells, FGFR2 occupies the rDNA promoter where it interacts with FGF2 and the RNA Pol I specific transcription factor UBF1, limiting transcriptional repressions by RUNX2. Enhanced FG-

FR2-mediated activation of rDNA transcription holds osteoprogenitor cells in a proliferate state that resists differentiation.

Poster #: 153
Title: Suture stem cells aid repair of cranial critical size defects
Name: Shery Park
Faculty Advisor: Yang Chai

Background: Critical size defects (CSDs) are conventionally defined as the smallest size intraosseous wound in a particular bone and species of animal that will not heal spontaneously during the lifetime of the animal. CSDs have been used routinely to test the osteogenic capacities of different bone repair techniques. The standard rodent CSD model is a 5mm round defect in a mouse calvarial bone. Recent studies have shown that 1.8mm or 2mm defects created in mouse calvaria fail to heal within 6 or 12 weeks, indicating that defects much smaller than critical size do not spontaneously heal in short time periods. Significantly, we recently discovered that craniofacial sutures provide a niche for mesenchymal stem cells (MSCs), which may play an important role in facilitating the healing of CSDs. **Purpose:** We hypothesize that craniofacial sutures possess better regeneration potential than other regions of the craniofacial bone due to the resident stem cell population. **Methods:** Injury sites were created with a half-round bur at different locations in the calvaria at varying distances from the sagittal suture in order to test how craniofacial suture MSCs contribute to the healing of CSDs. **Results:** After 6 weeks of healing, we compared the size of the injury sites remaining unhealed versus the distance from the sagittal suture. Following statistical analysis, we determined that the suture region has a stronger regeneration potential than other regions of the calvarial bone. **Conclusion:** Our study provides evidence that the suture MSCs of the craniofacial suture are critical for injury repair. Further studies of larger animals are necessary to understand the underlying mechanism of suture stem cell repair of CSDs.

Poster #: 154
Title: Smad6 methylation maintains homeostasis in gingival tissue
Name: Tingwei Zhang
Faculty Advisor: Jian Xu

Background: TGF-β is an anti-inflammatory cytokine that antagonizes Toll-like receptor (TLR) signaling-induced inflammatory responses. TGF-β induces the expression of Smad6, which promotes the degradation of TLR signaling adaptor MyD88 to attenuate inflammatory responses. We identified a novel mechanism to modulate Smad6 activity. Smad6 is methylated at the N-terminal region by a methyltransferase PRMT1. Methylation status defines Smad6 interaction with co-factors to modulate its activity. **Purpose:** We hypothesized that Smad6 methylation defines Smad6 interaction with MyD88 to modulate TLR4 and TGF-β signaling crosstalk and maintains homeostasis in barrier epithelium. **Methods:** Cell culture; immunoprecipitation; immunostaining; mouse model of ligature-insertion induced periodontitis; western blot. **Results:** We found that PRMT1-mediated Smad6 methylation regulates Smad6/MyD88 complex formation and LPS-induced NF-kB signaling. Besides, Smad6 methylation mediates TGF-β and BMP-induced repression of TLR4-MyD88-NF-kB activation in both normal human skin epithelial cells and mouse primary gingival epithelial and fibroblast co-culture. Furthermore, the Smad6 expression profile differs between healthy gingival tissue and periodontitis tissue. **Conclusion:** Our data suggest that Smad6 methylation is needed for TLR and TGF-β signaling crosstalk. Our future studies aim to establish a role for Smad6 methylation in the periodontal inflammatory processes.

Poster #: 155
Title: Mesenchymal stem cell-mediated regeneration of craniofacial and cortical bone
Name: Zoe Johnson
Faculty Advisor: Yang Chai

Background: Current methods for the reconstruction of cranial and long bones are inadequate for large defects that do not regenerate spontaneously. Cranial bone is cortical, while long bones have a cortical shell with a cancellous bone marrow space. These sites therefore pose different challenges for tissue engineering. Postmigratory cranial neural crest cells (CNCC) and bone marrow stem cells (BMSC) have been shown to possess mesenchymal stem cell characteristics such as multipotential differentiation capability and self-renewal. After transplantation, CNCCs form cortical bone, while BMSCs form cortical and cancellous bone with marrow space. **Purpose:** To test the differential abilities of CNCCs and BMSCs to repair critical cranial and long bone defects, with the aid of a 3D-printed scaffold implant. **Methods:** To test growth of cells in vivo, CNCCs and BMSCs were harvested from wild type mice, mixed with hydroxyapatite/tricalcium phosphate (HA/TCP) to stimulate bone formation, and transplanted subcutaneously into immunosuppressed mice. To achieve custom-designed bone quality (cortical versus cancellous) and density during tissue regeneration, a biodegradable, 3D-printed scaffold was designed to support the cells in vivo at the injury site. **Results:** CNCCs and BMSCs maintained viability and grew evenly on a preliminary scaffold in vitro. After subcutaneous transplantation into a host animal, CNCCs and BMSCs formed distinct types of bone. **Conclusion:** The design and printing material of the 3D scaffold will be optimized for cell growth. To study the mechanism by which cells form and differentiate, we will investigate *Wnt1-Cre;tdTomato* and *LEPR-Cre;tdTomato* mouse models. In mice and larger animal models, we will examine the integrity of transplanted CNCCs and BMSCs at the site of a critical-sized calvarial bone defect.

RESEARCH DAY

2016

FROM THE **EDITORS**

To our fellow students, faculty and staff:

It is our honor and privilege to help showcase this year's Research Day by bringing you the 8th edition of *The Explorer Journal of USC Student Research*. This is truly an exciting time to be editors-in-chief of this journal. In this edition, our talented student authors have brought you to the forefront of some of the innovative and game-changing research being conducted within the numerous programs at the Herman Ostrow School of Dentistry of USC, including the Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy and the Division of Biokinesiology and Physical Therapy, all of which are proud members of the Ostrow family.

Moreover, it is with great pride that we are able to share with our readers the exciting research currently being done by two of our own colleagues, members of the Doctor of Dental Surgery classes of 2017 and 2018, through our *Student Spotlight* section. Their contributions, though only a sample of the current research being done by our student body, show that the future is bright for the research program at the Ostrow School, and for our profession as well.

It is our hope that through reading this journal, students who are currently interested in doing research will be inspired to contact faculty and explore the many research opportunities that are available. We would like to congratulate all of our 2016 student and faculty research presenters on their curiosity and dedication. We are proud to showcase your hard work, and hope to see your research in future editions of *The Explorer*.

Fight on!

Emil Simanian & Katherine Schwartz

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Cover Photo: Dr. Ruchi Bajpai
7-day-old transgenic zebrafish embryo ventral view

Title page: Dr. Pascal Magne
Transparent 3D model of a mandibular molar obtained from micro CT scanning

Table of Contents: Dr. Pascal Magne
Silver coated stone replica of natural dentition

Back cover: Dr. Hu Zhao
Mouse molar tooth germ

The Explorer Journal of Student Research is published annually by members of the student body of the Herman Ostrow School of Dentistry of USC.

STUDENT RESEARCH GROUP | SRG

2015–2016

THE EXPLORER JOURNAL OF USC STUDENT RESEARCH, VOLUME 8

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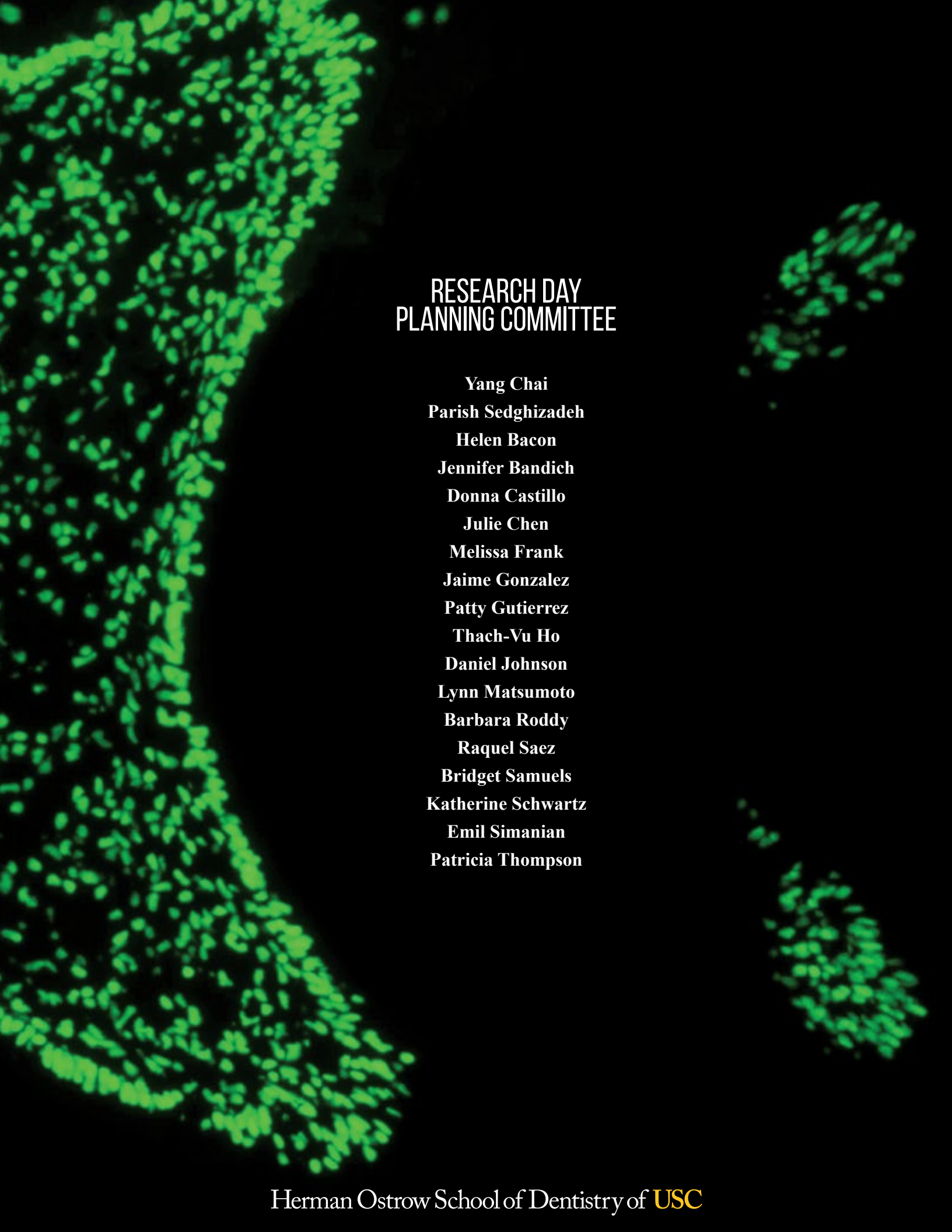

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