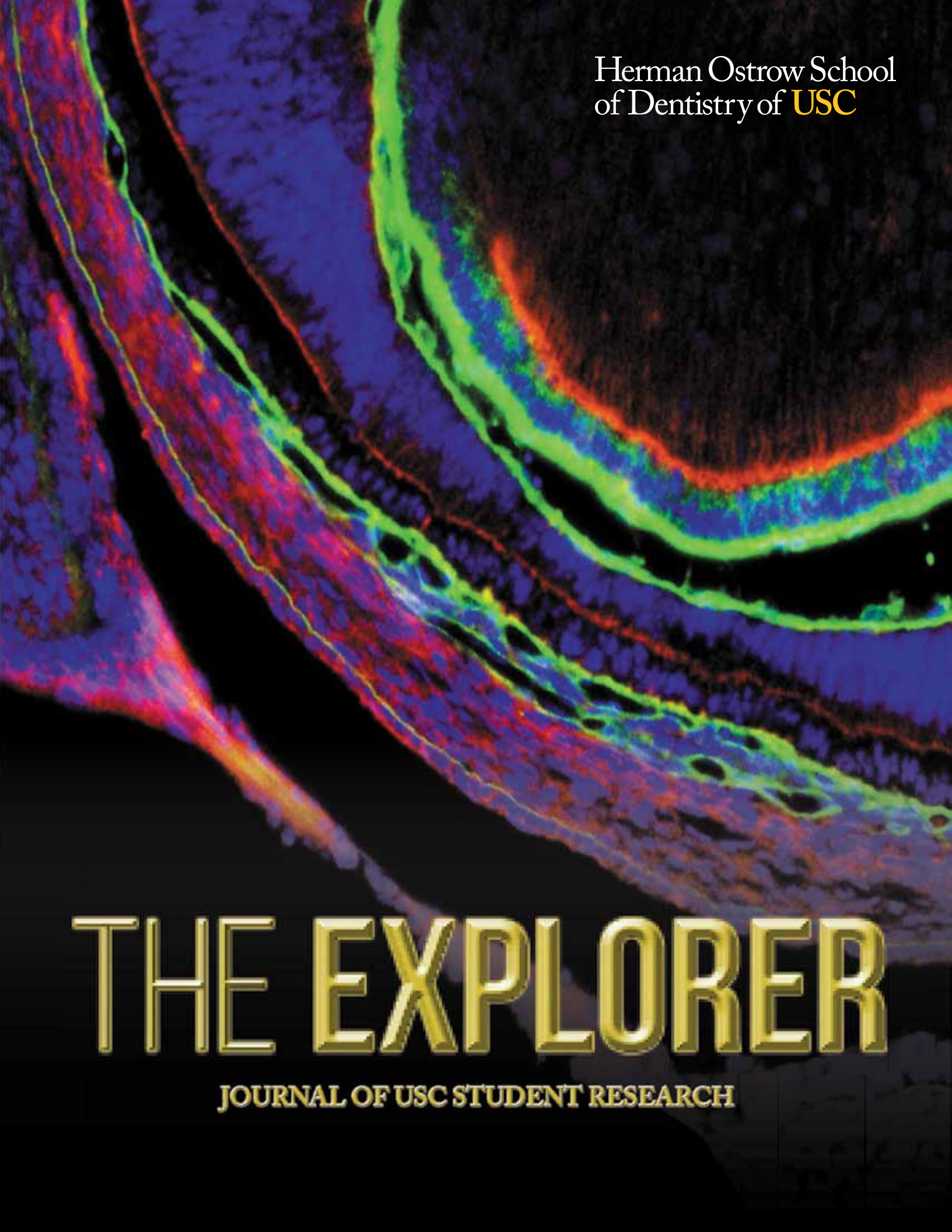
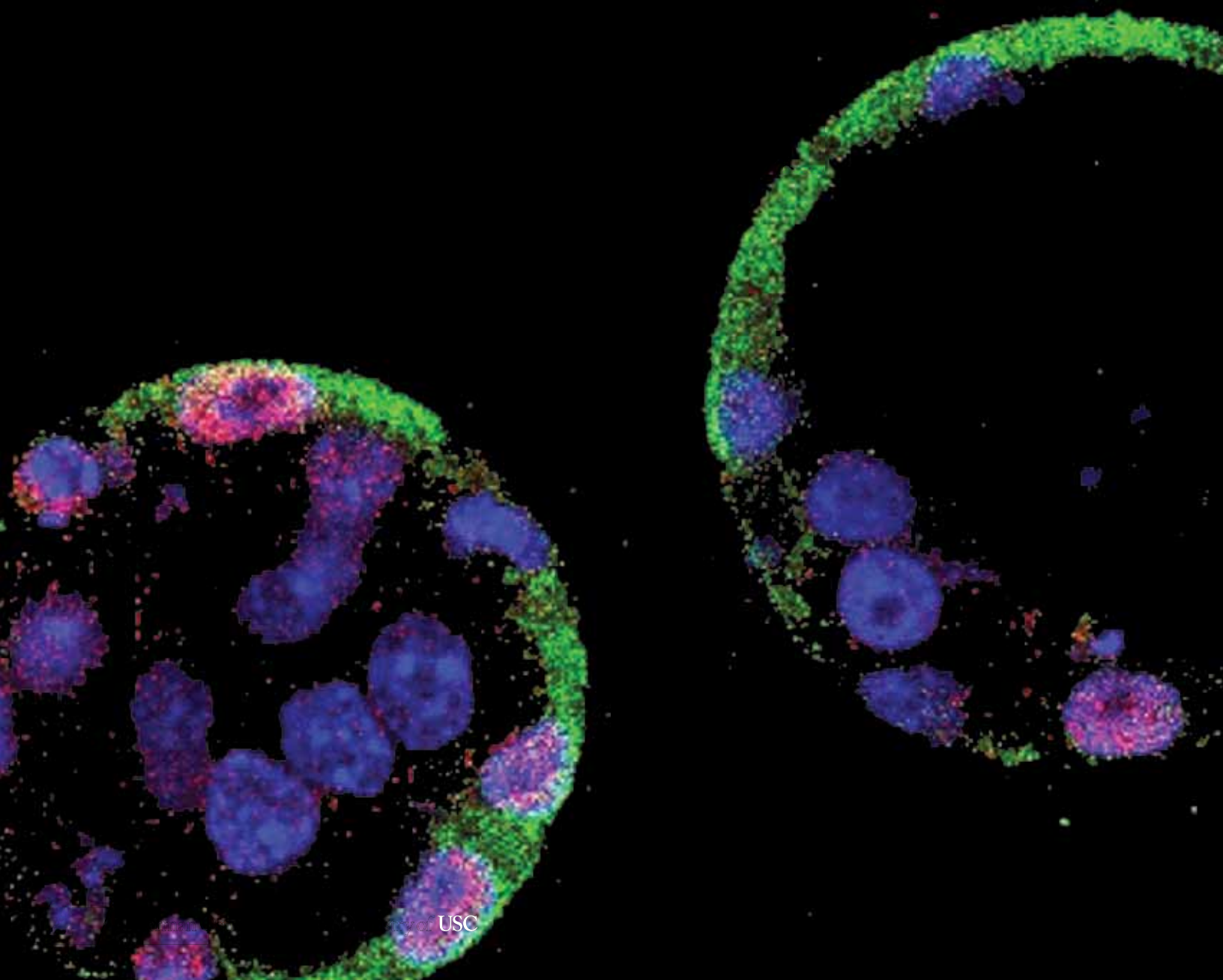




Herman Ostrow School  
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# THE EXPLORER

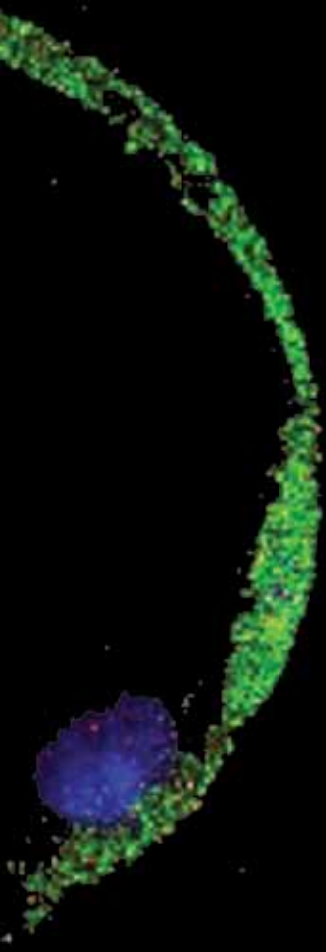
JOURNAL OF USC STUDENT RESEARCH



# THE EXPLORER

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VOLUME 7



USC | SRG

Research Day - March 25, 2015

Herman Ostrow School of Dentistry of USC





# FROM THE DEAN

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Dear students and colleagues,

Welcome to Research Day 2015! It is always with great anticipation that I attend this annual event, one of USC's only such events dedicated to scientific inquiry and innovation.

It is truly inspiring to see the curiosity and excitement in the faces of our dental faculty and students as well as those researchers from the USC Chan Division of Occupational Science and Occupational Therapy and the USC Division of Biokinesiology and Physical Therapy as they talk so passionately about their research. Better still, I can confidently say I always walk away from Research Day, having learned something new. I hope you all will be able to say the same.

We take scientific research very seriously at the Herman Ostrow School of Dentistry. In fact, the dental school has been the top-funded private dental institution by the National Institute of Dental and Craniofacial Research for two years in a row. On both campuses, some of dentistry's brightest minds are working tirelessly to solve some of oral and craniofacial health's most vexing problems.

This commitment to scientific discovery doesn't stop at dentistry. Our colleagues in occupational

therapy and physical therapy lead the way as the No. 1-ranked schools in the U.S. News and World Report's list of top graduate schools. As their profession's leaders, they often set the research agenda and lead federally-funded research efforts.

This focus on research is critical for our students. We often talk about how we must prepare our students to perform in the world not as it is today but how it will be in 10, 15 or 20 years down the road. While we may be able to pinpoint trends in our professions, there's no way to predict the future. But by preparing our students to become critical thinkers, they will be better equipped to navigate fields that will continue to dynamically change—perhaps more in the coming years than ever before.

As we embark upon this exciting day, I'd like to congratulate all our faculty and student presenters. We are all 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*

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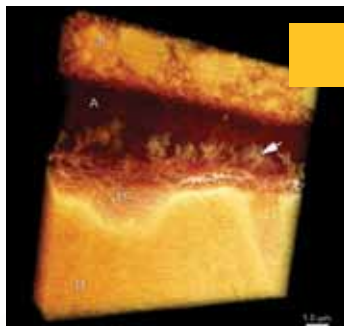


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Dean

*Herman Ostrow School of Dentistry of USC*



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





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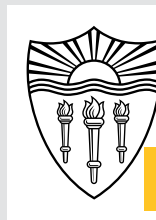
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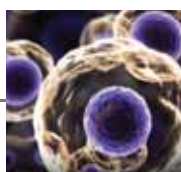


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Dear Colleagues,

**Welcome to Research Day 2015!** It is always exciting to host this annual event celebrating the innovative research being conducted by our students, staff, and faculty.

Students at the Herman Ostrow School of Dentistry of USC are privileged to be able to conduct research alongside our expert faculty. This is a valuable experience that only a few elite research-intensive universities are able to offer as part of dental education. One of our primary missions at USC is to train the next generation to become leaders in science and health care. Our students who engage in research are gaining hands-on experience that will benefit them throughout their careers and in all their endeavors.

We at the Ostrow School are committed to the development of new faculty and innovative research. In the last few years, we have recruited some of the best and brightest junior faculty members. You will be pleased to know that our junior faculty members are showing strong signs of success in their career development. For example, Dr. Ruchi Bajpai's innovative work on epigenetic control of human neural crest formation was recently funded with a new R01 grant, which will enable her to lay the foundation for preventing and treating craniofacial birth defects.

Several groundbreaking translational research projects at the Ostrow School are helping us to shape the future of oral health care. We are particularly fortunate to have great partners in the Mrs. T.H. Chan Division of Occupational Science & Occupational Therapy and the Division of Biokinesiology & Physical Therapy, allowing us to create new opportunities for our students. For example, we are very proud of our faculty members, Dr. Sharon Cermak and Dr. José Polido, who have been awarded a grant to study oral health care and sensory sensitivity in children from the National Institute of Dental and Craniofacial Research, National Institutes of Health. This fruitful collaboration demonstrates the success we can have when we work together.

It is our firm belief that exposing our students to the joys and challenges of research is crucial to providing them with added value in their education at USC. In light of the remarkable number of outstanding discoveries being presented today, it is clear that the future looks 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!

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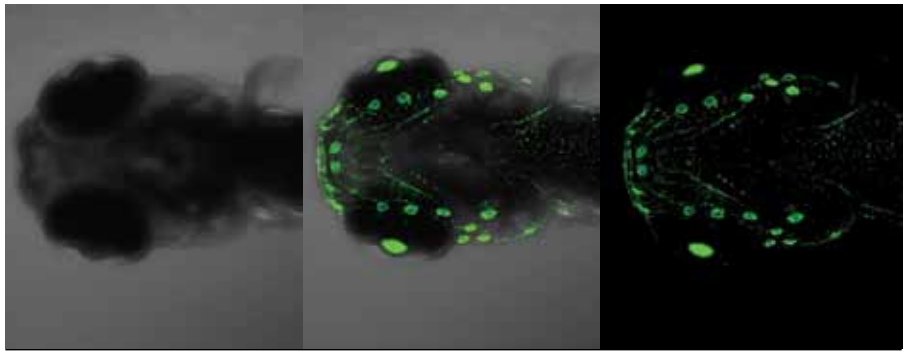
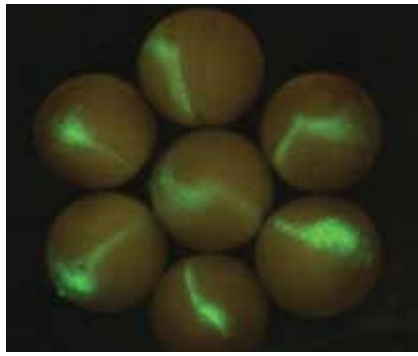
*Yang Chai, DDS, PhD*  
*Professor*

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*Associate Dean of Research*

*Director, Center for Craniofacial Molecular Biology*  
*Herman Ostrow School of Dentistry of the University of Southern California*







# CHARTING NEURAL CREST CELL DIFFERENTIATION

By Robbie Berger '16 and Evan Nahigian '17

The twists and turns that shape the path of life can be sudden, extraordinary and displacing. Dr. Ruchi Bajpai's path to her current research at the Center for Craniofacial and Molecular Biology at USC is an exemplary account of this. She was educated in India and initially entered university with an interest in mycology. However, Dr. Bajpai's path veered onto a different course when she encountered the drosophila fly for the first time. It wasn't the fly itself that piqued her interest. Instead, its novel DNA sequences led her down a path of epigenetic research.

As a graduate student at Jawaharlal Nehru University in New Delhi, Dr. Bajpai co-authored several articles on gene expression in drosophila. After graduating with her Ph.D. from the Center for Cellular and Molecular Biology, she accepted the position of Postdoctoral Fellow at the Burnham Institute in La Jolla, CA. She began working with human embryonic stem cells (hESCs) and multipotent neural progenitors. She studied and researched protocols for developing stable hESC lines that were capable of being tagged by lentiviral vectors. This fluorescent tagging has become a big part of her current research. While at the Burnham Institute, she helped to characterize a new method for rapid and uniform differentiation of hESCs into committed neural precursor cells (C-NPCs). These C-NPCs and neural crest cells offer a promising avenue for current research.

Dr. Bajpai continued her research at the renowned Wysocka lab at Stanford University. Her research centered on neural crest cells and their connection to craniofacial development defects. During the third to fifth week of gestation in human development, neural crest cells begin to rapidly migrate throughout the body. These cells eventually differentiate into various cell types. They lead to the formation of facial bones, teeth, meningeal covering of the brain, Schwann cells, melanocytes, and certain heart structures. A class of proteins called ATP-dependent chromatin remodelers determine whether particular genes are accessible for transcription in particular cells. While a postdoctoral fellow, Dr. Bajpai's research focused on a particular protein remodeler called CHD7. She discovered that when CHD7 expression was suppressed, fewer neural crest cells migrate during development. Conversely, increasing levels of CHD7 and another distal DNA element, PBAF, have been implicated in the metastasis of several cancers. This groundbreaking research gives hope to the 1 in 10,000 children born each year with craniofacial, heart ear, and growth retardation (CHARGE syndrome) and the millions diagnosed with cancer yearly.

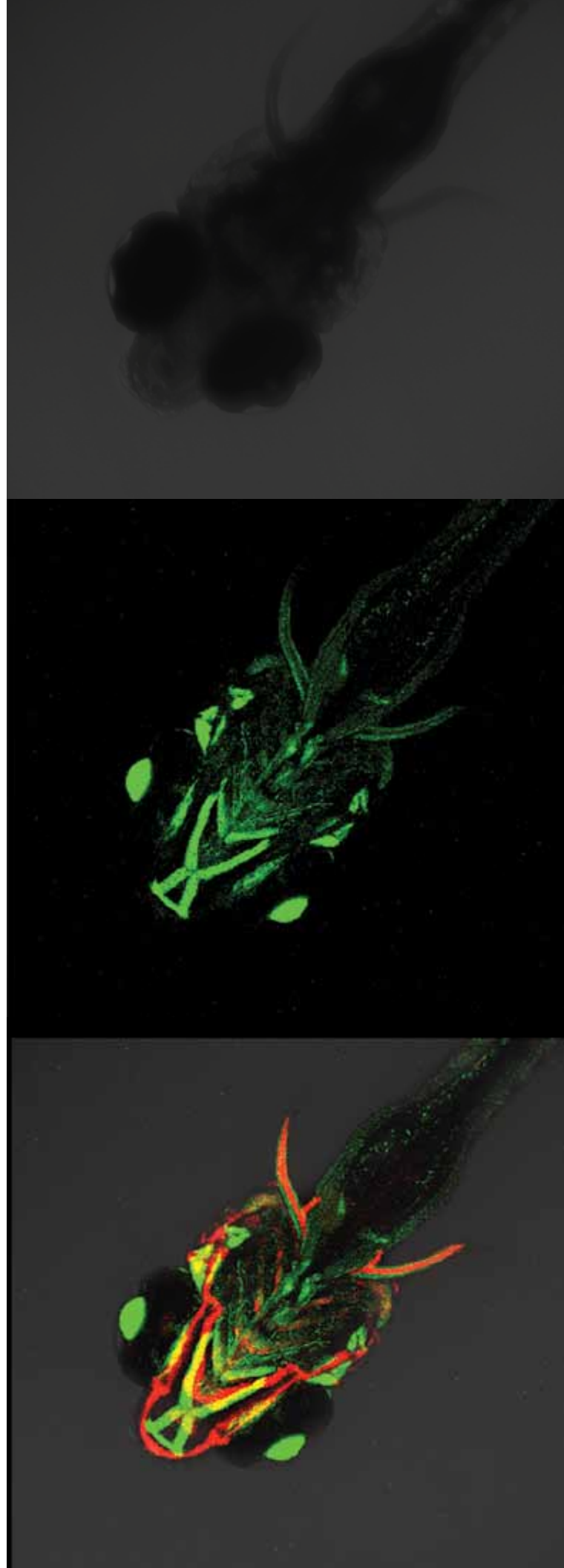
In 2011, Dr. Bajpai accepted a position at the Herman Ostrow School of Dentistry of USC as a principal investigator. Her lab's main focus is the propagation of human embryonic stem cells, their differentiation into neural crest cells (NCCs),



and the epigenetic machinery that guides this process. The analysis is done by extracting chromatin and RNA and then sequencing with Chip-Seq and RNA-seq. Chip-Seq is used to analyze the protein to DNA binding interactions found in the extracted chromatin. Chip-Seq helps to determine exactly where these proteins bind and is especially useful in phenotype abnormalities or defects like CHARGE syndrome. RNA-seq is used to look at the dynamic process of RNA modification. It can be used to look at exon/intron boundaries, splicing and transcriptional modifications and mutations. It is helpful in identifying mutations outside of the coding region in NCC.

In her lab, Dr. Bajpai cultivates a line of lentivirally transduced hESCs that display fluorescent reporters, ShRNA for knockdown, and cDNA for analysis of epigenetic regulatory sequences in NCCs. These hESC and NCC lines can then be implanted in chicken embryos. Through *in ovo* signaling cues, neural crest cell differentiation follows. Chicken embryos are an ideal model because they develop outside the body and are accessible for experimental manipulation. She then develops a line of lentivirally transduced neuroblastoma cell lines that display fluorescent reporters, ShRNA for knockdown, and cDNA to evaluate the cancer progression. The cells are analyzed with RNAseq, ChIP-seq, in vitro metastasis assays and in ovo assays.

Dr. Bajpai is a pioneer in the stem cell field. NCC research is promising because it may provide a source for cell replacement therapy. It also provides a model for studying craniofacial disease progression. In addition to her groundbreaking research, Dr. Bajpai runs her lab with ingenuity. She genuinely fosters a positive research and learning environment. She understands her students' passions and areas of interest and focuses their specific projects to that interest. For example, students with aspirations to be a surgeon are given assignments requiring fine pipetting and small minute detail. Each month, Dr. Bajpai posts quotes for the direction of the lab. This past months quote was "If you don't try the outrageous you will not achieve the impossible." Outside of the innovation in her lab, Dr. Bajpai is also active within her community. Each year, she volunteers at her children's elementary school by bringing in a chicken embryo to give the children a more tangible view of evolution and development. Dr. Bajpai's tenacity and character showcase her desire to elucidate the truths and wonders that science has to offer.





# IMPROVING BOND

## THE AN INTERVIEW



**D**r. Sillas Duarte is a world-renowned dentist, scientist and Chair of the Division of Restorative Sciences at the Herman Ostrow School of Dentistry of USC. Dr. Duarte received his dental education at São Paulo State University in Brazil. Subsequently, he obtained both his Master's degree and Ph.D. in biomaterials at São Paulo State University as well. Early in his educational career, Dr. Duarte was drawn to research – in particular, to advance the way dental materials are biomimetically adapted to tooth structure. He was particularly interested in the “weak link” between restorative materials and the natural tooth structure, which leads to the degradation of the restoration at the seal of the margin. During the beginning of his second year of dental school, Dr. Duarte delved into research on dental biomaterials. With his Ph.D. in hand, Dr. Duarte came to America and further advanced his education with post-doctoral training at the University of Minnesota. After his postdoctoral training, Dr. Duarte taught at Case Western Reserve University in Cleveland, Ohio. Due to the high quality of his research and overall prominence in the field, Dr. Duarte was personally recruited to teach at the Herman Ostrow School of Dentistry by our very own Dean Avishai Sadan.

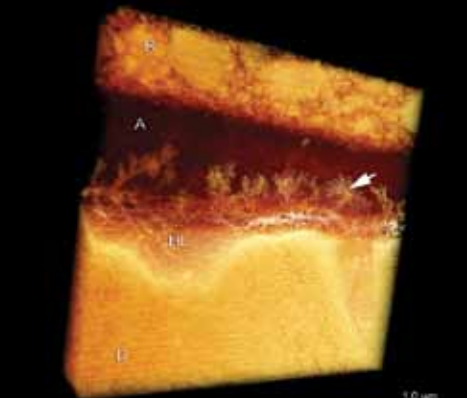
Currently, Dr. Duarte spends most of his time researching bonded dental materials, dental adhesive systems, ceramics and composites. One of

# WITH DR. SILLAS DUARTE

his current avenues of research is analyzing the bond between adhesive systems and dentin. Dr. Duarte has shown that particular areas at this interface are highly susceptible to hydrolysis, which over time causes expansion and results in decreased bonding strength with small spaces of 10-15 nanometers opening up in the damaged interface. Hydrolysis has been determined to be the main cause of failure of these interfaces. Dr. Duarte's research is focused on delaying this process. Crucially, he realized that both the material and the tooth itself contribute to the hydrolysis. The hydrodynamic movement of water inside the tooth and the water present within the collagen matrix compete with polymerization, resulting in poor infiltration of the adhesive and subsequently a weaker bond. Dr. Duarte's team works tirelessly to come up with cutting edge solutions to this problem. One solution that is being considered is incorporating hydrophilic materials into the adhesive to help delay hydrolysis. The addition of antibacterial materials might also help forestall secondary decay by preventing the development of bacterial colonies. These antibacterials will aid in the protection of the interface, even when an ideal seal is not achieved.

Dr. Duarte is the Editor-in-Chief of Quintessence of Dental Technology (QDT), a prestigious annual publication on esthetic dentistry. He became involved with QDT during

his graduate studies and became Editor in 2009. Dr. Duarte is the 3rd editor of QDT, following in the footsteps of the previous editor, Dean Avishai Sadan. QDT is renowned for publishing the top clinicians in the world. Its mission is to present the most innovative, cutting edge, and current research and clinical findings in esthetic dentistry. Publication in this publication is selective, and all



3-D reconstruction of an adhesive interface showing hydrolysis degradation.(R: Composite Resin, A: Adhesive Layer, D:Dentin, HL: Hybrid Layer, white arrow: Water Trees)

articles are reviewed for relevancy and accuracy. Some of the most current advances in dentistry, such as full-mouth esthetic rehabilitations, veneers, CAD/CAM, and implants, are topics within QDT's scope. The State of The Art section in QDT highlights the most impressive innovations in esthetic dentistry each year. The publication also includes a yearly biomaterials update that describes the pertinent chemical and physical properties of the newest biomaterials. QDT not only targets

the clinician but also lab technicians and related specialists. Some of the articles published by USC authors in QDT in recent years explore smile modification and CAD-CAM.

Here at USC, there are currently eight residents in the Master's degree program in operative dentistry, with four new residents entering per year. The residents are trained and then assigned to specific research topics. Some of the topics currently being investigated are optical properties of ceramic and composite restoration materials, CAD-CAM dentistry and adhesive interfaces. The optical properties of a material being investigated include its opalescence, fluorescence, translucency and value.

Dr. Duarte explains that his interest in doing something valuable with his hands coupled with his desire to create led him to dentistry and biomaterials research. A major interest of his outside dentistry is photography. In photographing his dental work, he found that he wanted to improve his technical skills and knowledge in photography. This led him to study landscape photography, which presents a new set of challenges regarding composition and lighting. Dr. Duarte is a pillar of the USC dental community and we are beyond fortunate to have such an innovative trendsetter as the figurehead of our Division of Restorative Sciences.



*Figure 1. Dr. Jack Lytle, DDS, MD & Dr. Natalie Tung, DDS, MD*

# THE USE OF 3-D TRE

**L**OS ANGELES – With a welcomed return to Southern California, Dr. Natalie Tung, DDS, MD, is a valuable new addition to the revamped USC Oral and Maxillofacial Surgery program, led by Dr. Mark Urata, DDS, MD. With her appointment as the pre-doctoral Oral and Maxillofacial Surgery (OMFS) clinic director, Dr. Tung has inspired many students with her dedication to education and commitment to clinical excellence. After earning her Bachelor of Arts degree with honors at the University of California, Berkeley, she completed her dental education at the University of California, Los Angeles, where she received her DDS degree with Magna Cum Laude honors. Dr. Tung then matriculated into Harvard/Massachusetts General Hospital's combined six-year OMFS-MD residency.

Dr. Tung states that “[Harvard/Massachusetts General Hospital] is one of the most challenging training programs and provides full-scope OMFS training. In particular, we performed many surgeries on facial trauma, orthognathic, TMJ, head and neck infections, pathology, pediatric anomalies, and minimally invasive oral and maxillofacial surgery such as distraction osteogenesis, sialoendoscopy, and endoscope-assisted condylar fracture repairs.” Dr. Tung brings her experiences to the pre-doctoral clinic and her broad scope of practice to the clinic floor. Her commitment to comprehensive patient care has proven to be a refreshing change amongst rotating students as they gain exposure to the field of OMFS. “My focus is definitely dental students. Even though many students will not become oral surgeons, I want them to be comfortable with dentoalveolar procedures and to know the scope of practice of an OMFS surgeon. Besides

putting emphasis on improving the oral surgery rotation for the students in general, I am also dedicated to improving the Oral Surgery Selective for those interested in OMFS and to better prepare them as applicants for residency.” Dr. Tung further stresses her commitment to providing USC students with an advantage when applying to the highly competitive specialty, stating, “We will and should match more USC students into OMFS residency programs.”

OMFS has a rich history and continues to attract students with a passion for the medical and dental management of orofacial injuries, pathology, and developmental deformities. With current developments in contemporary medical technology, Dr. Tung is confident that future OMFS residency programs will incorporate exciting innovation to their respective curricula – namely, minimally invasive surgeries and 3-D printing technology. Dr. Tung notes, “In the future, I can see OMFS residents doing more minimally invasive procedures such as those involving the use of endoscopes and smaller incisions. In addition, 3-D treatment planning for orthognathic surgery and reconstruction will become the standard of care, and residents most likely will no longer be doing much actual model surgery as that would be done on the computer.” 3-D printing and medical modeling have advanced in both dentistry (CAD/CAM) and medicine. Historically, a surgeon would have little time for preoperative preparation – the practitioner would resort to planning osteotomies and plate-bending reconstructions intraoperatively. Now, a 3-D computed tomographic (CT) image can be rendered on a computer to reconstruct the orofacial structure. From this reconstruction, a 3-D model is printed and surgical cutting guides are fabricated for resection. Remarkably, the reconstruction plate can be bent preoperatively for precision. This allows for substantially reduced intraoperative time, as surgeons will no longer have to bend plates in the operating room. Rather, they simply



# ATTENT PLANNING

## IN ORAL AND MAXILLOFACIAL SURGERY

By Omar Kholaki '16 and Ali Salehpour '17



Figure 2. Dr. Natalie Tung, DDS, MD, (third from left): Intraoperative photograph at Harvard/Massachusetts General Hospital (2014).

make small modifications to pre-bent reconstruction plates as necessary. Moreover, using preoperative anatomy can help streamline preoperative and postoperative esthetics and symmetry, allowing for more predictable outcomes. Current limitations in this technology exist in both duration and time; there is a long manufacturing time and a substantial associated cost. However, as mentioned, these limitations can often be offset by increased intraoperative efficiency.

1 (right): Preoperative anatomy recreated with CT imaging.



3 (below): Cutting jig for the proposed osteotomy fabricated using adequate surgical margins.



2 (above): Reconstruction plate customized for anticipated surgical resection.



4 (left): Final resection of simulated model.

Medical modeling used in the resection of a mandibular ameloblastoma.

# CHILDREN'S HEALTH AND MAINTENANCE PROJECT {CHAMP}

## INCREASING ACCESS TO DENTAL CARE

By Soo Lee '16 and Hoang-Anh Tran '16



Access to dental care for young children remains a problem in California and throughout the United States. The lack of access to dental care among disadvantaged children contributes significantly to their poor oral health. In 2000, the U.S. Surgeon General reported that underserved children face a “silent epidemic” in oral health, with dental caries being the most common chronic childhood disease. According to research by Drs. Roseann Mulligan, Hazem Seirawan, and Sharon Faust of the Herman Ostrow School of Dentistry of USC in 2011, nearly three out of every four underprivileged children from the 2-5, 6-8 and 14-16 year old age groups in Los Angeles (LA) County have untreated dental decay, with 81% of children needing dental care. A follow-up study in 2012 reported that children with tooth pain are almost 4 times more likely to have a low grade point average. Moreover, 58 and 80 school hours are missed due to dental problems annually per every 100 elementary and high school students, respectively, with the sample's parents averaging 2.5 absent days from work or school per year due to their children's dental problems.

Dr. Mulligan and her research team are the first to publish a comprehensive report of dental caries among disadvantaged children of LA County investigating the associated social determinants of oral health. The study describes the physical and psychosocial barriers that prevent this population from seeking early dental education, prevention and treatment, which include the knowledge, cultural and behavioral patterns of underserved populations (such as the lack of dietary and dental education, transportation, and childcare). Furthermore, this study was instrumental in identifying the correlation between dental pain (due to neglect, unawareness, and lack of access to dental care) and performance in school.

To help reduce these barriers, the Children's Health and Maintenance Program (CHAMP) was developed. The Herman Ostrow School of Dentistry of USC was awarded an \$18.4 million grant from First 5 LA, a non-profit



organization that allocates state tobacco tax revenues to fund health care, education and child development programs for children up to age 5. Other dental schools in the County were also recipients of First 5 LA grants, with USC having the most ambitious goal: to care for the dental health needs of over 45,000 children in the East LA, Central LA, South LA and South Bay regions over the next five years.

CHAMP is now in its second year of operation. The USC CHAMP team is composed of a diverse group of USC faculty, staff, and students including dental and health care professionals, “promotoras” (primarily Latino health educators), and social workers (unique to the USC CHAMP model). These teams visit Women, Infants and Children (WIC) centers, Head Start centers, day cares, and other community facilities throughout LA County to provide dental screenings, oral health education, and other community resources to families of children 0 to 5 years of age. In addition, teams assess dental treatment needs, assist families enrolling in insurance programs and finding dental homes, cooperate with community dental centers in order to provide dental care under sedation, and train dentists and other healthcare professionals in providing preventive services and dental care to very young children. Although CHAMP currently stands as a 5-year service project and research model, CHAMP administration is looking forward toward the project’s sustainability. USC is working on a model of billing DentiCal for preventive dental services in the field in order to keep the CHAMP project sustainable after the grant terminates in February 2018.

One of the main reasons for the high prevalence of poor oral health in underserved children is lack of dental knowledge and awareness. “We want families to change their behavior and know that going to the dentist on a regular basis is good for prevention of disease, instead of going only when it hurts,” states USC CHAMP Program Administrator Eleanor Aguilar. Many parents are unaware that establishing good oral habits even for primary teeth is critical for the developing dentition and for overall health. Once parents are

informed and educated about oral health care, the hope is that regular well-baby visits will include regular dental visits as soon as the first tooth erupts.

The heart of CHAMP is raising awareness through dental care outreach and education. Ms. Aguilar reports that CHAMP has already developed community relationships and partnered with 9 federally qualified community centers in order to provide medical and dental services for CHAMP participants. USC CHAMP is also expanding to provide direct restorative services every year to approximately 800 children in foster care who receive medical care through the Violence Intervention Program (VIP) at LAC+USC Medical Center. Furthermore, USC has added two additional spots in its postdoctoral pediatric dentistry residency program with the goal of inspiring more students to enter the specialty and to improve care the underserved community of LA County. Dr. Mulligan emphasized the importance of using this multi-dimensional approach in order “to promote oral health and reduce the individual and societal burden of dental caries in LA county.”

To learn more about USC CHAMP, visit [www.champ-usc.net](http://www.champ-usc.net).







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# COLLABORATION IN ORAL HEALTH RESEARCH

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By Kristine Hong '16, Catherine Tan '16, and Rasha Dubuni '18

In today's world, we have become accustomed to having a wealth of knowledge easily accessible to us online. We can communicate with our peers and colleagues locally, nationally, and globally with only a few keystrokes. Imagine the days before everyone had his or her own email address, when the Internet was something that was not yet used by students or dental professionals. Jane Forrest, RDH, EdD, saw the potential of the then-novel invention called the World Wide Web and wanted to use it to expand research collaboration to improve practice both here at the Herman Ostrow School of Dentistry of USC and nationally, through the National Center for Dental Hygiene Research & Practice.

The Herman Ostrow School of Dentistry is yet again a pioneer in the dental field through its curriculum that teaches students to access scientific information efficiently, enabling these future clinicians to make informed decisions using an evidence-based decision-making (EBDM) process when treating patients. Dr. Forrest has been dedicated to bringing evidence-based dentistry to the clinic since 2000, when she first received a federal grant to integrate EBDM into the dental hygiene, occupational therapy and physical therapy curricula. Here at USC, all of the DDS students know her well as an excellent resource on how to become an evidence-based clinician. She teaches the Evidence Based Dentistry and Behavioral Dentistry modules, in which students practice effectively utilizing web-based scientific databases, such as PubMed, as research tools. Using evidence-based research can have extensive clinical applications, improving the clinician's ability to decide which innovative new techniques or procedures to practice, which dental materials to use, or which oral hygiene products to recommend for maximum efficacy. Today, evidence-based knowledge and skills are required standards for both dental and dental hygiene education as identified by the ADA Commission on Dental Accreditation and the ADEA guidelines for entry into the professions. Dental schools are responsible for teaching students how to stay up-to-date with new technology, current research, and scientific findings in order to provide the most appropriate treatment for patients. The EBDM process also serves as the foundation for becoming a good consumer of the research literature and a life-long learner.

This emphasis on highly valuable research skills was initiated through a federal grant which established the National

Center for Dental Hygiene and Practice (NCDHRP) in 1993. As part of the grant, 20 teams comprised of clinicians, educators and researchers from universities throughout the country were formed. Together, these teams attended a Summer Research Institute program to learn how to conduct theory-based research.

Dr. Forrest has continued to advance this mission as the Director of the NCDHRP. The online home base for the NCDHRP is the DHNet, which serves as a central repository, providing reliable resources for dental professionals and students alike to access a broad range of topics on education, research and practice. One aspect that currently is being updated is an interface, known as a research collaboratory, to facilitate discussion and sharing of research among colleagues. Dr. Forrest created the DHNet with a special interest in building a research community of dental hygienists to improve the oral health of the public and to promote the translation of research evidence so that it is meaningful and useful in dental hygiene education and practice.

Dr. Forrest and Dr. Ann Spolarich, the NCDHRP's Associate Director, have been integral in building and fostering the research community through organizing three North American/Global Dental Hygiene Dental Research Conferences since 2009, strategically in Bethesda, MD, close to the NIH. The most recent conference in October 2014, "Beyond the Boundaries: Discovery, Innovation and Transformation," provided an opportunity for dental hygiene researchers from throughout the world to convene and explore commonalities in their research interests, learn from each other about new and ongoing research programs, and foster future collaborations. Forrest and Spolarich also coordinated a pre-conference meeting of the American, Canadian and International Dental Hygiene Association's leadership to discuss strategic plans, research priorities and how to coordinate research efforts in a purposeful way using the limited resources of each individual association.

Dr. Forrest has been on the cutting edge of sharing knowledge and the dental community should continue to look to her for future innovations advancing education and practice through research collaboration.

# KEEPING IT SIMPLE

## REINVENTING THE SURGICAL STENT

BY PAYAL PATEL '16 & TIFFANY LEE '16



*Figure 1. Frontal view of the surgical stent*



*Figure 2. Occlusal view of surgical stent with voids where contact exists between teeth.*





Technology is rapidly growing and developing, drastically changing our everyday lives. Dr. Ryan Hungate, a third year orthodontic resident at the Herman Ostrow School of Dentistry of USC, is in the vanguard of utilizing technology to make everyday practices more efficient.

Dr. Hungate observed that dental school clinics were plagued with inefficiencies. Students were constantly removing gloves or going back and forth between the computer and their patient. He also found that doctors spend anywhere from 30-50% of their day accessing their electronic health records. To combat this, he brainstormed ways to create a computer-interface that increases chair time efficiency. Two years ago, when the concept of Google Glass was revealed, he finally thought it was feasible. He worked with Dr. John Pham and Vince Nguyen to integrate Google Glass with different dental software to improve existing electronic health records. They pitched the idea to a Google competition, which provided them with Google Glasses to initiate their project. Comparing it to the Marvel Comic's "J.A.R.V.I.S." from Iron Man, Dr. Hungate described this system as voice activated, capable of displaying the dentist's schedule, chart, x-rays or patient demonstration videos on demand, and coordinated by chair location. In the future, the system will even help to dictate patient notes. Dr. Hungate and

seated correctly into the stent. This can lead to post-surgical malocclusion. Discrepancies in the teeth seating in the stent translate to discrepancies in the outcome of the orthognathic surgery. Such deviation from the predicted surgical outcome leads to unnecessary modifications in the orthodontic treatment and increased treatment time post surgery. Utilizing the same 3D printers that fabricated the traditional stents, Dr. Hungate designed a stent that fills in the negative space. Dr. Hungate described this negative space as the space that exists outside of normal tripodization contacts when teeth are in occlusion. He created a stent that allows for proper occlusion and therefore increases the accuracy in seating the teeth and jaw positioning during orthognathic surgery (Figure 4). Working in conjunction with Dr. Robert Relle, an oral and maxillofacial surgeon, and Dr. Dan Grauer, a faculty member in the USC orthodontics department, they applied this stent in six orthognathic surgery cases. They found a up to a three-fold increase in the accuracy of the immediate postoperative occlusion. This increased accuracy leads to a more predictable and ideal result, which in turn, facilitates a more efficient post-orthodontic treatment. Prior to this idea, rigid fixation with braces and rubber bands were placed for surgery. However, with the improved accuracy of the new stent, braces can be removed prior to surgery for increased patient comfort and to harness the rapid acceleratory



*Figure 3 (left). Traditional stent with open bite present*



*Figure 4 (right). Stent fabricated to fill in negative space, allowing for proper occlusion.*

his partners named this system "ARO". It can be integrated with all wearable devices like the Android and Apple watches. Through clinical trials in different private practices, they found that with ARO, practitioners could see six patients in the time it normally takes to see five patients. Continuing the innovation, ARO and Google Glass are being combined with dental loupes to reduce cross contamination and eliminate the nuisances that come with wearing loupes. This includes hands-free, voice activated light control and easy removal of the magnifying lens. Incorporating a small wirelessly charging battery behind the neck also eliminates the hanging light wire. With the advent of ARO, Dr. Hungate is making a positive impact on practice management. He has championed the concept of improving workplace efficiency throughout his tenure in residency.

Another aspect of orthodontics he aims to improve upon is the disconnect between oral surgeons and the referring orthodontists. Dr. Hungate noticed that often an orthodontist would refer a patient for orthognathic surgery, only to find the final results less than ideal. The traditional surgical stent used to guide the placement of the jaws during surgery (Figure 3) creates an open bite, making it difficult to see if the teeth are

phenomenon postsurgery. This phenomenon entails taking advantage of the physiology of swelling and inflammation after surgery to orthodontically move teeth faster. The predictable result through the use of this stent makes it feasible to produce Invisalign trays ahead of time and place them two weeks post-surgery. This represents an advantage over the six weeks that would normally be required post-surgery for the conventional maxillomandibular fixation wire method. Dr. Hungate hopes that the advent of this new 3D printed stent will simplify the technique for oral surgeons and therefore facilitate orthognathic treatment options for more patients.

Throughout his endeavors as an orthodontic resident, Dr. Hungate has incorporated new ideas with existing technology and materials to simplify dental practices. His goal in creating such innovations is to improve the dental experience for patients and increase efficiency for practitioners. With the innovations of ARO and the newly formulated stent, he made it possible for patients to spend less time in the chair and be provided with the most predictable treatment possible.

# TRAILBLAZING THE PERIODONTOLOGY

By Emil J. Simanian '17 and Shant Aharonian '17



Dr. Zadeh (5th from the left) poses with his advanced periodontal residents and colleagues.

# EVOLUTION OF MODERN DAY

**D**r. Homayoun Zadeh is the Director of the Postdoctoral Advanced Periodontology program at the Herman Ostrow School of Dentistry and the Laboratory for Immunoregulation and Tissue Engineering (LITE) at USC, and also maintains a private practice. Dr. Zadeh was initially attracted to the field of periodontology due to its strong biological involvement, vital research integration, and ability to provide comprehensive care. A leading researcher in periodontology for decades, his current focus within the Department of Periodontology at USC is bone regeneration and the pathophysiology of biofilm-induced infection, along with the resulting immune response such infection produces in the host.

What separates Dr. Zadeh from most periodontists is his passion to contribute to the evolution of the specialty through clinical research. Dr. Zadeh reports that “the basis of clinical practice is scientific evidence that is provided, but at the same time if you are a clinician and treating patients, you are in the best position to identify what are the significant problems that you have in your field. I think when one individual is involved with both the clinical and scientific area, then you have the insight into what areas of scientific questions should be pursued.” Much like other dental specialties, periodontology has undergone significant advancements in the last few decades. At the start of Dr. Zadeh’s career, a time when understanding basic pathogenesis and etiology was heavily emphasized, biological concepts were the focus of the department. Today, these findings are being utilized in patient care at USC’s Advanced Periodontology clinic, with the ultimate goal of better long-term outcomes for patients. An example of these advancements that Dr. Zadeh has been overseeing involves using a number of growth factors, such as platelet-derived growth factors, which have been developed and approved for periodontal regeneration. Enamel matrix derivative, a product of the research done at the Center for Craniofacial Molecular Biology at USC, is another growth factor being studied within the periodontal department that has shown great potential. Dr. Zadeh describes research as “one of those aspects that once you get involved and you really have an understanding of what the process involves, it can actually infect you with a bug that gets you really hooked.”

Dr. Zadeh has recently collaborated with his colleague, Dr. Casey Chen, to develop a novel technique for tissue regeneration. The conventional approach for tissue regeneration involves introducing exogenous growth factors to a specific region to mediate a certain function. Once this function has been established, the growth factors are no longer required and slowly diffuse out of the tissue. This technique, although well-established, is not practical, as it requires large amounts of growth factors which are very costly. The solution that Dr. Zadeh’s team has developed involves the utilization of antibodies that attract endogenous mediators, such as bone morphogenic protein 2 (BMP-2), to promote the healing process. The antibodies capture and concentrate BMP-2 that is naturally produced by the body, holding it in position to mediate bone repair. This therapeutic approach has been tested on a number of pre-clinical animal models, and so far the results have

been promising. The USC Advanced Periodontology department hopes to apply this revolutionary treatment in a clinical setting in the near future. Dr. Zadeh’s enthusiasm for research is apparent as he explains that “once you see how the clinical and the research and the scientific side can really go hand in hand, that’s what makes it quite exciting, to see that one can feed into the other.” Moving forward, Dr. Zadeh and his research team will be working with an animal model to study the pathogenesis of biofilms associated with peri-implantitis.

Clinically, the field has made tremendous strides as well, using technologies that periodontists could not have imaged a mere ten years ago. “With the many advancements in digital technology, this is a great time to be a clinician,” says Dr. Zadeh. He further states that “from the time of examination, diagnosis, treatment planning, and to the point of surgery and restoration, there are a variety of new tools available.” One example is the traditional use of study casts poured in dental stone, which has been a hallmark of diagnosis and treatment planning throughout the evolution of modern dentistry. Through the integration of computer software and oral scanners, teeth can now be modeled and manipulated in a digital environment to fit both the clinician and patient needs. Incorporating these different technologies has allowed novel approaches to provide basic periodontal care as well as complex surgical procedures. Upon treatment planning a dental implant, periodontal faculty and residents can import the patient’s existing tooth structure into their own personalized cone beam computed tomography (CBCT) scan. This is especially useful since CBCT scans do not accurately and predictably duplicate teeth that have been restored with metal, often generating a scattered appearance. Merging the digital study casts with the CBCT ultimately provides a view of the teeth and the surrounding structures that is ideal for periodontal treatment planning. This three-dimensional imaging technique allows for greater evaluation of the patient’s anatomy, bone contour, and existing pathology prior to any surgical intervention. Aside from allowing the clinician and patient to visually anticipate potential pitfalls of the treatment, more and more patients can now take a hands-on approach in developing their overall periodontal treatment plan. By having the entire treatment process managed in a digital environment, ultimately the goal is for these tools to be used by all dental professionals for a more efficient collaborative input.

Although there have been exciting technological advancements in the field and vast improvements in clinical outcomes, what Dr. Zadeh finds the most satisfying in his profession is sharing his knowledge and experience with the talented residents within his department. He believes that “the most rewarding aspect is working with the residents who are in training. They are the future of our profession and they are the ones who will be the beneficiary of the research that is being done, and the technical developments that are taking place.” The residents within the Postdoctoral Advanced Periodontology program at the Herman Ostrow School of Dentistry of USC are fortunate to have such an esteemed colleague and mentor.



According to the Centers for Disease Control and Prevention (CDC), it is estimated that over 1.1 million people live with the Human Immunodeficiency Virus (HIV) while 50,000 people are newly infected each year. More than 6,400 individuals were diagnosed with HIV in California alone in 2010. Los Angeles is the most populated metropolitan city in California and, as of 2012, has 45,474 people living with HIV/AIDS (PLWHA)—making Los Angeles home to the second highest population of PLWHA in the US. Of course, this statistic only represents diagnosed cases of HIV/AIDS. It is estimated that approximately 18% of HIV-positive individuals are undiagnosed and contribute 3-7 times more to transmission of HIV than individuals aware of their HIV-positive status. The search for this undiagnosed fraction of PLWHA should be the goal for all dental and healthcare professionals alike in order to lower new HIV infections.

Fortunately, Drs. Piedad Suarez-Durall, Phuu P. Han and Lisa Hou of the Special Patients Clinic at the Herman Ostrow School of Dentistry of USC are able to share their insights into how the dental office can become a key player in the diagnosis and treatment of HIV. Dr. Suarez-Durall, Assistant Professor of Clinical Dentistry and Section Chair of Geriatrics and Special Patients explains, “Early detection of HIV infection provides an opportunity for transmission reduction and lifesaving treatment strategies.” In addition to its resistance against the human body’s immune system, HIV’s success in establishing itself as one of the most infectious diseases in human history can be attributed to the population of HIV-infected individuals who are unaware of their seropositive status. This fraction of PLWHA is several times more likely to transmit HIV, which not only increases the population of unaware HIV-positive individuals but also creates a safe hiding place for the virus. Therefore, an effective strategy to lowering the number of new HIV infections is to make everyone aware of their HIV status. While it may appear as a simple task, there are still various barriers, such as access to healthcare and social stigma, which perpetuate HIV’s presence in our communities.

The Special Patient Clinic sees the dental clinic as the perfect opportunity to address these problems. Dr. Phuu P. Han, Assistant Professor of Clinical Dentistry, reveals that the clinic embodies “the international theme for World AIDS Day...set out by the Joint United Nations Programme on HIV/AIDS (UNAIDS)—‘Getting to Zero’—[which aims for] zero new HIV infections, zero discrimination and zero AIDS-related deaths.” Social stigma remains as a two-way street because HIV positive patients become afraid of discrimination in the dental office while dental practitioners are reluctant to treat

HIV patients or even offer rapid HIV tests in their practice. However, according to a 2011 survey conducted at the USC School of Dentistry, of patients who have not been tested before for HIV, 62.6% were willing to be tested in a dental visit. In addition, a third of graduating dental students were willing to perform rapid HIV testing in one study. Despite these mutual positive attitudes, dental practitioners end up not implementing these services due to a lack of education and patient management skills. Dr. Lisa Hou, Assistant Professor of Clinical Dentistry, explains, “Because of the lack of exposure, students are often wary about treating patients with HIV. Therefore, students should be educated in safe treatment and any potential dental modifications to remove any sense of doubt or lingering stigma associated with HIV. After the Special Patient Clinic, students understand how various complex medical conditions affect oral health and gain confidence in managing these patients accordingly.” By exposing students to HIV-positive patients, the Special Patient Clinic hopes to desensitize students to any HIV-related fears they may have and make them more comfortable discussing HIV and treating oral conditions associated with HIV. Dr. Han summarizes, “Education, building trust and having open communication with the patients are great ways of enhancing dental care for HIV/AIDS patients.”

Currently, HIV-positive patients treated in the Special Patient Clinic are sponsored by programs under the Ryan White Grant—the largest federal program to help PLWHA gain access to appropriate healthcare services. As part of their access to medical care and medications, patients covered by this grant are required to obtain dental care because the oral cavity provides a reservoir of opportunistic pathogens and a site for several HIV-related morbidities. “HIV/AIDS patients are considered to be immunocompromised and as dentists, we should watch out for potential comorbidities associated with the disease,” says Dr. Hou. “In addition to oral hygiene, dental students are expected to educate patients on HIV-associated oral conditions so that they can be on the look out.”

Fortunately, patients who are funded by the Ryan White Grant have access to medical care and highly active antiretroviral therapy (HAART) medications. As a result, dental practitioners rarely see these conditions because the patients’ viral loads are low and their CD4 counts are at a competent level. Outside of the special patients clinic, however, dental practitioners often encounter patients who are already diagnosed and medically treated. For dental professionals, it is therefore important to be on the look out for these lesions in all patients, since there are HIV-infected patients who are unaware of their status or have had their status change without their knowledge. In regards to the unaware or uncontrolled

# SPECIAL PATIENT CLINIC: DEVELOPING A DENTIST’S ROLE IN HIV

patient, Dr. Han explains, “The most common oral lesions seen in HIV/AIDS patients are different types of Candida infection, especially the pseudomembranous type. Linear gingival erythema, acute necrotizing ulcerative gingivitis and acute necrotizing ulcerative periodontitis are also oral lesions found in patients with low CD4 counts.” Additionally, herpes simplex, cytomegalovirus and herpes zoster outbreaks are associated with low CD4 count. It becomes the duty of dental care providers to be aware of these particular lesions associated with low CD4 counts and to be suspicious of their patients’ current HIV statuses. Patient management also becomes a crucial tool, since as Dr. Suarez warns, “not all infections are specific of HIV patients which is why you have to be careful in the way that [dental practitioners] approach the patients and determine if the patient is at high risk to acquire the condition.”

If clinical judgment suggests that the patient may have HIV, then the dental visit becomes an opportunity for the dental professional and patient to discuss HIV and the patient’s current medical status. In fact, a 2005 National Health Survey revealed that 50% of patients who had not seen their primary doctor in the previous year disclosed that they had seen an oral health provider in the same time frame. Therefore, dental practitioners have an even greater potential to aid in the diagnosis of HIV. Oral health providers can refer patients to the appropriate resources, such as testing facilities or their physicians, or offer rapid oral HIV testing in their office. While providers may feel skeptical about offering HIV testing to their patients or the reliability of the tests, these are outdated fears. As previously mentioned, two thirds of patients who have not previously been tested for HIV have expressed a desire to undergo testing. In addition, rapid oral HIV tests such as OraQuick Advance have shown remarkable sensitivity levels (>98%) that rival the standard serum enzyme immunoassays. As a model practice, the Special Patient Clinic has partnered with the Dental Hygiene Clinic to offer free rapid oral HIV testing for patients. Staff members Carolina Maradiaga and Jaime Montoya have been conducting the HIV tests for willing patients since September 2013. The OraQuick Advance Rapid HIV-1/2 Antibody test is currently used in the clinic and only takes 20 minutes to produce results. If patients test positive, then a second test is conducted to eliminate false positives. Patients who test positive in the Dental Hygiene clinic are referred to resources such as their physician or HIV counseling programs. Whether a patient is considered to be at high risk or not, “the ability to offer HIV testing in the dental setting breaks down misconceptions between students and patients,” says Ms. Maradiaga. Both the Special Patient and Dental Hygiene Clinics hope to further improve the HIV testing program to navigate through this intersection of HIV and oral health.

Unfortunately, HIV is still surrounded by many fears and is not traditionally addressed in the dental office. However, the presence of HIV-associated oral lesions and the patient’s immunocompromised medical condition manifest are important for dental professionals. Oral health providers have the unique opportunity to work with both diagnosed and undiagnosed HIV-positive patients. The Special Patient Clinic aims to place oral health providers at the forefront of diagnosis and treatment for HIV patients as their contribution to ‘Getting to Zero.’



Dr. Lisa Hou (above) & Dr. Phuu P. Han (below)



By Johnathan Nguyen '17



# OPPORTUNITIES IN THE

By Paulina Nguyen '18 and Brent Roberts '18

As dental students, we are often overcome by the immense load of laboratory work or juggling patient treatments and get caught up in the daily hectic routine of dental school. Students tackle the demands of a dental curriculum by mastering biomedical sciences, preclinical laboratory classes, and patient procedures, and by preparing for national exams. The Herman Ostrow School of Dentistry teaches its students to ask questions constantly and seek the answers to our curiosities in a problem-solving environment. The School has developed and successfully maintained this learner-centered approach to education for many years. Other schools mimic this learning style, yet USC maintains its reputation at the top. The problem-based academic education combined with clinical hands-on skills place students in an environment that values and nurtures both critical thinking and practical abilities. These skills can be directly applied to upcoming research projects in dentistry. Cutting edge research in areas such as oral biology, craniofacial molecular biology, and tooth morphogenesis has led to innovative technologies and the discovery of new ideas. Although students may hesitate to become involved in research amongst their numerous other responsibilities, research at USC can foster an environment for students to develop laboratory and critical thinking skills while gaining opportunities to present innovative projects both nationally and internationally.

The Summer Research Fellow Program offers a unique opportunity for incoming DDS students to participate directly in high-quality research alongside renowned research professors, prior to their freshman year. This program began in 2010, and was created by the Associate Dean of Research with the aims of helping new students develop an interest in research experience and providing an introduction to the wider academic side of dentistry by integration of research. Mark Choe, a current first year dental student, completed this program last summer and expressed, "it adds another dimension to dental school

that most students don't get to experience. It helps to sharpen your mind and reinforce some of the essential topics that are discussed in science today."

Students who enter the program come from a wide variety of backgrounds. The D.D.S. program boasts one of the most varied student demographics in the country, both in terms of cultural and academic backgrounds. The Summer Research Fellow Program aims to tap into this diversity and offers incoming students from any background the opportunity to participate in high quality research as well as insight into the often-overlooked field of academic dentistry.

Whereas some students have been involved with research since high school or college and are looking to continue their passion while in dental school, many others have no prior research experience and apply simply because it provides an opportunity to act on a long-time personal interest. Weston Grimes, a first year dental student who was a Summer Research Fellow in 2014, already had three years of research experience in molecular biology. He stated, "I wanted to get a better understanding of the new areas being pursued within the dental community and how I could participate with research in the future." Those who are accepted into the program work closely with faculty and may be considered for future research training. Fellows whose interests continue to expand during the program may begin to consider careers in academic dentistry or explore graduate programs in the biomedical sciences, options that are often overlooked by prospective dentists.

Recruitment for the program begins as part of the welcoming information package for incoming D.D.S. freshmen. In early spring, applications to the Summer Research Fellow Program are sent out to students who have accepted their offer of admission to the Ostrow School of Dentistry. Applications are due by the end of



# SUMMER RESEARCH FELLOW PROGRAM

the spring trimester. Accepted applications are passed on to faculty who are interested in having Fellows help with their current research projects. Students are expected to commit to ten to twelve weeks of full-time research work, in addition to any required training and certification that may be required. The program starts in the beginning of summer and runs until the middle of August just before orientation week for dental school. Approximately four to five students are accepted per year and placed into research centers such as the Center for Craniofacial Molecular Biology, the Oral Biology Group, and the Center for Esthetic and Biomimetic Restorative Dentistry.

By the end of the program, students have gained insight into the world of academic dentistry, and have the option to continue research on either ongoing or new projects. The program serves as a stepping stone for students who wish to become involved with academic dentistry. Students also receive credit for publications to which they have contributed, and have the opportunity to present their findings at the Herman Ostrow School of Dentistry of USC's Annual Research Day, as well as at national and international conferences. The Summer Research Fellow Program is an excellent starting point to gain new skills as well as a new perspective on the importance of one's own contributions to the scientific and dental communities.

For students who may have missed the application deadline or are trying to determine whether to apply for next year, there are presentations every Friday on USC's Health Sciences Campus at the Center for Craniofacial Molecular Biology that are open to students. At these events, current graduate students defend their theses, and both USC-based and visiting researchers present their work in progress. Occasionally, there are also video conferences with groups at other top universities. Potential, future, and current students interested in more information about the Summer Research Fellows Program can contact Donna Castillo at: [dvcastil@usc.edu](mailto:dvcastil@usc.edu).



# PROFILING THE SINGLE CELL

## A CLOSER LOOK AT CELL POPULATIONS

By Christopher Patuwo '16 and Matthias Fallis '17

Imagine conducting a population study of Los Angeles and trying to compare how much money people make, where they live, their age distribution, and other variables. After collecting the necessary information from individuals, this data is aggregated and usually averaged to provide a quick glimpse of the overall population. Yet, some of the individuals could have a very different status from the average. For this reason, considering only the average individual could be misleading in dictating public policy.

The same logic can be applied to the study of cell populations, especially in considering highly heterogeneous populations such as tumors or developing tissues. Traditional methods for molecular profiling of cell lysates (which represent a mixture and physical average of the cell populations) measure only the average parameters of a cell population. Such results cannot recognize the differences among individual cells. Instead, the data are interpreted under the assumption that all individual cells are well represented by the average. It is increasingly evident that this assumption is not true and that there are certain levels of heterogeneity present in cell populations. Focusing on elucidating this heterogeneity, Dr. John Zhong and his lab have developed and optimized microfluidic devices to profile individual cells.

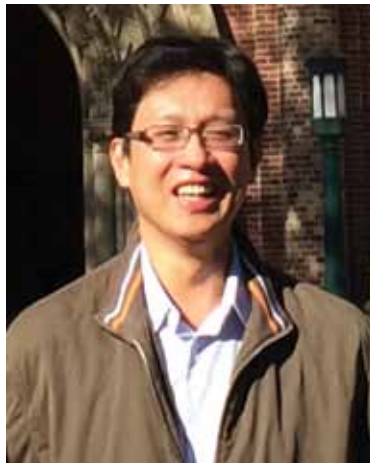
The microfluidic devices developed by Dr. Zhong's research team shrink the molecular biology reactions normally done in the centrifuge tube and with pipettes down to the picoliter scale, which is suitable for accurately studying single cells. From there, Dr. Zhong explains, "the applications of the new perspective provided by single cell profiles are numerous, from lineage determination in early development and organogenesis to clinical diagnostics in tumor prognosis."

In one study, Dr. Zhong's group performed single-cell molecular analysis to isolate whole genome transcriptomes from individual cells within a heterogeneous population of mesenchymal stem cells. Mesenchymal stem cells have intriguing applications in regenerative medicine because of their ability to differentiate into different types of tissues. Thus, accurate molecular characterization of these cells is desirable to pinpoint cells with varying developmental potential in a population. By comparing the single cell mRNA expression profiles at consecutive developmental stages, Dr. Zhong's group is able to classify different cells into molecular subpopulations.

The hope is that these subpopulations can serve to characterize cells in the absence of known biomarkers.

Another area of application of Dr. Zhong's work is in the clinical diagnosis of cancer. A tumor represents a heterogeneous population of cells possibly with mixed origins and with varying propensities to metastasize. The diagnostic goal in analyzing single-cell transcriptomes is the ability to identify expression signatures in circulating tumor cells which are rare in blood and use these to dictate prognosis and treatment. This process would not only clarify diagnosis of tumors, but also allow for collection of samples via a blood draw, a minimally invasive procedure.

For Dr. Zhong, the upcoming move from the Zilkha Neurogenetic Institute to the Herman Ostrow School of Dentistry of USC represents a chance to explore a new avenue of applications for single cell studies: microbiology. After setting up his new lab, Dr. Zhong hopes that future collaborations at the Ostrow School will facilitate exploration of single cell molecular profiling in the context of microbial pathogens such as HIV and oral bacteria as well as cancer biology.



## USC Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy



2015 marks the first Research Day for the newly named USC Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy, one of eight academic divisions housed at the Ostrow School of Dentistry of USC. In September 2014, USC Trustee Ronnie C. Chan MBA '76 and his wife, Barbara, dedicated \$20 million to the pioneering occupational science and occupational therapy program. Given in honor of Chan's mother, the gift, which endowed and named the division, was the first of its kind and largest ever made to any occupational therapy program in the history of the field.

"My family and I are pleased to provide a third major gift to USC — in this case to support the cutting-edge work of the most influential division of occupational science and occupational therapy in the world and to honor my mother who worked for many years as a nurse," Chan said. "I am grateful for the opportunities that USC afforded me and my sons, and our gift to the division is one of several ways we intend to continue supporting USC in the future."

The gift represented a significant milestone for the division, which has accumulated a long list of firsts since occupational therapy education began at USC in 1942. The division established the nation's first two-year, entry-level master's degree program in occupational therapy and first post-professional degree program in occupational therapy. It is also internationally renowned for establishing the world's first Ph.D. program in occupational science. Since U.S. News & World Report began ranking occupational therapy educational programs in 1998, USC has held the No. 1 spot for 13 years — more years than all other programs combined.

"This historic endowment gift ensures the USC Mrs. T.H. Chan Division's prominence among the most elite programs in occupational science and occupational therapy, not just in the United States but throughout the world," said USC President C. L. Max Nikias.

Occupational therapy is a health care profession focused on enabling people to decrease their risk of or better manage chronic disease and disability through sustainable, health-promoting activities and routines in order to live happier and more productive lives. Occupational therapists work with populations across the life span in various settings, including hospitals, nursing facilities, community clinics, schools, private practices, corporations and wellness centers. The Chans' support ensures the division will continue leading the profession in education, research and clinical programs.





# SOOK-LEI LIEW AIMS TO HARNESS **BRAIN POWER** FOR IMPROVED **STROKE REHABILITATION**

BY HOPE HOMASHIGE

Strokes can happen in an instant but their effects can last a lifetime. For stroke survivors, subsequent motor impairments can dramatically impact their quality of life until rehabilitation can begin the process of restoring function.

While healthcare professionals who work with stroke survivors have all seen patients who respond beautifully to therapy, they also know that therapies simply do not work equally well for all patients. Assistant Professor Sook-Lei Liew MA '08, PhD '12, who found those times when therapy failed both frustrating and inspiring, is hoping to change that.

“We never knew what was going to work and whether they were going to have a good outcome,” explains Liew. “That was my motivation for going into research—to uncover more ways to help these patients have good outcomes.”

Following stroke, the brain loses the ability to perform certain functions and has to be retrained to perform seemingly simple tasks.

Those patients who have trouble walking, for example, perform repetitive exercises to relearn that skill. Making the muscles work often makes the brain work, too, and for some patients, recovering function is a matter of practicing a motion over and over again. But not all patients fully regain their motor skills, or their quality of life, through repetitive movement.

Liew's research is exploring ways to supplement this approach of using muscles to train the brain. She is studying how to enhance the brain's own ability, with the help of cutting-edge technology, to bring back function to those parts of the body that are compromised following a stroke.

"With the help of novel technology, we can start to understand how to augment the brain's recovery and personalize the approach for each patient," she says.

Using imaging technology called functional magnetic resonance imaging (fMRI), a non-invasive technique used to observe brain activity, Liew is able to better understand which parts of the brain are involved when a patient is asked to learn to perform a particular task.

Because every person's brain is wired slightly differently, explains Liew, not every person engages the exact same areas of their brain when re-learning a task. Having the ability, thanks to imaging technologies, to observe which parts of the brain each patient engages may help develop targets for customizing therapy to maximize the outcome for that individual.

Once target brain regions have been identified, Liew then studies ways to encourage brain activity in those regions to enhance neural repair. One method she uses is non-invasive brain stimulation to enhance neuroplasticity, which is the brain's ability to reorganize neural pathways based on learning new skills. This stimulation is thought to help neurons fire more easily which, in turn, may help the brain recover better than it would without such stimulation.

Another method is real-time fMRI neurofeedback, which uses a computer interface coupled with fMRI technology.

This allows Liew to analyze real-time brain activity and give patients feedback about their brain activity on a second-by-second basis.

With this feedback, patients can potentially learn to re-control their own brain activity in regions that may have been damaged after stroke, using only their thoughts. Liew says this technology gives patients a way to become active players during their own recovery by learning how to control their own brain networks.

"We give them a way to control their own brain activity, even if they cannot necessarily control their own limb movements," she says. "So far, we've seen that people with more severe motor impairments also show the greatest increases in brain activity with neurofeedback, suggesting that this is a promising tool for individuals who cannot recover through traditional motor practice alone."

Liew, who earned her PhD degree in occupational science at USC in 2012, returned to the USC Chan Division as a faculty member in January 2015 after spending two years conducting postdoctoral research at the National Institutes of Health's National Institute of Neurological Disorders and Stroke. By its nature, stroke research is a multidisciplinary pursuit that can be improved through collaboration among experts from many disciplines. Liew, who directs the Neural Plasticity and Neurorehabilitation Laboratory and also holds faculty appointments in the USC Division of Biokinesiology and Physical Therapy and in the Department of Neurology at the Keck School of Medicine of USC, believes having access to experts in many disciplines will improve her own research. In fact, it was one of the primary reasons she chose to return to USC.

"It's great to be back at USC because it feels like home," she says. "I also feel there are so many resources here that will benefit my research and, hopefully, help find new methods that will improve quality of life for stroke patients."





# INCLAB INFANT NEUROMOTOR CONTROL LABORATORY

**D**r. Beth A. Smith and the students working with her in the Division of Biokinesiology and Physical Therapy's Infant Neuromotor Control Laboratory (INCLab) are studying the development of neural control of movement in infants. The INCLab focuses on early identification of atypical infant development and evaluating effectiveness of interventions to promote neural and functional development in infants with or at risk for developmental delay. Accurate early identification of atypical development within the first months of life is a challenge for the field. This is an important challenge to solve because the potential to have a positive impact on development is unparalleled during infancy. Accurate early identification of atypical development will allow for targeted therapy to be provided as early as possible, supporting optimal neuromotor development. The most effective content for early therapy is yet another unknown for the field, and also a focus of the INCLab.

Dr. Smith and her students use many different tools to evaluate infant movement. Some projects involve infants wearing small movement sensors on their arms or legs to

collect information about the number of times they move in a day and the types of movements they are making. The sensors can be worn all day as the infant and their family go about their normal daily activities at home or out in the community. Other projects involve measuring infant brain function related to movement control, collected as electroencephalography (EEG) data. EEG uses small sensors placed on the surface of the head to measure the electrical activity produced by the underlying cortex. The INCLab also collects detailed information about limb movement trajectories through space using a 3-dimensional motion analysis system and 3 synchronized high-speed video cameras. Finally, the INCLab can measure the muscle activity used to produce movement through surface electromyography and can measure where infants are looking using a head-mounted infant eye-tracking system. Different tools are used for different projects depending on the specific research question.

Current research projects in the lab include the following: Full-day leg movement assessment in infants at risk for developmental delay: In this project, infants between 1



and 24 months of age who are at risk for developmental delay wear movement sensors on their legs for a full day on 3 occasions. Their data are compared to those of typically developing infants. The goals of this project are to determine 1) if quantity, type and quality of daily leg movements are related to the onset of independent walking (identifying how much and what type of leg movement practice precedes walking onset) and 2) whether measures of quantity, type and quality of daily leg movements early in life can predict later developmental outcomes. This work is supported in part by a grant from the American Physical Therapy Association Section on Pediatrics.

**Daily arm movement practice and brain development:** In this project, infants between 1 and 6 months of age are tested on 3 occasions. On each occasion they 1) wear movement sensors on their arms for a full day to determine amount and type of daily arm movement practice and 2) wear the EEG cap while they reach for objects, measuring both their brain function and reaching skill. The goal of this project is to map the development of infants' earliest spontaneous and goal-directed arm movements to the specific areas of cortical

brain activation that produce them. This work is supported by a grant from the Bill & Melinda Gates Foundation.

**Positioning device project:** For this project, infants between 1 and 6 months of age are positioned in 3 different positioning devices: a jungle gym, a bumbo seat, and a car seat. The goal of this project is to determine whether infants increase or decrease their rate of arm and leg movements when encouraged to move (gym), provided postural support (bumbo), or constrained (car seat). The results of the current project will inform researchers about the immediate effects of the devices on infant movement, and in the future can allow them to study the effects of device use on infant development. This work is supported in part by a grant from the USC Undergraduate Research Associates Program.

In addition to the specific funding sources acknowledged above, Dr. Smith's salary and research are supported in part by NIH K12-HD055929.

## ARTICLE AND PHOTOS COURTESY OF DR. BETH SMITH

Opposite page *upper right* photo: "Equipment used in the Infant Neuromotor Control Laboratory. Bottom left: Opal movement sensors shown with sleeves for attaching them to an infant's arms or legs, one sensor on top of sleeve for visualization, one sensor in sleeve. Top: Electroencephalography cap for collecting brain activity data from infants. Right: Example of toy used to encourage infants to reach.

Right photo: A 2-month-old child being tested in the laboratory, wearing movement sensors on her arms and legs.



# RESEARCH DAY

SCHEDULE OF EVENTS | MARCH 25, 2015

8:00am

9:00am - 12:00pm

11:30am - 12:00pm

12:00pm - 12:30pm

12:30pm - 12:45pm

Registration: Presenters and Judges

Poster judging

General registration

Lunch

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

12:45pm - 1:25pm

## **Keynote Speaker: Paul Thompson, PhD**

*"The ENIGMA of the Human Brain: Analyzing 30,000 Brain Images and Genomes from 33 Countries to Discover What Helps or Harms the Human Brain"*

Institute for Neuroimaging and Informatics, Keck School of Medicine of USC



Paul Thompson is a Professor of Neurology, Psychiatry, Radiology, Engineering, Pediatrics & Ophthalmology at USC, and Director of the USC Imaging Genetics Center. He leads the ENIGMA Center for Worldwide Medicine, an NIH "Big Data" Center of Excellence for analyzing vast volumes of biomedical data worldwide. Dr. Thompson co-founded and leads the Enhancing Neuro Imaging Genetics through Meta-Analysis (ENIGMA) consortium, a worldwide medical network of 185 institutions in 33 countries, studying the major disease of the brain. ENIGMA discovers factors that affect the progression on Alzheimer's disease and other dementias, schizophrenia, depression and bipolar illness, HIV/AIDS, methamphetamine abuse, autism, and childhood brain disorders. One of the 30 ongoing ENIGMA studies unites teams from the Thai Red Cross, the US, and South Africa to study how treatments restore brain growth in HIV-infected children. Thompson's group, which includes 35 USC scientists, also created the first maps of Alzheimer's Disease and



schizophrenia spreading in the living brain, and a method to detect brain growth in children, published in the journal *Nature*. Thompson obtained his M.A. in Mathematics and Greek and Latin Languages from Oxford University, England, and his Ph.D. in Neuroscience from UCLA.

1:30pm - 2:10pm

**Keynote Speaker: Sook-Lei Liew, PhD**

*"Neuromodulation of the Human Motor System and Implications for Stroke Rehabilitation"*  
Occupational Science and Biokinesiology and Physical Therapy, Herman Ostrow School of Dentistry of USC and Department of Neurology, Keck School of Medicine of USC



Dr. Sook-Lei Liew is an Assistant Professor at the University of Southern California with joint appointments in the Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy and the Division of Biokinesiology and Physical Therapy in the Herman Ostrow School of Dentistry, as well as in the Department of Neurology at the Keck School of Medicine. She is also the director of the Neural Plasticity and Neurorehabilitation Laboratory. The goal of Dr. Liew's research is to understand mechanisms of neural plasticity in healthy individuals and individuals after neurological injury in order to improve their quality of life and engagement in meaningful activities. Using neuroimaging, noninvasive brain stimulation, and real-time fMRI neurofeedback, the Neural Plasticity and Neurorehabilitation Laboratory aims to: 1) characterize processes of neural plasticity during learning and rehabilitation, 2) enhance neural plasticity and neurorehabilitation through noninvasive brain stimulation and neurofeedback, and 3) personalize the use of these plasticity-inducing paradigms to capitalize on each individual's learning or recovery potential.

2:15pm - 2:55pm

**Keynote Speaker: Pascal Magne, DMD, PhD**

*"The Ultimate Biomimetic Restoration"*

Esthetic Dentistry & Restorative Sciences, Herman Ostrow School of Dentistry of USC



Dr. Pascal Magne is an Associate Professor with Tenure and the Don and Sybil Harrington Foundation Chair of Esthetic Dentistry in the Division of Restorative Sciences, Herman Ostrow School of Dentistry of USC. He graduated from the University of Geneva Dental School,



Switzerland, in 1989 with a Med.Dent. He obtained his Doctorate in 1992 and his Ph.D. degree in 2002. Dr. Magne received postgraduate training in fixed prosthodontics and occlusion, operative dentistry and endodontics, and was a lecturer at the same university beginning in 1989 until 1997. From 1997 - 1999, he was a Visiting Associate Professor at the Minnesota Dental Research Center for Biomaterials and Biomechanics, University of Minnesota, School of Dentistry. After concluding two years of research, Dr. Magne returned to University of Geneva Dental School and assumed the position of Senior Lecturer in the Division of Fixed Prosthodontics and Occlusion until he was recruited to the University of Southern California in February 2004.

Dr. Magne is a recipient of multiple awards from the Swiss Science Foundation, the Swiss Foundation for Medical-Biological Grants, and was the recipient of the 2002 Young Investigator Award from the International Association for Dental Research as well as the 2007 and 2009 Judson C. Hickey Scientific Writing Award (for the best research article of the year published in the *Journal of Prosthetic Dentistry*). He is also the author of numerous clinical and research articles on esthetics and adhesive dentistry and is an internationally known mentor and lecturer on these topics. Furthermore, Dr. Magne authored the book *Bonded Porcelain Restorations in the Anterior Dentition - A Biomimetic Approach*. This book has been translated into twelve languages and is considered as one of the most outstanding books in the field of adhesive and esthetic dentistry. Dr. Magne is a founding member of the Academy of Biomimetic Dentistry and a mentor of the Bio-Emulation think-tank group. In 2012, he launched a revolutionary approach to the teaching of Dental Morphology, Function and Esthetics (the 2D/3D/4D approach) for first year dental students at the Herman Ostrow School of Dentistry of USC.

3:00pm - 4:00pm

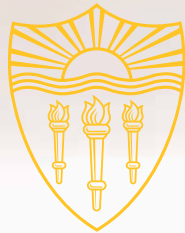
Poster Viewing

4:00pm - 4:30pm

Awards Presentation

4:30pm - 5:30pm

Reception



Herman Ostrow School  
of Dentistry of **USC**

## 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

## JA WILSON DENTAL LIBRARY BIOINFORMATICS AWARD

Award 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 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 created 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 researchers 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: Ensuring Rehabilitation Priorities are Reflected in the Value-Based Health Care  
Name: Natalie Leland

Background: Value-based purchasing is the use of financial incentives to facilitate provider improvement in the delivery of high quality health care. For example, the 30-day hospital readmission measure aims to capture the quality of the care transition. Unfortunately, the indicators that have been evaluated for value-based payment do not capture the objectives of rehabilitation or reflect the priorities of individuals with disabilities. Purpose: Develop a rehabilitation relevant quality measure and examine variations in provider performance. Methods: The study examined a national cohort of fee-for-service Medicare hip fracture rehabilitation patients discharged from the hospital after surgical repair to inpatient rehabilitation or skilled nursing (n=880,339). A secondary analysis of Medicare Administrative data was used to develop the quality measure, successful community discharge (i.e., 30 consecutive days spent in the community after discharge from post-acute care rehabilitation). Results: Patients were followed for 90 days after hospital discharge to capture successful community discharge from rehabilitation. On average, patients spent 27 days in post-acute care before community discharge. Regional and organizational level analysis identified variations in successful community discharge suggesting differences in the quality of care. Guided by these findings, two case studies will be used to illustrate the need for a clinical quality improvement initiative and the impact of a rehabilitation facility's performance in the context of value-based purchasing. Conclusion: Quality measures are a key component of quality improvement strategies in health care. Successful community discharge is a rehabilitation relevant outcome that complements the existing 30-day hospital readmissions measure and reflects the priorities of rehabilitation.

### Poster #: 2

Title: Rotator Cuff Postoperative Protocols from the Perspective of Physical Therapists  
Name: Brian McNeill

Background: Rotator cuff dysfunction is one of the most commonly seen musculoskeletal disorders today. Its association with pain and weakness directly diminishes a patient's functional ability and can significantly affect a patient's quality of life. Rotator cuff dysfunction is typically described as

continuum of pathology ranging from tendinitis and bursitis, to partial tearing, to a complete tearing in one or more of the tendons. Often times when one or more of these tendons tear they require surgical intervention to restore strength and function of the shoulder. The medical field has examined this pathology for over 200 years and there have been vast advancements in repairing this tendon failure (Randelli 2015). Despite the progress in knowledge, surgical technique and technology, there is still an undesirable amount of surgical failures and poor clinical outcomes. Much of the poor outcomes result secondary to constant pain, and the limited progress of range of motion and strength. It is thought that these impairments are due to failure of the repaired tendon. Together orthopedic surgeons and physical therapists are striving to address this issue in order to improve clinical outcomes and patient quality of life. Research looking at surgical technique, tendon histology and healing time, patient risk factors, and postoperative rehabilitation techniques have been the main focus of the literature. Studies have shown that rotator cuff retears primarily occur during weeks 6-26 following shoulder surgery (Iannotti, 2013). In addition, various animal studies show weakness in the repair as high as 50% at 16 weeks post-surgery (Ward JOSPT 2010). With the majority of postoperative patients undergoing some form of formal rehabilitation the timelines for these retears occur while under the care of both the physical therapist and the orthopedic surgeon. One factor which has been found to be associated with poor clinical outcomes is the size of the rotator cuff tear prior to surgery. Recent studies show a range from 13% to 94% of large and massive rotator cuff tears fail within the first 2 years after surgery (Miller AJSM 2011). This statistic makes it all the more important that orthopedic surgeons and physical therapists work together during this rehabilitation process to ensure the integrity of the surgical site. Currently, the most common tool in managing the patient's rehabilitation is a postoperative protocol. However, the information given in these protocols are generically based and lack patient specificity. This is often due to the fact that the complexity of every patient and vary. Certain patients may advance at a more rapid pace; whereas other patients must be progressed more conservatively. Although the concepts which guide clinical practice and the stages of rehabilitation are based on tissue healing and biomechanical stress (Millett 2006 JAAOS,) rehabilitation protocols tend to vary considerably among healthcare providers and are frequently based on clinical expertise and expert opinion rather than scientific rationale (Clinical Commentary

Rehabilitation after Arthroscopic Rotor Cuff Repair: 2012). A recent survey performed by the Kerlan-Jobe Orthopaedic Clinic looked at the cohesiveness of Orthopedic Surgeons regarding current concepts involving pre-operative corticosteroid injections, and rotator cuff rehabilitation/patient postoperative management. The survey was investigating the various differences between surgical specialties, example: Shoulder Specialist and Sports Medicine Specialist. Their findings stated numerous statistically significant differences between how surgeons manage rotator cuff disease. This provoked further questions and investigation highlighting the need for more research and a closer look at patient management specifically regarding Surgeon-Therapist communication and postoperative protocols. Furthermore, the findings of the Kerlan-Jobe Orthopaedic Clinic survey lead us to believe that the continuity of care between rehabilitation specialists will also vary. These concepts are critical to investigate in order to determine current standards of practice and areas of discrepancy among rehabilitation management. Purpose: The goal of this study is to investigate the current concepts regarding postoperative rotator cuff protocols, and the state of communication between the referring surgeon and the skilled provider caring out the rehabilitation in order to improve clinical outcomes and patient care. Methods: An electronic survey will be distributed to physical therapists who commonly see orthopedic and sports related conditions. Inclusion: Licensed physical therapists who commonly treat orthopedic and sports conditions of various experience, specialties and training levels. Physical therapists who have to ability to read and understand the English language. Exclusion: Physical therapy students, physical therapy assistants, non-licensed physical therapists Results: Pending Conclusion: Pending

### Poster #: 3

Title: Therapist Perceptions of Sonographic Utility in the Musculoskeletal Rehabilitation  
Name: Shawn Roll

Background: Point-of-care sonographic imaging for musculoskeletal conditions is rapidly expanding. Numerous advantages (e.g., enhancing evaluation, monitoring disease progression) have been reported by a variety of health care providers. Prior to widespread adoption, a more complete understanding of potential uses by occupational therapists is needed. Purpose: Using a qualitative descriptive design, potential uses for sonography by occupational therapists in the rehabilitation of musculoskeletal disorders were explored.

Methods: Two occupational therapists working in a hand rehabilitation clinic were purposefully recruited and trained in the use of sonographic imaging. Over 3 months, the therapists implemented sonography with nine patients with diagnoses of the wrist, hand and fingers. Data were collected using questionnaires and periodic short-interviews (15 mins) to explore their experiences with each use of sonography. At the conclusion of the implementation period, long-interviews (60 mins) were conducted with each therapist. Three researchers individually reviewed the data from 10 questionnaires, 5 short- and 2 long-interview transcripts to identify emerging themes. Numerous discussions and iterations of data analysis culminated in consensus on thematic units. Results: Four areas of utility for sonography by occupational therapists were revealed: mastering anatomy and pathology, augmenting clinical reasoning, supplementing intervention, and building evidence. Novel findings included improved therapist appreciation of normal and abnormal anatomy, as well as the perceived use of sonography as a mind-body intervention to enhance patient experiences with care. Conclusion: A wide range of uses for sonography by occupational therapists exists. Enhanced identification of underlying pathology may improve targeting of interventions. Furthermore, occupational therapists are uniquely positioned to maximize the mind-body potentials of sonography.

### Poster #: 4

Title: Infant Exploratory Learning and Leg Joint Coordination: Influence of Prematurity  
Name: Barbara Sargent

Background: Preterm infants with very low birth weight (PT) are at risk for developing spastic cerebral palsy which is characterized by decreased selective hip-knee joint coordination. Purpose: Determine the ability of full-term (FT) and PT infants to: (1) learn the contingency between leg action and mobile activation, and (2) demonstrate increased selective hip-knee coordination when leg actions are reinforced with a mobile. Methods: 14 FT infants at 3 months and 10 PT infants at 4 months participated in 2 sessions of mobile reinforcement. Infants were positioned supine under a mobile. Day 1 consisted of a 2-min baseline condition (no mobile reinforcement) and 6-min acquisition condition (mobile reinforcement for specific leg actions). Day 2 consisted of a 2-min baseline condition, 6-min acquisition condition, and 2-min extinction condition (no mobile reinforcement). Results: FT infants increased reinforced leg action during the acquisition as compared to baseline condition to meet performance criteria Day



2. FT infants classified as Learners (n=5), but not Non-Learners (n=9), demonstrated decreased hip-knee correlation coefficients during acquisition on Day 2 as compared to baseline kicking on Day 1. PT infants met performance criteria on Day 1. There was no statistically significant difference in hip-knee coordination across conditions for PT infants classified as Learners (n=6) or Non-Learners (n=4). Conclusion: PT infants performed the task on Day 1, however unlike FT infants, PT infants who demonstrated learning did not exhibit more selective hip-knee coordination. PT infants have difficulty generating more selective hip-knee coordination and may require additional days participating in the paradigm to change their coordination patterns.

#### Poster #: 5

Title: Developing Occupation-Based, Preventive Programs for At-Risk, Late Middle-Aged Latino Patients.  
Name: Stacey Schepens Niemiec

Background: Latinos between 50 and 60 years old are at high risk for developing chronic conditions that can lead to early disability. Provision of occupation-based health promotion programs (OHPPs) in primary care may prove effective in offsetting disability and disease progression in this population. Purpose: Identify lifestyle domains and health-actualizing strategies important to late middle-aged Latinos, to inform development of patient-centered OHPPs implementable in primary care. Methods: We conducted a qualitative study with 11 Latinos (five females; age  $56 \pm 3.27$  years) in this demographic group. One-on-one, semi-structured interviews addressing routines, health management, and healthcare utilization were administered until theme saturation. A content analysis was completed to identify patterns and regularities in the data. Interview content was compared across the sample to determine commonalities, disagreements, and focal points. A promotor (community health worker) reviewed the results to validate conclusions referencing Latino culture. Results: Informants identified six lifestyle domains: Weight Management; Disease Management; Mental Health and Well-being; Personal Finances; Family, Friends, and Community; and Stress Management. A typology of perceived health-actualizing strategies was derived for each domain and a schema constructed. Conclusion: The resultant schema can be used as a foundation for designing patient-centered OHPPs for late middle-aged, at-risk Latino patients. The valued domains and strategies we extracted can be expanded into learning modules using evidence-based best practices. The findings demonstrate the need for sophisticated clinical judgment in assessing the complex issues that impact the health of this underserved population.

#### Poster #: 6

Title: Decline and Recovery of Perceived Physical Health among Older Adults  
Name: Stacey Schepens Niemiec

Background: Older adults are subject to both gradual declines in health due to natural aging or chronic conditions and more dramatic declines from sudden injury or illness. Patient-reported perceived physical health (PPH) reflects chronic conditions, suggesting that decline in PPH (dPPH) may have

enduring effects on well-being and warrants investigation. Purpose: To identify predictors and covariates of dPPH among elders and predictors of recovery from dPPH. Methods: We conducted a secondary analysis of older adults who participated in the Well Elderly Trial and completed the six-month post-intervention testing (n=359). Participants were independent-living, ethnically diverse, and aged 60+ years. PPH was measured up to five times over two years using the SF-36 physical health component. Results: During the first six months, 19% (n=67) of participants had substantial declines in PPH (dPPH). Those with dPPH had higher baseline PPH, lower baseline mental health, social support, and social network scores, and worse negative changes in life satisfaction and stress than the non-declining group. Recovery from dPPH varied by race/ethnicity, magnitude of initial decline, and baseline PPH and activity frequency. Latinos showed greater improvements than Whites, and those with lower baseline PPH showed more improvements than those with higher baseline PPH. Conclusion: The perception that healthy older adults (especially those with high PPH) can easily recover from dPPH may be misguided. Future research is necessary to determine if elders with dPPH may benefit from early intervention to increase chances for recovery.



#### Poster #: 7

Title: Experimental Models of Compensation Following Regional Oral Sensory Damage  
Name: Derek Snyder

Background: Oral sensory variation arises from anatomy, receptor genetics, and nerve damage. Of these, nerve damage is least understood because its sensory outcomes defy easy prediction. Four cranial nerves innervate specific oral regions, and certain health conditions target specific nerves: Severe childhood ear infections damage the chorda tympani (CT), blocking anterior taste cues; tonsillectomy damages the glossopharyngeal nerve (IX), blocking posterior taste/tactile cues. Oral anesthesia shows that local nerve loss disinhibits intact oral sensations: CT block elevates IX, trigeminal, and whole-mouth intensity, particularly among supertasters of PROP bitterness. Variation in the efficacy of disinhibition may explain inconsistent clinical accounts of oral sensory dysfunction. Purpose: We use CT anesthesia to simulate anterior oral sensory loss, exploring individual differences in sensory change elsewhere in the mouth. As a clinical correlate, we examine regional oral sensory

loss in individuals with histories of severe ear infection and/or tonsillectomy. Methods: Laboratory participants (N=27) underwent unilateral auditory canal block, with spatial testing before and after. In a larger spatial dataset (N=301), individuals with severe ear infection and/or tonsillectomy history were compared with individuals without. Spatial testing involved anterior, posterior, and whole-mouth intensity judgments of solutions (NaCl, sucrose, citric acid, quinine, ethanol). Results: Unlike supertasters, nontasters undergoing CT block experienced asymmetric posterior losses that failed to sustain whole-mouth taste. Individuals with presumptive CT or IX damage showed elevated whole-mouth sensation, but those with both conditions showed reductions. Conclusion: Native taste status (i.e., anatomy, receptor genetics) and degree of loss govern the impact of oral sensory damage, yielding potentially varied clinical outcomes.

#### Poster #: 8

Title: Behavioral Consequences of Disrupted MET Signaling  
Name: Barbara Thompson

Background: Utilizing genetically modified mouse lines to dissect the role of specific genes in the neurobiological underpinnings of neurodevelopmental disorders is an important approach. Our laboratory discovered that the gene encoding the receptor tyrosine kinase, MET, contributes to autism risk. Subsequent studies have shown a role for MET in functional and structural cortical connectivity in typically developing individuals and those with autism spectrum disorder. Furthermore, our studies have illuminated a role for Met in dendritic and spine architecture and excitatory drive in the cortex of mouse models of altered Met signaling. Purpose: To further understand the contribution of Met to brain development and its impact on behavior, we generated two conditional mouse lines in which Met is deleted from select populations of cerebral cortex neurons: 1)  $Met^{fl/fl}/Emx1^{cre}$  (deleted from all cells arising from the dorsal pallium) and 2)  $Met^{fl/fl}/Emx1^{cre}$  (deleted from all neural cells). A battery of behavioral tests was then performed to assess cognitive, emotional, and social disturbances that are observed in multiple neurodevelopmental disorders, including autism spectrum disorders, and that are in part sub-served by circuits that express Met. Methods: Multiple cohorts of mice were tested in early adulthood on rotarod, activity chamber, elevated plus maze, spontaneous alternation in the T-maze, olfactory dishabituation, social novelty preference, marble burying, contextual fear conditioning, and direct social interaction with simultaneous USV recordings. Results: We found that the null  $Met^{fl/fl}/Emx1^{cre}$  mice display significant hypoactivity in the activity chamber and in the T-maze despite normal performance on the rotarod. Additionally, these animals show a deficit in spontaneous alternation. These mice show normal anxiety, olfactory dishabituation, social novelty preference, contextual fear conditioning, and marble burying. In comparison, the null  $Met^{fl/fl}/Emx1^{cre}$  mice display deficits in contextual fear conditioning, and a weak deficit in sociability in the social novelty preference task. These mice show normal performance on rotarod and activity chamber, anxiety, spontaneous alternation, olfactory dishabituation, and marble burying. Conclusion: These data suggest a complex

contribution of Met in the development of social, emotional, and cognitive behavior. The impact of disrupting developmental Met expression is dependent upon the circuit-specific deletion pattern. The null  $Met^{fl/fl}/Emx1^{cre}$  mice (Met deleted from every cortical cell) show behavioral phenotypes consistent with autism. In contrast, the null  $Met^{fl/fl}/Emx1^{cre}$  mice (Met deleted from cells arising from the dorsal pallium) show a different behavioral repertoire, with decreased exploratory behavior and memory. Future studies will determine the impact of environmental interactions with the deletion of Met from the  $Met^{fl/fl}/Emx1^{cre}$  mice on further social, emotional, and cognitive behaviors.

#### Poster #: 9

Title: Head and Neck Cancer Rehabilitation: Comparison of Two Program Designs  
Name: Kimiko Yamada

Background: We previously determined that an 8-week 5 session group rehabilitation program for individuals after head and neck cancer (HNC) treatment was safe, feasible, and resulted in significant improvements in the participants' pain, disability, mobility, and endurance. Purpose: In a continuation of this study, we aimed to determine the safety and feasibility of a modified version of the program in which the content is delivered over 6 weekly sessions. We hypothesized that the shorter program will improve attendance rate and result in similar significant improvements. Methods: At the initial evaluation and re-evaluation the participants completed 3 functional outcome questionnaires (Neck Disability Index, DASH questionnaire, and FACT - Head & Neck). Neck and shoulder active range, deep neck flexor endurance, and the 6-minute walk test were assessed. Wilcoxon Signed Ranks test determined statistical significance of changes in outcome questionnaires and pain. Paired samples t-tests were run to determine statistical significance of changes in range and endurance testing. Similar comparisons of the means between the two groups were completed to determine program effectiveness. Results: Fourteen of the 23 people and 14 of the 27 people completed the 8 and 6 week program, respectively. No adverse events were reported by any participant in either program. Mean changes in all measures improved in both groups and the differences between the two groups were not statistically significant. Conclusion: The 6-week 6 session and the 8-week 5 session designs demonstrate good safety and feasibility for a group rehabilitation program to make a positive impact on disability, pain, cervical and shoulder range of motion, and endurance in patients after HNC treatment.

#### Poster #: 10

Title: Bio-Inspired Hard-to-Soft Interface for Implant Integration to Bone  
Name: Yan Zhou

Background: Accomplishing full, functional integration at the host-to-biomaterial interface has been a critical roadblock in engineering implants with performance similar to biological materials. Purpose: Molecular recognition-based self-assembly, coupled with biochemical signaling, may lead to controllable and predictable cellular differentiation at the implant interface.

**Methods:** We engineer a bio-inspired interface built upon a chimeric peptide. Binding to the biomaterial interface is achieved using a molecular recognition domain specific for the titanium/titanium alloy implant surface and a biochemical signal guiding stem cells to differentiate by activating the Wnt signaling pathway for bone formation. **Results:** During a critical period of host cell growth and determination, the bioactive implant interface signals mouse, as well as human, stem cells to differentiate along osteogenic lineages. **Conclusion:** The Wnt-induced cells show enhanced mineral deposition in an extracellular matrix of their creation and an enhanced gene expression profile consistent with osteogenesis, thereby providing a bone-to-implant interface that promotes bone regeneration.



Poster #: 11

**Title:** Pseudocarcinomatous Hyperplasia: A Simple Way to Differentiate it from OSCC  
**Name:** Kamal Al-Eryani  
**Faculty Advisor:** Parish Sedghizadeh

**Background:** Granular cell tumor (GCT) of the oral cavity is a benign lesion. Half of oral GCTs demonstrate pseudocarcinomatous hyperplasia (PCH) of the mucosa which can mimic invasive islands of oral squamous cell carcinoma (OSCC). Such similarity might confuse a pathologist or investigator when diagnosing or evaluating these two conditions, leading to misdiagnosis or misclassification. Indeed, several misdiagnosed cases of oral GCT have been reported in the literature as OSCC or malignant oral GCT that resulted in unnecessary aggressive treatment for the affected patients. **Purpose:** The aim of this study is to simplify discrimination between oral GCT-PCH and OSCC. **Methods:** To distinguish between these two entities, we examined 12 patient specimens of oral GCT-PCH and OSCC histologically and via immunohistochemistry (IHC) for CK10, CK13, CK17 and P75. **Results:** The results suggest that the cellular population and morphology of the underlying connective tissue is most relevant for making a correct diagnosis between the two conditions. Consideration of IHC findings for epithelial markers alone may lead to erroneous diagnosis; however, immunopositivity of GCT cells for P75 can be an easy way to identify the underlying tumor and exclude OSCC. **Conclusion:** Finally we recommend more studies on the molecular biology of PCH to understand how PCH is able

to mimic OSCC histologically without harboring its malignant phenotype clinically, which could have significant translational potential for understanding invasive OSCC.

Poster #: 12

**Title:** Modified VISTA for Implant Placement in Maxillary Anterior Site  
**Name:** Hamad Alqadhi  
**Faculty Advisor:** Homa Zadeh

**Background:** A variety of incision designs are available during implant placement in the maxillary anterior site. The traditional techniques available have limitations, such as the need for marginal incisions that compromise the blood supply resulting in a "black triangle" or significant gingival recessions in the esthetic area. This can be critical when adjacent to restorations where recession might reveal dark margins. Outcome predictors have demonstrated the significance of minimal surgical trauma and a thick gingival biotype in order to avoid compromised esthetic results. Incision designs such as Papilla Preservation technique and intra-sulcular incisions extending to adjacent teeth are limited in their ability to prevent apical migration of papillary height between implant and tooth. The Vestibular Incision Subperiosteal Tunnel Access (VISTA) technique has been developed in an attempt to preserve the circulation of blood resulting in superior outcome compared to available techniques for gingival recession defects. This case report is aimed to demonstrate the novel incision design, termed the modified VISTA technique. **Purpose:** In an effort to preserve soft tissue contours of adjacent teeth during implant placement and soft tissue augmentation of a single tooth site, a novel technique has been developed. This technique is termed Modified Vestibular Incision Subperiosteal Tunnel access. A single edentulous site was replaced with dental implant (Biomet 3i) and a connective tissue graft to increase width. The recipient site for the graft was accessed through the vestibule, while the implant was placed raising a minimal palatal flap. No reflection of the adjacent papilla was performed. Results after 12 month show comparable papilla height to baseline. The results of this case report demonstrate the potential for the modified VISTA technique with connective tissue graft and implant placement, in achieving optimal esthetic results for soft tissue augmentation during implant placement in the maxillary anterior site. **Methods:** Patients were treated for single implant treatment and soft tissue augmentation using the VISTA technique in the maxillary anterior site. A crestal incision was made, slightly palatal to the midline and not extending to the adjacent papilla. Two oblique incisions in a mesiopalatal and distopalatal direction made and full thickness flap reflected to provide access to underlying alveolar ridge. A modified vestibular incision was made apical to site of implant placement, followed by a subperiosteal tunnel for release and augmentation of a connective tissue graft (CT), to achieve a thicker biotype. The connective tissue was harvested from the maxillary tuberosity and placed through vestibular tunnel, onto denuded bone. The graft was manipulated using sutures and hand instruments, then secured into place. Implant was placed shortly after securing graft. In this manner, no reflection of the adjacent papilla was necessary and minimal surgical trauma was delivered preserving the blood supply to

the recipient site. The gingival condition and the percentage of remaining papilla height relative to those at baseline were measured to compare the percentage of remaining papilla at the conventional incision design group at 3 months post-operatively. Clinical observation was followed up to 1 year. **Results:** The results of clinical measurements showed that papilla height in modified VISTA incision group was comparable to those at baseline. The percentage of remaining papilla height relative to those at baseline at modified VISTA group was  $97.5 \pm 3.5\%$ , while a conventional incision group showed that it was  $31.0 \pm 11.5\%$ . Statistically significant difference was found based on statistic analysis (Student t-test). Clinical observation revealed that conventional incision jeopardize blood circulation and compromised esthetic results with papilla loss appeared between implant and adjacent tooth. On the other hand, modified VISTA incision successfully preserved papilla height and achieved 100% papilla fill between contact. No further recession was noted at 12 months in modified VISTA group. Thick biotype was observed at both groups. **Conclusion:** This case report highlights the importance of minimal surgical trauma to avoid gingival recession in adjacent teeth. The results of this case report demonstrate the potential for the modified VISTA technique with connective tissue graft and implant placement, in achieving optimal esthetic results for soft tissue augmentation during implant placement in the maxillary anterior site. Baseline gingival margin level following extraction may influence the outcome of esthetic result, including papilla height and width after definitive restoration delivery.

Poster #: 13

**Title:** Alveolar Ridge Dimensional Changes Following Ridge Preservation Procedure: CBCT Linear Analysis  
**Name:** Diane Anthony  
**Faculty Advisor:** Homa Zadeh

**Background:** Alveolar ridge atrophy has been considered as an unavoidable consequence of tooth extraction, leading to compromised esthetics and function. Ridge preservation has been proposed as a strategy to reduce post-extraction bone resorption. An array of ridge preservation protocols has been proposed, though data on the biologic outcome of the healing response is scant. **Purpose:** This study examined the magnitude of alveolar bone alterations following ridge preservation grafting with anorganic bovine bone matrix (ABBM) protected by a non-resorbable membrane. **Methods:** The present retrospective study (N=16) quantitatively compared CBCT images pre-operatively and following healing of tooth extraction and ridge preservation (mean 5 months) by Simplant® Software. Minimally invasive extraction was followed by ridge preservation, which entailed filling sockets with large particle cancellous anorganic bovine bone minerals (ABBM), and coverage with non-porous polytetrafluoroethylene (PTFE) membrane. **Results:** Comparison of pre- and post-operative bone width and height at various positions relative to the alveolar crest revealed that at 1mm apical to crest, most of alveolar bone width was lost. Alveolar bone width at 2, 3, and 5mm from bone crest were significantly maintained by ridge preservation. Bone height at buccal aspect underwent most significant atrophy. **Conclusion:** Results from

the current study suggest that placement of ABBM protected by PTFE was effective in minimizing post-extraction socket width and height alterations, compared with historical data for sockets that are allowed to heal without additional intervention.

Poster #: 14

**Title:** Assessment of the Quality of Reporting Observational Studies in Periodontal Literature  
**Name:** Diane Anthony  
**Faculty Advisor:** Kian Kar

**Background:** Observational studies intend to examine variables in a population with hopes of characterizing any potential associations. Thus, the quality of reporting of observational studies is important in evidence-based clinical decision-making processes. Comparison of the reporting quality to established standards can help identify short comings of a study and aim to improve quality of reporting and relevance of the published data in clinical decision making. **Purpose:** To assess the quality of reporting of observational studies in a widely read periodontology journal, the Journal of Periodontology (JoP). **Methods:** Electronic search using Medline database, supplemented by hand search of JoP was completed independently and in duplicate by two reviewers. The combined strengthening the reporting of observational studies in epidemiology (STROBE) statement and checklist (consisting of 22 criteria) were used to evaluate the reporting quality of the selected observational studies from JoP published in the year of 2013. **Results:** STROBE items 9 (publication bias), 10 (study size determination), 12e (sensitivity analysis), 13c (diagram usage), and 19 (limitations) were consistently scored low in the journal and year of assessment, whereas items 2 (background), 4 (study design), 5 (setting), and 15 (outcome data) were consistently scored high. **Conclusion:** The quality of reporting of observational studies in JoP can be improved as compared to the STROBE statement.

Poster #: 15

**Title:** 3D Printed Denture Base - Adaptation and Accuracy  
**Name:** Sangho Byun  
**Faculty Advisor:** Tae Hyung Kim

**Background:** Heat-polymerized denture bases deform during and after polymerization that can have negative impact on the clinical performance of complete denture. **Purpose:** The aim of this study was to evaluate the processing deformation of conventional denture base material and new 3D printed light cured denture base material on a standardized anatomic model by using a laser scanner and surface matching software. **Methods:** Metal master cast was made and 10 stone casts were poured after conventional PVS impression taken. Denture bases were made using Dentsply Lucitone 199 (Dentsply, Corp) material according to the manufacturer instructions and standard protocol (control group). For the experimental group, metal master cast was scanned using laser scanner (3 Shape D700, 3Shape Inc.) and printed 10 denture bases using light curing material (Dentca Base, Dentca Inc.) and DLP type 3D printer (Dentca Solution, Dentca Inc.). After the printing, 3D printed denture bases were washed with isopropanol alcohol, dried and post-cured under UV/Vis curing unit

(Honle UV America Inc.) for 1 hr. All 20 denture bases (control and testing group) were digitized using laser scanner. Surface matching software was used to measure dimensional changes between digitized metal master cast and denture base made from conventional heat-polymerized denture base material (Dentsply Lucitone 199) and 3D printed denture base material (Dentca). McNemar test was used for statistical analysis. Results: All 10 samples made from Dentca light-cured base denture material show less deformation ( $\pm 0.05$  mm) than conventional denture base material. Conclusion: 3D printed experimental denture base material shows more accurate fitting on the metal master cast than conventional heat-polymerized denture base material.

**Poster #: 16**

Title: Numerical Design Optimization of CAD/CAM Bonded Composite Resin Implant Crowns  
Name: Marco Carvalho  
Faculty Advisor: Pascal Magne

Background: Because all-ceramic restorations demonstrated a potential for catastrophic brittle failure, an alternative approach evolved using composite resin materials to compensate the absence of periodontal ligament on implant restoration. Finding an optimal abutment design could improve the mechanical behavior of the composite resin crown. Purpose: The aim of this study was to assess the mechanical behavior of CAD/CAM composite resin crowns bonded to 3 different metal implant abutments. The hypothesis considered is that the axial and occlusal thickness of the crown restorative material would have an influence on the stress distribution within the restoration. Methods: A CAD software (SolidWorks 2013) and FEA package (Ansys Workbench 14.0) were used to create three finite element models of posterior maxilla segment with a single premolar implant restored with a composite resin crown. The effect of three abutment designs (4.0Øx4.0mm - control, 2.0Øx4.0mm - slim, and 2.0Øx2.0mm - slim & short) on the maximum principal stress ( $\sigma_{max}$ ) within the crown. All structures were considered isotropic and bonded. Each model received an 800N axial load distributed to both cusps. Results: The max value for the crown was the highest with the slim abutment (98MPa), followed by control (84MPa) and slim & short (83MPa). The higher stresses within the restoration concentrated near the axio-occlusal edge of the abutment and at the occlusal groove. Those findings are in agreement with the companion experimental study. Conclusion: The design of the implant abutment influences the stress distribution within bonded composite resin crowns.

**Poster #: 17**

Title: Experimental Design Optimization of CAD/CAM Bonded Composite Resin Implant Crowns  
Name: Rafaella Cid and Priscilla Lazari  
Faculty Advisor: Pascal Magne

Background: Composite resin crowns bonded to implant abutments have similar dynamic response to load (damping behavior) when compared to teeth with a simulated PDL. Changing the design of the titanium abutment (diameter and height) and consequently increasing the thickness of the polymer crown may influence the flexibility of the assembly and result in a higher rate of success

(less screw loosening, increase resistance of fracture, reparability and wear-friendliness to antagonist teeth). Purpose: The aim of the present study was to assess in vitro, the fatigue resistance and failure mode of CAD/CAM high performance polymer crowns bonded to implant-supported titanium abutments with three different designs. The null-hypothesis considered was that the abutment/restoration adhesive interface would fail before the abutment itself and that the optimized design of the metal abutment together with the different thicknesses of the restorative material (high performance polymer) would have an influence on the fatigue resistance and failure mode of the assembly. Methods: Fifty-one (51) composite crowns were fabricated using CAD/CAM CEREC SW 4.0. Following insertion into a Morse taper implants (CM Titamax EX; Neodent, Curitiba, Brazil), the titanium abutments were adhesively restored with CAD/CAM high performance polymer crowns (Lava Ultimate, air-abraded, silanated) using adhesive resin (Optibond FL) and preheated light curing composite resin (Filtek Z100). There were 3 experimental groups ( $n = 17$ ): Group  $\alpha$  (control) 4.0Øx4.0mm - CM Universal Post (original manufacturer's abutment); Group  $\beta$  (slim) 2.0Øx4.0mm - Modified CM Universal Post; Group  $\zeta$  (slim & short) 2.0Øx2.0mm - Modified CM Universal Post. Cyclic isometric chewing movements (5Hz) were simulated by axial loading, starting with 200N, by stages of 400N, 600N, 800N, 1,000N, 1,200N and 1,400N, at a maximum of 25,000x each. Samples were loaded until fracture or to a maximum of 175,000x. The three groups were compared using the life table survival analysis (Logrank test at  $P = 0.05$ ). Results: The average load/cycles until failure for Group  $\alpha$ ,  $\beta$  and  $\zeta$  were respectively 1,329N/155,924X; 1,071N/119,598X and 1,364N/166,073X. Survival rates ranged from 47% for  $\alpha$ , 17% for  $\beta$ , and 76% for  $\zeta$  with a significant difference in survival probability ( $P < 0.0001$ ). Most failures were mixt cohesive and adhesive and some of them were complete adhesive failure (no abutment failure and no screw loosening). Those results are in agreement with the companion numerical simulation study. Conclusion: The 2-mm axial and occlusal reduction of the abutment (Group  $\zeta$  2.0Øx2.0mm) presented the highest survival rates, similar to that of the original abutment (Group  $\alpha$  4.0Øx4.0mm) but significantly better than group  $\beta$  (2.0Øx4.0mm). The thickness of the high performance polymer crowns will promote a more tooth-like damping behavior, resulting in a strong force absorption despite the rigidity of the fixture.

**Poster #: 18**

Title: Periapical Actinomycosis Presented Radiographically as Malignant-Like Lesion: Case Report  
Name: Diego Dalla-Bona  
Faculty Advisor: Saravanan Ram

Background: Actinomycosis is a rare chronic infection caused by species of *Actinomyces* and characterized by abscess formation, tissue fibrosis, suppurative lesions and fistulas. A patient with unusual malignancy like radiolucent lesion around the apices of her mandibular molars presented to our clinic. Purpose: To report a case treated in our clinic. Methods: Hypothesis was not tested. It is a case report. Results: Actinomycosis infection could present radiographically in a different way and could be very destructive.

Conclusion: When a lesion appear poorly defined in radiography, it is important to do an incisional biopsy and pathology report to better treat patient condition.

**Poster #: 19**

Title: A Novel Biofilm Mediated Osteolytic Infection Model: A Micro-CT Analyses  
Name: Ramon Gavilan  
Faculty Advisor: Homa Zadeh

Background: Bacteria in biofilm state are more resistant to clearance by immune components or antimicrobial agents. One of the obstacles in studying biofilms is the lack of appropriate animal models. The purpose of this study was to establish a novel animal model to study the host immune response to *Aggregatibacter actinomycetemcomitans* (Aa) biofilm. Purpose: The purpose of this study was to establish a novel animal model to study the host immune response to *Aggregatibacter actinomycetemcomitans* (Aa) biofilm. Methods: Customized two-piece titanium implants (1.4 x 3.0mm) and abutments were fabricated and their surfaces were micro textured by grit blasting and acid-etching. The abutments were inoculated in vitro with wild type Aa D7S-1 ( $n=15$ ) and a double knockout mutant of genes for Omp29 and a paralogue of omp29 were deleted (DN) ( $n=15$ ). Sham-inoculated abutments served as negative control ( $n=15$ ). Sterile titanium implants were transmucosally inserted into rat maxillary alveolar ridge. The abutments with or without established Aa biofilm were attached to implants and were followed up for 6 weeks. Micro-CT imaging was performed at 3- and 6-week intervals to examine peri-implant bone volume. Results: An inflammatory response characterized by clinical inflammation, bleeding, ulceration, hyperplasia, and necrosis was observed around biofilm-inoculated titanium abutments. qPCR analysis of Aa was performed on implants at 6 weeks. The percentage of Aa decreased by 75% for wild type and 99.8% for the mutants. Bone loss was noted in bone surrounding implants inoculated with bacteria but not in sham-inoculated implants. Conclusion: These results describe a novel animal model where Aa 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.



**Poster #: 20**

Title: Vestibular Incision Subperiosteal Tunnel Access for Soft Tissue Augmentation  
Name: Alfonso Gil  
Faculty Advisor: Homa Zadeh

Background: In recent years, attempts to cover areas of deep, wide gingival recession were treated by a variety of techniques for

soft tissue augmentation which had limited success for covering wide root denudation. For years, attempts to cover areas of deep, wide gingival recession were met with frustration. Miller indicated that the presence of interdental bone loss unables complete root coverage. The Vestibular Incision Subperiosteal Tunnel Access (VISTA) technique has been developed in an attempt to address the limitations of current techniques. VISTA involves 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 fixated to each tooth with flowable composite. The present cases examined the efficacy of VISTA technique, using the clinical measurements and study cast volumetric analysis. Purpose: The aim of this case report is to present the percentage of root coverage of VISTA technique according to Miller classification as well as the cast analysis of soft tissue augmentation Methods: 41 teeth, including Miller Class I ( $N=5$ ), Class II ( $N=7$ ), and Class III ( $N=29$ ) were treated using VISTA technique (Figure 1 a-h). The percentage of root coverage was evaluated at baseline and at 18 months by clinical measurements by UNC perio probe. The impression was performed at baseline and 6, 12, 24 months to analyze the alteration of soft tissue volume, using CBCT analysis (Accuitomo®, J. Morita, Kyoto, Japan). The images were reconstructed on a personal computer using specially designed I-VIEW software (J. Morita, Kyoto, Japan). All teeth at the baseline image and at the images at different time period were superimposed and analyzed at the same position using image subtraction analyzer. The result of subtraction images showed augmented soft tissue. The amount of soft tissue augmentation relative to those at baseline was measured within 4 mm below the final gingival margin level at the center of tooth. Then, the volume of soft tissue augmentation per 1 mm width was calculated. The Student's t-test was used for pairwise comparisons of CBCT-scan data. Statistical significance was given at  $p < 0.05$  Results: After 18 months, the percentage of root coverage for the type I, II, and III defects was 100%, 100%, and 86%, respectively. The result of this study showed a favorable outcome in both root coverage and soft tissue augmentation by the application of VISTA technique. Initial gingival recession included 1 mm in the Miller type I defects, 2.7 mm in the type II, and 2.8 mm in the type III. After mean follow up period of 18 months, 0 mm. was found in the type I and II defects, and 0.4 mm. in the type III defects. Clinical measurements clearly showed that complete root coverage was achieved in type I and II defects, and 85% in type III defects at 18 month (Figure 2). The study cast analysis revealed that the alteration of soft tissue augmented volume was changed by tooth type. Canine and premolar group showed slight increase in soft tissue volume from 12 month to 18 month as well as decrease in those at both incisor and lateral incisor groups. This can be attributed to the anatomy of root and cervical contour of tooth. Conclusion: Long term results revealed that soft tissue augmentation and root coverage treatment of Miller class I, II, and III recession defects using VISTA resulted in favorable clinical outcomes. Dynamics of soft tissue volumetric change may be varied by tooth type.



Poster #: 21

Title: Local and Systemic Responses to Craniofacial Osteolytic Defects  
Name: Sabina Hamid Faculty Advisor: Parish Sedghizadeh

Background: Peri-implantitis is an inflammatory process involving alveolar bone and alveolar mucosa. Previous Peri-implant studies have inoculated specific pathogenic bacterial biofilms in a periodontitis animal model. This makes it difficult to elicit the role of specific pathogens in the immune response, and may inaccurately represent the pathogenic process due to artificial biofilm induction. Purpose: To examine the local and systemic responses to craniofacial osteolytic, specifically peri-implantitis defects, by using an *Aggregatibacter actinomycetemcomitans* (Aa) biofilm-inoculated titanium implant model and a calvarial lesion animal model without an Aa biofilm. Methods: 30 five month old rats were divided into two equal groups; Aa biofilm-inoculated implants, and control implants. The implants were placed transmucosally into the palate. Animals were followed for 6 weeks post-operatively. Bacterial samples of the Aa biofilm and that of the control were collected from the surfaces of the implants after 1 to 14 days, and 1 to 3 weeks. Clinical inflammation, micro-CT of bone volume, PCR of Aa persistence and Western blot analysis of antibody production were all evaluated. Results: In the Aa model, chronic inflammation was observed when Aa was introduced via an implant delivery system. In non-Aa controls, only transient acute inflammation was observed, and this resolved fully post operatively. Conclusion: The results of this study confirmed that the craniofacial osteolytic lesion alone without the introduction of Aa does not result in local and systemic pathology or mortality. Further clinical study into this area would be useful in the understanding of host-pathogen interactions.

Poster #: 22

Title: Investigation of SLC6A4 Gene Polymorphisms in Jordanian patients with RAS  
Name: Jumana Karasneh  
Faculty Advisor: Parish Sedghizadeh

Background: Recurrent aphthous stomatitis (RAS) is a complex genetic disorder that can be triggered by several environmental factors including anxiety. The serotonin transporter gene (SLC6A4) which encodes the serotonin transporter (5-HTT) is linked to stress and regulates serotonin signaling. Furthermore, polymorphisms in SLC6A4 have been associated with a pro-inflammatory state. Purpose: The aim of this study was to investigate if there is an association between RAS and functional polymorphisms in the SLC6A4 gene. Methods: A case-control association study including 100 Jordanian RAS patients and 150 age- gender- and ethnically-matched controls was conducted. One 44 bp insertion/deletion polymorphism (5-HTTLPR) in the promoter region (rs4795541) and four SNPs were genotyped; rs28914828, rs1042173, rs25531 and rs28914834. Genotyping was conducted using PCR-RFLP technique. Association was assessed by logistic regression analysis. Results: The rs28914828, rs28914834 and rs25531 markers were not polymorphic in the Jordanian population. No significant difference in the genotype or allele

distribution between cases and controls was observed for rs1042173 and rs4795541. The logistic regression analysis after correcting for age, gender, smoking status, anxiety and depression revealed no significant change in the odds of having any of the genotypes for rs1042173 or rs4795541. However, the 5-HTTLPR LL genotype reduces the likelihood of having RAS by 37%. Conclusion: This is the first study to investigate the association of the SLC6A4 gene with RAS. Results from this study population indicate a lack of association with RAS. Confirmatory studies in other populations with larger sample may be warranted.



Poster #: 23

Title: Long Term Outcomes of Regenerative Approach for Treating Peri-Implantitis  
Name: Vahid Khoshkam  
Faculty Advisor: Homa Zadeh

Background: Regenerative procedures, applying the concept of the guided bone regeneration (GBR) are implemented to rebuild peri-implant supporting bone. The effectiveness of regenerative procedures have been measured by a variety of radiographic and clinical parameters, and among them are radiographic bone fill (RBF), probing depth (PD) reduction, clinical attachment level (CAL) gain, and reduction of bleeding on probing (BOP) Purpose: The purpose of this systematic review was to evaluate long-term outcomes of regenerative procedures for treating peri-implantitis. Methods: Electronic search of 5 databases and hand searching were performed to identify human trials that had treated more than 10 peri-implantitis lesions using a regenerative approach with the follow-up of at least 36 months. To meet the inclusion criteria, studies had to report at least one of the following parameters: radiographic bone (RB) fill, probing depth (PD) reduction, clinical attachment level (CAL) gain, bleeding on probing (BOP) reduction, and mucosal recession (MR). The pooled weighted mean (WM) and the 95% confidence CI of each variable were estimated. Results: Searches yielded 1412 records and after evaluating titles, abstracts and full-texts, 5 case series and 1 controlled trial were included for quantitative data synthesis. Meta-analysis for the amount of RB fill revealed a weighted mean of 2.41 mm (ranged from 1.46 mm to 3.30 mm) with 95% CI. For PD reduction, the weighted mean was 3.06 mm (ranged from 1.24 mm to 5.21 mm). Conclusion: There is limited evidence in the literature reporting long term results of regenerative approach for treating peri-implantitis.

Poster #: 24

Title: Adhesive Effectiveness of a Multi-mode Adhesive Containing tt-farnesol  
Name: Diana Leyva  
Faculty Advisor: Sillas Duarte

Background: Dental caries is the most prevalent and costly oral infectious disease in the world. It is usually treated by removal and replacement of infected tooth tissues

with restorative materials, such as adhesively bonded resin composites. Nonetheless, most of these restorations fail within 5-7 years mainly due to the development of secondary caries. In recent years, the addition of antibacterial agents into the adhesive systems has been investigated with the objective of prolonging the life of such restorations by reducing the incidence of secondary caries. Purpose: To evaluate microtensile bond strength to human dentin and pH of a multi-mode adhesive system modified by adding different concentrations of an antibacterial agent. Methods: Crowns of twelve recently extracted human third molars were sectioned and assigned to four groups: A control group (containing only the adhesive Adper Scotchbond Universal, 3M ESPE) and three experimental groups with the same adhesive containing different concentrations of tt-farnesol (based on the minimum inhibitory concentration against *S. mutans* at 0.38%, 1.93%, and 3.94% w/w). All samples were etched with 35% phosphoric acid for 15 s (ScotchBond Etchant, 3M ESPE), rinsed, blot-dried, bonded with one of the four adhesives, and restored with a microhybrid resin composite (Filtek Z250, 3M ESPE). They were stored in distilled water for 24 h, sectioned in X/Y direction to obtain sticks with a cross sectional area of  $0.8 \pm 0.2 \text{ mm}^2$ , and then tested for  $\mu\text{TBS}$  in a universal testing machine (Instron 5965, Instron) at a crosshead speed of 1 mm/min. Additionally, pH values were recorded for the adhesives in all experimental groups and mean values calculated. All data was analyzed using one-way ANOVA followed by Tukey HSD and Dunnett post-hoc tests ( $\alpha=0.05$ ). In addition, two specimens per group were processed for nanoleakage using FESEM and CLSM. Results: Only the experimental group at 0.38% showed no statistical difference from the control group (0%) for microtensile bond strength. pH values for the three experimental groups showed similar values with no statistical difference from the control group. Conclusion: The experimental multi-mode adhesive containing a concentration of 0.38% tt-farnesol showed similar bond-strength and acidity compared to the control group.

Poster #: 25

Title: Volumetric Analysis of VISTA Using the Intraoral Digital Scanner (i-TeroTM)  
Name: Matthew Somerville  
Faculty Advisor: Homa Zadeh

Background: Gingival recession is a common manifestation in most populations. Root surface exposure resulting from gingival recession may also create root caries, dental hypersensitivity, and esthetic problem. The significance of any gingival recession may vary considerably depending on the etiology, extent and associated symptoms in each case. In addition, 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 to be superior in accuracy of gingival examination than traditional gingival examination using periodontal probe. Purpose: This study aimed to report the efficacy of Vestibular Incision Subperiosteal Tunnel Access treatment of multiple recession defects using the intra oral digital scanner (i-TeroTM). 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 2mm 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 Vestibular Incision Subperiosteal Tunnel Access (VISTA) technique has been developed in an attempt to address the limitations of current techniques. VISTA involves vestibular incision in an area remote 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 fixated to each tooth with flowable composite. The impressions were taken at 6 and 1 year following the surgery. All study casts were scanned by the intra oral digital scanner (i-TeroTM) to evaluate the soft tissue alteration according. Results: Data from case series, which have documented the efficacy of VISTA will be presented. Conclusion: Innovative soft tissue coverage technique, VISTA resulted in favorable clinical outcomes. Using the intra oral digital scanner (i-TeroTM) was the best method to measure the volumetric analysis.

Poster #: 26

Title: The Quality of Reporting of Systematic Reviews in Periodontology Journals  
Name: Husain Mohammad  
Faculty Advisor: Kian Kar

Background: Systematic reviews (SR) intend to synthesize the vast amount of published primary research to answer a focused research question. Validated instruments have been developed to assess the quality of SR such as the Assessment of Multiple Systematic Reviews (AMSTAR) and checklist by Glenny and colleagues. Despite the best efforts of journals, previous research has shown that the quality of reporting of SR remains below par impacting the evidence-based clinical decision-making process. Purpose: To assess the quality of reporting of systematic reviews with and without meta-analyses in two widely read periodontology journals, namely, Journal of Periodontology (JoP) and Journal of Clinical Periodontology (JCP). Methods: Electronic search using Medline database, supplemented by hand search of JoP and JCP was done independently and in duplicate by two reviewers (HM & SK). AMSTAR statement and Glenny's checklist were used to evaluate the reporting quality of the selected systematic reviews from both journals published in the years 2010 and 2013. Results: AMSTAR items #4 (status of publication, i.e., gray literature); #10 (publication bias) and #11 (conflict of interest) were consistently scored low in both the journals and years of assessment whereas items #1 (a priori design) and #6 (characteristics of the included studies) were consistently scored high. Glenny checklist #D (published and un-published literature); #E (languages considered) and #J (quality assessment by at least 2 reviewers) were consistently scored low in both the journals and years of assessment whereas #A (focused question), #B (search for appropriate papers), and #M (results display) were all consistently scored high. Conclusion: The quality of reporting of SR in JoP and JCP can be improved according to evaluation by AMSTAR and Glenny statements.

Poster #: 27

Title: Surgical Treatment of Peri-Implantitis  
Name: Navid Sharifzadeh

**Background:** The primary goal of peri-implantitis treatment is cessation of disease progression to maintain the implant in function with stable peri-implant tissue. Regeneration of the lost bone can be helpful to reduce the magnitude of the bone defect. One of the main obstacles of regeneration is the presence of hard and soft biofilm, which is difficult to remove. Various decontamination procedures have been proposed, though there is no consensus about the most effective protocol. **Purpose:** The present case report provides a protocol, which will include implant surface decontamination, as well as regeneration. **Methods:** 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:** Clinical and radiographic outcomes have demonstrated significant regeneration of peri-implant bone and soft tissues. 11 implants have been treated in 7 patients using this protocol. Radiographic outcome demonstrated gain of marginal bone of between 2.0 to 5.4 mm with the mean of 3 mm. In one case, two implants were reconstructed in this manner and during the second stage surgery, it was discovered that implants were fractured. The implants were removed and histologic evaluation was performed, demonstrating significant evidence of new bone regeneration around the treated implants. **Conclusion:** Within the scope of this case series, regeneration of peri-implant bone and soft tissue is achievable via utilizing this treatment protocol.

Poster #: 28

Title: Histological Analysis of Extraction Sockets Grafted with Anorganic Bovine Bone  
Name: Azadeh Tavari

**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 AG, 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

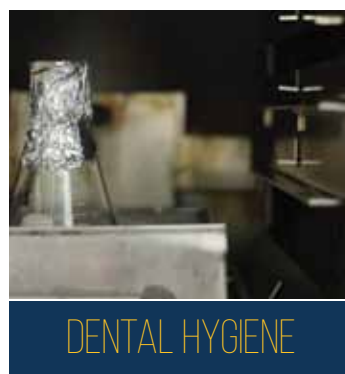
by histology examination. Quantitative histomorphometric analysis was performed (NIH Image J software) to identify osteoid bone, connective tissue, and residual xenograft. **Results:** A total of 39 samples were processed for histologic examination and stained with H&E and Trichrome, followed by histomorphometric 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%, 51%, respectively. According to age of patients, 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 ( $p < 0.05$ ). 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 demonstrated, therefore, 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 #: 29

Title: Comparing and Standardizing In-Patient Consultation Protocols for Cardiac Clearance Patients  
Name: Michelle Tsao  
Faculty Advisor: Richard Green

**Background:** Odontogenic infections can compromise the outcome of cardiac surgery by increasing morbidity, delaying wound healing, and extending hospital stays. Dental extractions of compromised teeth are often performed prior to surgery. The American Heart Association recommends dental clearance for patients undergoing valvular operations. However, little research has been conducted on methods for evaluating dentition for extractions. **Purpose:** To compare protocols for in-patient extraction consultations for cardiac clearance patients across hospitals in the state of California and to create a standardized universal protocol based on compiled data and existing literature. **Methods:** All fourteen general practice residency program directors in California were contacted to obtain existing protocols for in-patient cardiac clearances. Their responses, in addition to peer-reviewed research were analyzed to establish a protocol for dental cardiac clearances. **Results:** Six of fourteen directors responded. None reported a standardized protocol for evaluating dentition for cardiac surgeries. From literature, eight categories were established to evaluate the need for dental extractions. If a tooth meets any of these criteria, extraction is recommended: 1) Mobility – Miller mobility class III or beyond 2) Clinical Attachment Loss –  $>7\text{mm}$  3) Clinical Presence of Decay

– Active caries in exposed dentin either depth is halfway to pulp OR size is more than half of tooth 4) Missing Restoration / Fracture – see criteria for #3 5) Abscess – Periodontal Abscess with suppuration 6) Patient Symptoms – Persistent Pain 7) Periapical Radiolucency – Presence of PARL 8) Radiographic Decay – see criteria for #3 **Conclusion:** Cardiac clearance patients are recommended to receive a panoramic radiograph or full mouth series prior to clinical dental evaluation. However, intraoral evaluations without radiographs have also been shown to have good sensitivity and specificity with visual and tactile examination. Research suggests tooth extraction should be conservative and limited only to dentition with active or high likelihood of infection six months post-op. Eight categories are recommended for use as a standardized framework to aid in the decision of tooth extraction, thereby ensuring patients are provided the best and most consistent level of care.



Poster #: 30

Title: Validity and Utility of ADHA's Hyposalivation with Xerostomia Screening Tool  
Name: Kristel-Mae Caganap  
Faculty Advisor: Ann Eshenaur Spolarich

**Background:** The ADHA HXST was designed to assess risk for hyposalivation with xerostomia in at-risk patients. **Purpose:** The purpose of this study was twofold. First, to test the validity of the ADHA HXST to detect hyposalivation as compared to salivary flow rate measures. Second, to test utility of the ADHA HXST in dental hygiene practice. **Methods:** (Phase I) USC School of Dentistry guidelines were followed to collect both unstimulated and stimulated saliva samples in ten volunteers. Volunteers received a clinical examination and a risk assessment score using the tool. Correlation analysis was used to compare subjects' flow rates with risk assessment scores. (Phase II) Thirty dental hygienists were given the tool for use with their patients on one workday. Afterwards, they completed an online survey to rate the utility of the tool, and to determine how its use influenced their practice behaviors. Descriptive statistics were used to report utility measures. **Results:** For Phase I, there was no significant correlation between unstimulated flow rate and risk score (Spearman's  $\rho = 0.0$ ,  $p > 0.05$ ) or between stimulated flow rate and risk score (Spearman's  $\rho = 0.32$ ,  $p = 0.36$ ). For Phase II, time was noted as the biggest barrier for use ( $n = 9$ , 45%). 13 participants (65%) would consider future use of the tool. **Conclusion:** ADHA HXST was not a valid tool for assessing risk for hyposalivation. Time needed to complete the tool was a barrier to

use. Additional research is needed using a larger sample size and with varied patient populations. USC IRB #UP-14-00504

Poster #: 31

Title: "BEET" High Blood Pressure  
Name: Lucy Hua, Jane Law, and Cassie Lowe

**Background:** The circulating nitrates from vegetables are bioactivated by oral microflora to produce nitrite (Govoni, et. al., 2008). Systemic nitrite is then metabolized into nitric oxide, which plays a significant role in the reduction of blood pressure (Govoni, et. al., 2008). A recent study has shown that individuals who consume nitrate-rich vegetables and also use Chlorhexidine-based antiseptic mouthwash actually experienced a 2-3/5mmHg increase in their blood pressure (Kapil, et.al., 2013). **Purpose:** This review will study the effect of Chlorhexidine and emphasize the importance of manual plaque removal in order to utilize all of the benefits from ones diet. **Methods:** Seven healthy non-smoking volunteers, from ages 24-51 were enlisted. Two separate experiments were conducted to determine the plasma and salivary levels of nitrate and nitrite. Within the control and mouthwash group each test subject had their blood drawn every 30 minutes before and after ingesting sodium nitrate. **Results:** After nitrate ingestion in both groups, the levels of nitrate had no significant difference. But in the mouthwash groups the oral bacteria was destroyed and therefore, the levels of nitrite remained extremely low throughout the rest of the experiment. **Conclusion:** The ingestion of vegetables increases the nitric oxide levels in our body, which may cause vasodilatory effects. In order to maximize the benefit of our diet, we should focus more on effective manual plaque removal through flossing, brushing and additional aids. Our role as dental hygienist and responsibility to educate our patient is crucial. We want to enhance our patient's knowledge about mouthwash so that they can become more mindful of how they use it.

Poster #: 32

Title: Transmission of *Streptococcus mutans* from Mother to Predentate Infant  
Name: Cara Mang  
Faculty Advisor: Joan Beleno

**Background:** One of the most outstanding statistics that still holds true today is the prevalence of dental caries in young children. The Surgeon General's report in 2000 identified dental caries as the most prevalent chronic childhood disease which is five times more common than asthma. The current dental paradigm adopts the construct that *Streptococcus mutans* (*S. mutans*) is a highly virulent pathogen which is the primary etiologic agent of dental caries, and is only viable on mineralized surfaces (Kuramitsu, 1993, Hamada and Slade, 1980). However, according to a recent study performed by Plonka et al. in 2011, *S. mutans* was found in the oral cavities of predentate infants as little as 34 days after birth (Plonka et al. 2012). This novel research indicates that *S. mutans* is in fact viable in the oral cavity of predentate infants. This is a huge discovery, as many health care providers still believe *S. mutans* cannot be present with out teeth. A plethora of current resources indicate that

inoculation of the highly cariogenic *S. mutans* from mother to child occurs well before tooth eruption. Purpose: The cariogenic disease process begins in predentate infants. Prevalence and incidence of *S. mutans* in young children can be controlled and reduced. Therefore, promoting oral hygiene education programs for pregnant women, women who plan to become mothers, and mothers of infants, is imperative to mitigating the risk of transmission from mother to child. Future implications of this suggest that education of mothers and other caregivers is necessitated to reduce infectivity and prevalence of *S. mutans*. Suppression of pathogens includes restorative treatment for active caries, nutritional counseling, oral hygiene education, scaling and root planning, fluoride treatment have proven to reduce infectivity potential, and should be a part of treatment therapy in the future. Methods: Study analysis was performed using the USC PubMed database. All studies used mother infant pairs to determine infectivity potential and gather data. All studies used for our research were within 20 years. Results: A study illustrated that 71% of genotypes were identical in strains of *S. mutans* cultured from mother-infant pairs. Recent clinical studies demonstrate that *S. mutans* can colonize the mouths of predentate infants; the furrows of the tongue appear to be an important ecological niche. The major reservoir from which infants acquire *S. mutans* is their mothers. A study showed that incidence of infection was 9 times greater when the mother had greater than 105 CFU versus mothers with less than 103 CFU (58% versus 6%). Several clinical studies in which *S. mutans* strains were isolated from mothers and their babies exhibited similar or identical bacteriocin profiles and identical plasmid or chromosomal DNA patterns. Conclusion: According to a recent study performed by Plonka et al. in 2011, *S. mutans* was found in the oral cavities of predentate infants as little as 34 days after birth (Plonka et al. 2012). This novel research indicates that *S. mutans* is in fact viable in the oral cavity of predentate infants. A plethora of current resources indicate that inoculation of the highly cariogenic *S. mutans* from mother to child occurs well before tooth eruption. Research findings reveal that the prevalence of *S. mutans* increases with frequency and amount of exposure. Newborns have sterile oral cavities at birth. What was found is that infants whose mothers have high levels of MS, a result of untreated caries, are at greater risk of acquiring the organism earlier than children whose mothers have low levels.

Poster #: 33  
Title: HealThy Self  
Name: Connie Sanchez  
Faculty Advisor: Joan Beleno

Background: Periodontal disease commonly affects individuals leading to the destruction of bone and gingival tissues. For these affected individuals, periodontal surgery is commonly recommended to remove subgingival biofilm deposits in the attempts to reduce pocket depth formation. Because of the invasive nature of periodontal surgery, post-operative pain and discomfort will always be a factor these patients must experience. Platelet-rich fibrin (PRF), a matrix of white blood cells containing concentrated amounts of blood clotting proteins, immunologic proteins, and growth factors targets the induction

sites for regeneration and repair in addition to decreasing post-operative recovery time. PRF is developed from autologous blood, and therefore is safe and ideal. We would like to inform patients and hygienists about the applications of PRF in periodontal and oral surgery. Purpose: The purpose of this presentation is to inform patients and hygienists about the applications of PRF in dentistry. Methods: Benefits and risks are assessed from research and professional journals. Results: There have been no statistically significant clinical results in bone regeneration or pocket depth reduction; however, PRF in periodontal and oral surgery has been shown to reduce inflammation, pain, and postoperative recovery time. Conclusion: It's important to be aware of procedures that are emerging in the dental field involving tissue regeneration as well as understanding the positive and adverse effects when planning a patient's treatment.

Poster #: 34  
Title: What's 'HAP'ing?  
Name: Jennifer Stone  
Faculty Advisor: Joan Beleno

Background: Enamel, the outer layer of the tooth, is a hard biomineral with remarkable fracture and wear resistance to protect the inner, sensitive layers of the teeth from physical and chemical damages. Its structure ranges from the microscale of enamel rods to the nanoscale of tightly-packed crystals organized into a robust, interwoven structure. Before the tooth surfaces, the structure of the enamel is developed by enamel cells that secrete a protein, amelogenin to regulate the growth and organization of crystalline enamel rods. However, once the tooth surfaces, the cells and protein in the enamel degrade, leaving behind an inorganic, mature enamel structure. Therefore, if mature enamel is substantially damaged, it cannot regenerate. Even though the enamel is the hardest substance in the body, it can be damaged overtime by excessive plaque buildup and bacterial growth, leading to the formation of dental caries (cavities). If these caries are not treated early on, the cavities grow larger and affect the sensitive layers of the teeth, eventually leading to infection and even tooth loss. Currently, enamel damage is among the world's most common health problems, so a proper treatment is crucial. Purpose: The conventional restorative treatment for enamel damage involves drilling out the damaged areas and filling the area with materials, like metals or ceramics. However, even after this treatment, secondary caries develop overtime due to the microscopic cracks caused by the drilling technique and the weakening adhesion between the filler material and the damaged enamel structure, which causes further damage on the teeth. Thus, there is a need for improvement in the durability and adhesion of restorative materials that would enable the material to rigidly adhere to the enamel surface. Recently, an amelogenin-chitosan hydrogel (CS-AMEL) was developed to promote the organized growth of a synthetic enamel-like layer on the surface of a damaged. The regrown synthetic layer formed in the hydrogel significantly improved the structure and hardness of etched enamel. Importantly, this biomimetic in-situ regrowth of enamel-like crystals generated a robust enamel-restoration interface between the synthetic layer and the damaged enamel, which ensures the efficacy and durability of the restorative treatment. Methods: We first

conducted a literature analysis on current biomimetic techniques and their efficacy in vivo testing. From there, we were able to determine past discoveries and the potential biomimetics held. The literature we focused on was from Dr. Janet Oldak's study on synthesizing HAP crystals. The methods of this study are as followed: 1. Amelogenin Preparation of rP172, a specific amelogenin protein that is vital for tooth formation. 2. Tooth Slice Preparation: Teeth were cut longitudinally in 0.1-0.2 cm wide sections using a water-cooled slow speed diamond saw. Surfaces were then acid etched with 30% phosphoric acid for 30 seconds and then rinsed with deionized water. 3. Application of CS-AMEL: 20 mL of chitosan-based hydrogel was applied to enamel surface and dried in ambient conditions. It was then immersed in 30 mL of artificial saliva at 37 degrees Celsius for 7 days. 4. Characterization: Results were determined by using a Scanning electron microscope (SEM), X-ray diffraction (XRD), and High resolution transmission electron microscopy (HR-TEM) were used to test the remineralization, hardness, modulus, and connectivity of CS-AMEL to the etched enamel. 5. Antimicrobial evaluation: Real saliva with Lysogeny broth was used in both chitosan-containing amelogenin and solitary amelogenin. The two test dishes sat overnight in 37 degrees Celsius. Results: To further optimize the CS-AMEL hydrogel application method, the hydrogel and AS Solution were replaced every two days for 7 days to observe its effects on the enamel regrowth process. Based on the SEM images, the replacement of the hydrogel and the AS Solution developed a dense, synthetic layer with organized, enamel-like crystal structures. Thus, the optimization of the application method significantly impacted the enamel regrowth process in repairing larger caries, since sufficient ions are provided by the AS Solution to allow the hydrogel to form rigid and continuous regrowth layers. Conclusion: In summary, this biomimetic approach of synthesizing amelogenin fluorinated hydroxyapatite crystals for enamel rejuvenation was proven to have great potential in the restorative dental materials field. It not only forms a seamless bond to the vital enamel, it also shows increased hardness and modulus, as well as, an antimicrobial property. This would elongate the longevity of a restoration and minimize the risk of recurrent caries. While similar experiments have made similar attempts, the CS-AMEL shows great potential for clinical use due to its biologically safe nature that is viable not only in ambient conditions, but also in a patient's mouth.

Poster #: 35  
Title: Oral Health Knowledge and Behaviors of Clients with Mental Illness  
Name: Andrea Wong  
Faculty Advisor: Jane Forrest

Background: Clients living with a severe mental illness (SMI) have poor oral health. Barriers faced include access to care, negative side-effects of psychotropic medications (e.g., xerostomia/dry mouth), poor awareness and perceptions of dental needs, and lack of oral health education. The negative oral health implications are primarily related to the side effects of psychotropic medications, poor diet (which may increase caries), and a higher incidence of tobacco use. Collaborative efforts among healthcare providers are thought to reduce many of the barriers and provide more efficient and optimal

care. Purpose: Through collaboration of occupational therapy and dental hygiene, identify oral health behaviors and barriers people with SMI face and create an oral health educational and advocacy program to address their needs. Methods: One-on-one interviews of 15 people with SMI at a wellness center were conducted to determine attitudes, behaviors, and barriers to obtaining care. Based on this assessment, a Facilitator's Manual and Client Workbook were created to support implementation of an educational program, and community resources were identified and contacted. A post-program survey was administered to identify changes and program success. Results: Through this collaborative pilot-project, 47% of the clients completed the full program, of which 43% were able to obtain dental care. Educational resources were developed for ongoing use and program sustainability. For the consistent core of participants, knowledge and behaviors improved. Conclusion: Interprofessional practice is necessary to create programs for people with SMI and to reduce barriers they face in maintaining their oral health and obtaining care.



Poster #: 36  
Title: Expression of Recombinant Phosphorylated Amelogenin in Microalgae: A New Approach  
Name: Karthik Balakrishna  
Faculty Advisor: Janet Oldak

Background: The enamel matrix protein amelogenin plays a key role in enamel biomineralization. The phosphorylated serine in position 16 of amelogenin is believed to be important for its function in controlling crystal formation. Attempts to express recombinant amelogenin with the serine 16 being phosphorylated have been challenging. Purpose: To develop microalgae system as an efficient and cost-effective platform to express large amounts of phosphorylated amelogenin. Methods: The DNA template of porcine amelogenin was transformed into *Chlamydomonas reinhardtii* cells using a "nuclear expression" vector. The positive transformants were grown under constant illumination and harvested through centrifugation. After initial processing, the proteins were purified through a reverse-phase HPLC column. The peak fractions were characterized by Western blotting and by mass spectroscopy analysis. Results: Amelogenin expression was observed by SDS-PAGE following two months of culture. Four peaks were isolated by HPLC fractionation and confirmed to be amelogenin by Western blotting. All four fractions showed MW of 25 kDa, indicative



of full-length amelogenin. Mass spectroscopy analysis of one major fraction confirmed the presence of at least two phosphorylated serines and one phosphorylated threonine. Conclusion: Amelogenin was phosphorylated in the nucleus of *Chlamydomonas reinhardtii* but the phosphorylation state was different than native amelogenin. Amelogenin has the potential to be phosphorylated at more than one site. Comparison between native phosphorylated amelogenin and amelogenin expressed in *Chlamydomonas reinhardtii* may provide insight into the nature of kinases in enamel formation.

Poster #: 37

Title: BMP Activity Regulates Dental Mesenchymal Lineage Commitment during Root Development  
Name: Jifan Feng  
Faculty Advisor: Yang Chai

Background: The apical region of immature human teeth contains a distinct mesenchymal stem cell (MSC) population, namely stem cells of the apical papilla (SCAPs), which is potentially crucial for root formation during postnatal tooth development. 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 early tooth development and odontogenic differentiation of dental mesenchymal stem cells in vitro, we hypothesize that BMP signaling may also regulate apical papilla stem/progenitor cells to undergo odontogenic differentiation in vivo. Methods: We first investigated the in vivo identities of SCAPs and their relationship with BMP signaling during root development. We then disrupted BMP signaling in the apical mesenchymal cells in vivo utilizing a transgenic mouse model to investigate the functional requirement of mesenchymal BMP signaling in their fate determination during tooth morphogenesis. Results: We identified the in vivo cell population with MSC characteristics that support postnatal molar mesenchymal development. Interestingly, BMP signaling is active in the more differentiated cells adjacent to but exclusive from the MSCs. Furthermore, disruption of BMP signaling in the root mesenchyme in mutant mice resulted in a differentiation defect and increased undifferentiated cells. Conclusion: Our results demonstrate that BMP signaling is required for the in vivo odontogenic lineage commitment of MSCs during tooth morphogenesis.

Poster #: 38

Title: Healthy Eating and Lifestyle After Stroke: A Pilot Study  
Name: Valerie Hill  
Faculty Advisor: Florence Clark

Background: Stroke is the leading cause of disability and 3rd leading cause of death in the US. Stroke survivors have high rates of subsequent coronary events, recurrent cerebrovascular events, and mortality. Lifestyle factors reduce the risk of cardiovascular disease and mortality. Healthy lifestyle practices reduce these risks, yet adherence to healthy lifestyle practices is poor among stroke survivors and socioeconomically disadvantaged race/ethnic minorities. Purpose: To conduct a pilot test of an outpatient post-stroke lifestyle intervention in a safety-net healthcare system to estimate

and compare effect sizes for short-term changes in BMI, diet, and physical activity. Methods: Design: Pilot randomized control trial Participants: Partial referred sample from the SUSTAIN trial. Inclusion criteria: Adults ( $\geq 40$  years) with ischemic stroke or TIA  $\geq 90$  days prior; English- or Spanish-speaking. Randomization stratified by SUSTAIN randomization arm and language (English vs. Spanish). Setting: Rehabilitation hospital outpatient therapy clinic. Interventions: Weekly 2-hour small group sessions led by an OT for 6 weeks focusing on nutrition, physical activity, and self-management. Approach included: didactic presentation; peer exchange; activity participation; and personal exploration. Key elements included: activity-based setting; client goal setting; overcoming potential obstacles; participation in activities; everyday routine; self-efficacy and self-management skills. Main Outcome Measure(s): BMI: 18.5-24.9 kg/m<sup>2</sup>; 5% weight reduction; change in BMI. Diet: great than 5 servings of fruits/vegetables per day; change in number of servings of fruits/vegetables per day. Physical activity: 90 minutes per week of moderate activity; change in minutes of physical activity per week. Results: Results: Phase 1 completed. Total number enrolled as of January 2014: 41 (41% of target). 15 English speakers and 26 Spanish Speakers. 6 group clinics completed: 3 English and 3 Spanish. 32 participants completed 6-month follow up. Phase 2 (n=59) and formative evaluation is in progress. Conclusion: Conclusion: HEALS Phase 1 suggests that a six week lifestyle management program consisting of a 2-hour small group format, healthy lifestyle content, and led by an occupational therapist may be feasible for the proposed population.

Poster #: 39

Title: Protein Methylation in Epithelial to Mesenchymal Transition of Epicardial Cells.  
Name: Olan Jackson-Weaver  
Faculty Advisor: Jian Xu

Background: The epithelial to mesenchymal transition (EMT) is an important cellular mechanism in a diverse range of biological processes such as development, wound healing, cancer metastasis, and organ fibrosis. EMT is a key mechanism for epicardial cell activation and differentiation. Epicardial cells are mesothelial cells lining the heart that are important progenitors and a source of growth factors during development. Our recent work has established an important function for the protein arginine methyltransferase PRMT1 in EMT. Purpose: We hypothesized that PRMT1 is important for EMT in an epicardial cell line (MEC-1) and the interplay between epicardial cells and cardiomyocytes. Methods: Cell culture, western blots, real-time PCR, siRNA. Results: We found that PRMT1 is required for a subset of the EMT marker changes in epicardial EMT. Surprisingly, many of these EMT protein changes were regulated post-transcriptionally. Furthermore, PRMT1 knockdown reduced MEC-1 migration and invasion, suggesting that PRMT1 is critical for epicardial function. Co-culture of MEC-1 cells with neonatal cardiomyocytes caused cardiomyocyte hypertrophy, and this was enhanced when MEC-1 cells were pre-treated with TGF- $\beta$  to induce EMT. Interestingly, MEC-1 cells treated with PRMT1 siRNA also induced cardiomyocyte hypertrophy, but TGF- $\beta$  pre-treatment of these MEC-1 cells did not enhance this

effect. Conclusion: In conclusion, epicardial EMT is largely dependent on PRMT1. Epicardial cells also promote cardiomyocyte hypertrophy, which is enhanced in epicardial cells that have undergone EMT in a PRMT1 dependent manner. These studies establish a role for protein methylation in the EMT process, and could lead to treatments for heart failure and other diseases affected by EMT.



Poster #: 40

Title: BMP-SHH Interaction Controls Epithelial Stem Cell Fate in Developing Tooth  
Name: Jingyuan Li  
Faculty Advisor: Yang Chai

Background: During embryogenesis, ectodermal stem cells adopt different fates, generate a variety of tissue-specific stem cells, and form diverse ectodermal organs, such as teeth, hair follicles, mammary glands, and salivary glands. Although these ectodermal organs share common morphological and molecular features, they differ in their tissue homeostasis, which leads to differing abilities for continuous growth postnatally. Mouse incisors retain the ability to grow continuously, whereas mouse molars lose this ability. BMP/TGF $\beta$  signaling regulates dental epithelial stem cells during development, but the mechanism involved remains unclear. Purpose: Our aim was therefore to determine whether/how BMP/TGF $\beta$  signaling contributes to the differential fate of epithelial stem cells in postnatal tooth development. Methods: We utilized developing mouse molars from different mutant models to identify the key signaling pathway controlling epithelial stem cell fate. Results: In this study, we investigated the difference in epithelial stem cell dynamics between post-natal mouse incisors and molars. We found that Sox2+ stem cells exist transiently during molar development, contribute to all epithelial cell lineages of the molar and disappear prior to root formation. Furthermore, tissue-specific loss of Smad4 in the dental epithelium results in ectopic activation of SHH-Gli1 signaling and prolonged maintenance of Sox2+ dental epithelial stem cells and their niche during post-natal molar development. The BMP-Smad4, but not the TGF $\beta$ -Smad4, signaling cascade regulates Sox2+ stem cell maintenance during molar development. BMP-Smad4-SHH-Gli1 signaling network may provide a niche supporting transient Sox2+ dental epithelial stem cells in mouse molars. In parallel, ablation of Smad4 in the dental epithelium expands Sox2+ dental epithelial stem cells and their niche in continuously growing mouse incisors, through alteration in spatial distribution of SHH-Gli1 signaling activity. Conclusion: Collectively, our study highlights the importance of crosstalk between two major pathways, BMP and SHH, in the regulation of epithelial stem cell fate during organogenesis.

Poster #: 41

Title: Nfic-Hedgehog Signaling Cascade Participates in Apical Growth of Root  
Name: Yang Liu  
Faculty Advisor: Yang

Background: Nfic and Hedgehog signaling were important for root development but the mechanism has not been investigated. Purpose: To investigate the role of Hedgehog (Hh) signaling and its relationship with Nfic in apical papilla growth during root development. Methods: LacZ staining was performed in *Gli1<sup>lacZ/+</sup>*. HE staining was performed on control mice at several stages. *Gli1-creER; TdtTomato<sup>+/+</sup>* was tamoxifen-induced and sectioned for lineage tracing. *Gli1-creER; SmoM2<sup>+/+</sup>* was generated, tamoxifen-induced, and sacrificed for micro-CT, HE and immuno-staining. *Gli1<sup>lacZ/+</sup>* was injected with Hh inhibitor, sacrificed for micro-CT, HE and immuno-staining. For rescue experiments, *Nfic<sup>-/-</sup>* pups were injected with Hh inhibitor, and then sacrificed for HE and immuno-staining. RNA-seq was performed on the tooth of *Nfic<sup>-/-</sup>* and control, and ChIP was done to confirm the direct regulation of Nfic on Hedgehog signaling. Results: During root development, Gli1 expression can be detected in the apical region. Using a *Gli1-creER/loxP* system, progenitor cells can be targeted during root development. Constitutive activation or inhibition of Hh signaling pathway in root progenitor cells by *Gli1-creER; SmoM2<sup>+/+</sup>* or Hh inhibitor led to reduced root length. Gli1 expression in the molar tooth germs of *Nfic<sup>-/-</sup>* mice was stronger, especially in the apical region, suggesting up-regulation of Hh activity in the progenitor cells during root development in *Nfic<sup>-/-</sup>* mice. Upon applying Hh inhibitor, elevated Gli1 expression in *Nfic<sup>-/-</sup>* was attenuated, and the apical papilla growth defect was partially rescued. Nfic regulated Hh signaling pathway by directly binding to the promoter of Hh inhibitor Hhip. Conclusion: Nfic functions as a Hedgehog signaling inhibitor during root development to maintain proper apical papilla growth.

Poster #: 42

Title: Ameloblastin and Amelogenin Cooperate to Maintain the Enamel Rod-Interrod Morphology  
Name: Parachita Mazumder  
Faculty Advisor: Janet Oldak

Background: The regulation of organized growth of enamel crystals and their assembly into prisms is dependent on the proper functions of enamel matrix proteins (amelogenin, ameloblastin and enamelin). Protein-protein, protein-mineral and protein-cell interactions all are believed to play important roles. Our quantitative colocalization study suggested that amelogenin-ameloblastin protein complexes may be the functional entities at the early stage of enamel mineralization. It has been proposed that after cleavage the N-terminal segment of ameloblastin diffuses into the enamel prism boundary and retained by hydrophobic interactions with other proteins. In human and mice abnormal enamel phenotypes were observed due to the deletion of N-terminal segments (exons 5 and 6) of ameloblastin. Purpose: To explore whether N-terminal ameloblastin and amelogenin interact around the periphery of enamel rods and function to protect the integrity of the prisms during maturation stage. Methods: We used in-vivo

and ameloblastin in the enamel matrix of first molar sections from 8-day-old mice. For further detailed study of interactions at molecular level we used confocal fluorescence resonance energy transfer (C-FRET). Results: We observed a fish-net pattern on the enamel surface during the maturation stage. Amelogenin co-localized with the N-terminal segment of ameloblastin around the prism boundary. FRET analysis confirmed that ameloblastin-amelogenin interactions occur at molecular level. Conclusion: Our study suggests that at the boundaries of enamel prisms ("sheath space") the N-terminal ameloblastin together with amelogenin may prevent inter-rod crystallites from invading the adjacent rod and hence help assemble proper rod-interrod morphology.

Poster #: 43

Title: Parent Facilitated Social Engagement for ASD: An Integrative Review  
Name: Jennifer McCorkle Kovacs  
Faculty Advisor: Mary Lawlor

Background: It is important to determine what actions parents take to facilitate successful social experiences for their children with autism spectrum disorder (ASD) in daily life. Current parent-mediated interventions are a popular mode of service delivery for children with ASD, but it is not known whether these interventions effectively address parent-reported strengths and needs. Purpose: Research investigated how parents attempted to facilitate social experiences for children with ASD, and whether current parent-mediated interventions addressed parent strengths and concerns. Methods: eBooks authored by parents of children with ASD were reviewed to identify situations in which caregivers reported strengths or concerns regarding child social engagement facilitation. Randomized controlled trials (RCTs) of parent-mediated intervention studies were then systematically reviewed to determine whether interventions addressed parent strengths and needs. Results: The parent-authored literature review revealed parents strengths including skilled interpretation of child communication and in-depth knowledge of child interests. Parent concerns included difficulties traveling outside of familiar home or school contexts and helping to resolve conflicts with siblings. The review of RCT's revealed insufficient evidence for effectiveness of parent-mediated interventions with children older than 6 years, and methodological limitations undermine existing data. Conclusion: Parent-mediated interventions are needed which simultaneously address parent strengths and needs. More research is necessary to determine effective practices in parent mediated intervention. Future client-centered interventions should encourage open therapist-parent collaboration, utilize modular manualization to fit individual needs, and employ multiple natural contexts in intervention delivery.

Poster #: 44

Title: Microbicide Activity of Flavonoids on HIV-1 Infection  
Name: Juliana Noguti  
Faculty Advisor: Ramiro Murata

Background: Despite all the informations circulating around the globe to prevent the contamination by HIV virus, AIDS continues to spread. More than 90% of

new infections are acquired through sexual HIV transmission. Unprotected sex in heterosexual couples remains a considerable public health concern. Informations not fully understood as well the optimism around AIDS have changed the way of how people see the contamination. All these factors have significantly impacted HIV behaviour, and the use of condoms has been decreasing. Microbicides is a essential weapon to prevent and reduce the HIV transmission by vaginal or gastrointestinal mucosa. Purpose: The goal of this research was to evaluate several compounds from bioflavonoids in order to determine the activity against HIV infection. Methods: In this study we reported the in vitro cytotoxicity and anti-HIV-1 activity of Myricetin in a dual chamber model that simulates the female epithelial genital tract. Cytotoxicity and anti-HIV-1 activity of Quercetin and Pinocembrin tests were conducted on PBMC, TZM-bl, H9 and HeLa cell cultures testing concentrations from 0.01 to 100µM. Tests were conducted in order to evaluate the citotoxicity and activity against HIV. Results: Purpose: Cytotoxicity tests were previously performed on PBMC and HeLa cells. The Myricetin presented ≥ 88% of cell viability at 100 µM concentration when compared with the negative control (cells only). The anti-HIV-1 activity of Myricetin was also previously determined by our reserach group (in press) using a range (0.001 - 1000 µM). Microbicide activity of Myricetin using the Dual Chamber System: Myricetin treatment inhibited the HIV-1 viruses infections in this system. Conclusion: Overall, the flavanol, Myricetin showed superior inhibition of HIV activity when compared to the other two flavonoids which showed modest activity against HIV-1: Quercetin and Pinocembrin. Further studies are necessary using different experimental models in order to confirm anti-HIV activity to develop potential microbicides.



Poster #: 45

Title: Disruption of ERK/MAPK Pathway in Neural Crest Causes Pierre-Robin Sequence  
Name: Carolina Parada  
Faculty Advisor: Yang Chai

Background: Disrupted ERK1/2 signaling is associated with several developmental syndromes in humans. For instance, haploinsufficient ERK2 expression causes conotruncal and craniofacial anomalies arising from perturbation of neural crest development. Purpose: The goal of this study is to understand the function of Erk2 in the postmigratory neural crest populating the craniofacial region during mouse development. Methods: We studied *Wnt1-Cre;Erk2<sup>fl/fl</sup>*, *Osr2-Cre;Erk2<sup>fl/fl</sup>*, *Col1-CreERT2;Bmpr1a<sup>fl/fl</sup>*, and *Dlx5-CreERT2;Bmpr1a<sup>fl/fl</sup>* mice. Results: *Wnt1-Cre;Erk2<sup>fl/fl</sup>* mice exhibited cleft palate (CP), malformed and malpositioned tongues, compromised tendon development, micrognathia and mandibular asymmetry. CP in these mutants was associated with

failure of palatal elevation, caused by the tongue malposition and micrognathia as demonstrated by in vitro and in vivo experiments. *Osr2-Cre;Erk2<sup>fl/fl</sup>* mice in which the mutation is restricted to the palatal mesenchyme did not display CP, confirming that CP in *Wnt1-Cre;Erk2<sup>fl/fl</sup>* mice is a secondary defect. The tongue phenotypes in *Wnt1-Cre;Erk2<sup>fl/fl</sup>* mice were significantly rescued after in vitro culture in which the mandible was removed, indicating that the tongue malformation in *Erk2* mutants might be a secondary defect. The primary malformation, i.e., micrognathia with mandibular asymmetry, in the *Wnt1-Cre;Erk2<sup>fl/fl</sup>* mice was linked to a severe osteogenic differentiation defect occurring right before palatal shelf elevation. Microarray analyses showed that *Bmp6* was downregulated in *Wnt1-Cre;Erk2<sup>fl/fl</sup>* mandibles at the onset of osteogenesis, with consequent downregulation of BMP downstream targets such as *Mx1* and *Id5*. Accordingly, exogenous BMP6 rescued the osteogenic differentiation defect in mandibular explants from *Wnt1-Cre;Erk2<sup>fl/fl</sup>* embryos. To evaluate the function of BMP on mandibular osteogenesis, *Col1-CreERT2;Bmpr1a<sup>fl/fl</sup>* and *Dlx5-CreERT2;Bmpr1a<sup>fl/fl</sup>* mice were generated. Only the latter displayed a severe phenotype, which mimicked that of the *Erk2*-mutant mice. Conclusion: Collectively, our study demonstrates that the mandibular defect in *Erk2*-mutant mice leads to Pierre-Robin sequence and *Erk2* regulates *Bmp6* expression in the mandibular primordium to control osteogenesis.

Poster #: 46

Title: Crucial Factors Driving Mandibular Development  
Name: Carolina Parada  
Faculty Advisor: Yang Chai

Background: During normal development, the lower jaw is formed from the mandibular component of the first branchial arch. After their initial formation, the mandibular processes undergo considerable outgrowth along all three axes and merge in the midline region, following a specific pattern. The neural crest-derived mesenchyme condenses, commits into the osteogenic or chondrogenic lineage, and differentiate into osteoblasts or chondroblasts, respectively. The result of this sequence of developmental events is the formation of mandibular bone. Purpose: Our goal is to integrate the analysis of diverse aspects of the development of the mandible from cellular to molecular levels to build a comprehensive resource for the research community. Methods: For this purpose, we are currently working on the following analyses: (1) Genetic cell lineage tracing in mice performed using the *Cre-loxP* system targeting the epithelium, neural crest cells, and myoblasts derivatives (*K14-Cre;R26R*, *Wnt1-Cre;ZsGreen*, *Myf5-Cre;TdTomato* respectively) at different embryonic stages; (2) Proliferation heat maps obtained from BrdU-incorporation experiments in controls and *Wnt1-Cre;Tgfb<sup>fl/fl</sup>* mutant mice; and (3) Analysis of the molecular identity of the mandible at specific stages and dynamic changes during development through in situ hybridization and microarray analysis. The gene expression profiling includes both comparison of distal versus proximal regions within the same stage and among stages. Pathway analysis from microarray data were performed using Partek ANOVA and GO panther with the following parameters:

p<0.05, fold change cut off: 2 and -2, number of gene hit per pathway >1, % of total gene hits with number of gene hit per pathway >1. Results: The results obtained so far show a close relationship between morphology, cellular types and activities, and molecular signature at the stages analyzed in control embryos. Conclusion: Overall, the integration of this data will facilitate the understanding of normal mandibular development and will help further investigation on the causes of craniofacial dysmorphology as well as craniofacial tissue regeneration.

Poster #: 47

Title: Matrix Metalloproteinase-20 (MMP-20) Prevents Amelogenin Occlusion Inside Brushite Crystals  
Name: Dongni Ren  
Faculty Advisor: Janet Oldak

Background: The enamel proteinase MMP-20 cleaves specific functional domains within amelogenin before its complete degradation. Mutation in the MMP-20 gene leads to the formation of soft and disorganized enamel. Purpose: To test the hypothesis that MMP-20 acts to prevent amelogenin occlusion inside brushite crystals, which is used as an in vitro model of enamel crystals. Methods: Crystals were synthesized with or without amelogenin to evaluate protein occlusion inside them in vitro. MMP-20 was added to examine its effect on preventing protein occlusion. FITC was added to label amelogenin. Electrophoresis and high performance liquid chromatography (HPLC) were used to test MMP-20 cleavage efficiency. X-ray diffraction (XRD), scanning electron microscopy (SEM), fluorescent microscopy and thermal gravity analysis (TGA) were used to detect amelogenin occlusion inside crystals. Results: Electrophoresis and HPLC showed that MMP-20 digestion of amelogenin was successful in crystal growth experiments. Brushite crystals remained stable with amelogenin but their morphology was affected, increased defects and formation of multiple layers were observed. Without amelogenin, fluorescent microscopy showed very strong fluorescence on crystals before washing, while no fluorescence was observed after washing with phosphate buffer. With amelogenin, the crystals still showed fluorescence even after the adsorbed proteins were removed by a phosphate wash. After MMP-20 cleavage of amelogenin, such fluorescence disappeared. TGA showed a significant mass loss difference between crystals synthesized with amelogenin and those without it, indicating the presence of protein inside crystals grown with amelogenin. Conclusion: Amelogenin affects brushite growth in vitro by being occluded inside the crystals, resulting in defective crystals. Addition of MMP-20 prevents protein occlusion and rescues crystal morphology.

Poster #: 48

Title: Layered Monetite-Chitosan Composite: a Novel Precursor for Hierarchical Enamel Synthesis  
Name: Qichao Ruan  
Faculty Advisor: Janet Oldak

Background: Biomimetic reconstruction of tooth enamel is a promising approach to the treatment of defective enamel. However there are still major challenges in mimicking the complex hierarchical structures of enamel from the nanoscale to the macroscale.

**Purpose:** To develop a novel strategy to synthesize a biomaterial with enamel-mimetic structures from the nanoscale to the macroscale. Our objectives were i) to prepare a monetite-based composite with a layered structure on the micrometer scale, and ii) to synthesize enamel-like materials via phase transformation of this composite. **Methods:** 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 3 hours. The morphology and composition of products were characterized using scanning electron microscopy (SEM), transmission electron microscopy, X-ray diffraction and energy dispersionspectroscopy. The assembly mechanism of the layered structure was investigated using SEM, atomic force microscopy, and Fourier transform infrared spectroscopy. **Results:** Organized and parallel arrays of monetite tablets were synthesized in the presence of chitosan and MAc. The chitosan and MAc molecules hierarchically assembled into an organized complex and further guided the mineralization of monetite crystals. The nanoscale enamel-like bundles were formed via phase transformation of the monetite composite. Most interestingly, the layered structure observed on the micrometer scale was preserved to some extent during the transformation. **Conclusion:** This study demonstrated a novel strategy to synthesize enamel-like materials with hierarchical structures from the nanoscale to the microscale.



Poster #: 49

**Title:** The Role of the V-type ATPase Proton Pump in Amelogenesis  
**Name:** Juni Sarkar  
**Faculty Advisor:** Michael Paine

**Background:** Several diseases like proximal and distal renal tubular acidosis as well as osteoporosis are related to intracellular pH dysregulation resulting from mutations of genes coding for ion channels such as proton-pumping V-type ATPase. Many of the V-type ATPase subunits play key roles in enamel development, yet our understanding of the relationship between the endocytotic pathway and dental disease is limited. **Purpose:** The hypothesis of this study is to understand the ameloblast-associated pH regulatory networks essential for amelogenesis. **Methods:** Carry out quantitative RT-PCR on tissues from secretory and maturation stage enamel organs to determine which ATPase subunits show higher expression levels relative to others through amelogenesis. Validate this data using western blot analysis. Use specific antibodies to define the localization/localization of V-type ATPase on endosomal and lysosomal membranes during amelogenesis. **Results:** Previously published array data suggested that a number of V-type ATPase subunits were significantly upregulated. This was validated by RT-PCR that showed six subunits (Atp6v0a3, Atp6v0e1, Atp6v1c1, Atp6v1e1, Atp6v1f

and Atp6v1g1) that had higher mRNA levels during maturation stage. Specific antibodies have been identified to validate the RT-PCR data via western blot and carry out immunohistochemistry analysis to identify the location of these subunits on membranes. **Conclusion:** The role of each V-type ATPase subunit during enamel maturation in part can be identified by examining the dentition of commercially available Atp6v1b1, Atp6v1b2 and Atp6v0d2 knockout animals. Generating an Odam-Cre transgenic mouse to conditionally knock out V-type ATPase subunit restricted to maturation stage ameloblast can identify the role of each subunits during amelogenesis.

Poster #: 50

**Title:** Clinical, Histological and 3D Evaluation of VISTA on Ridge Augmentation  
**Name:** Yun Wang  
**Faculty Advisor:** Homa Zadeh

**Background:** In an attempt to address the limitations of current flap design in bone augmentation, the vestibular incision superperiosteal tunnel access (VISTA) technique has been applied to GBR. **Purpose:** This case series evaluated the treatment outcome of VISTA GBR for severe maxillary horizontal defects and dental implant placement **Methods:** Four patients with severe Siebert class 3 ridge defect were included in this study. 15 tooth sites were treated with VISTA GBR procedure for horizontal bone augmentation at anterior maxilla. Alveolar ridge width was measured at 1,3,6,10 mm below alveolar crest using computed tomography scans, preoperatively and 6 months postoperatively. Implant placement was performed at 6 months following bone augmentation. Core biopsy was retrieved during implant placement and processed for light microscopy. **Results:** Mean ridge width at crestal level was  $2.8 \pm 0.79$ mm at baseline and  $7.0 \pm 2.1$ mm at 6 months post-surgery, for a mean increase of  $4.2 \pm 2.1$ mm. Postoperative ridge width was correlated with baseline ridge width ( $r = 0.90$ ). Greater ridge width gain was observed at 6-10mm below alveolar crest with an average of  $7.5 \pm 2.1$ mm. Three of four patients had total of 10 implant placements without additional bone graft. One patient delayed implant placement for logistic reasons. Clinical evaluation of the new bone revealed no difference in bone quality between native and grafted bone. Primary stability was achieved for all the implants with Insertion torque >25Ncm. Bone core biopsy were obtained by 2.0mm trephine bur at osteotomy site from one of the patients receiving implants. Histomorphometry revealed a mean percentage of vital bone was  $35.5\% \pm 12.7\%$ . **Conclusion:** This series is first to report on horizontal ridge augmentation using VISTA as flap management. VISTA had advantages on preserving blood supply on the crest as well as reducing the flap tension. It demonstrated that more ridge width gain was achieved by VISTA GBR compared to traditional GBR.

Poster #: 51

**Title:** Methylation of Smad6 is Required for its Inhibition of Smad1  
**Name:** Jian Wu  
**Faculty Advisor:** Jian Xu

**Background:** Bone morphogenetic proteins (BMP) signaling pathway plays pivotal roles

in embryonic development, especially in bone formation and cardiac valvulogenesis. Upon ligand-binding to type II and type I BMP receptors (RII and RI), activated RI recruits and phosphorylates receptor-Smads (Smad1, 5 and 8), followed by Smad1/5/8 complex formation with Smad4 and translocation to nucleus for numerous gene regulation. Smad6 is the inhibitory Smad that fine-tunes BMP signaling pathway. **Purpose:** Our proteomic data revealed that R81 in the N-terminal of Smad6 is both mono-(R81me1) and di-methylated (R81me2). We sought to test whether this novel post-translational regulation affects Smad6 function. **Methods:** (combined with results) **Results:** Using customized anti-R81me1 and anti-R81me2 antibodies, we found that BMP4 treatment is sufficient to induce both R81me1 and R81me2 in HaCat cell by western blots. To find the corresponding arginine methyltransferase responsible for the R81 methylation, we tested the interaction between Smad6 and PRMT 1 through 9 in 293T cells, and found that PRMT1 was the hit. When PRMT1 is knocked down by si-RNA, methylation of R81me1 and R81me2 were both dramatically reduced. Strikingly, when R81 was mutated to either alanine (A) or lysine (K), Smad6 were unable to binds to BMP4-induced activated Smad1. Increasing amount of ectopic Smad6-wt disrupted Smad1-Smad4 interaction, while expression of Smad6-R81A did not. **Conclusion:** In short, the newly-uncovered R81 methylation regulates Smad6 inhibition function through modulating its recruitment to activated Smad1. **Perspective:** we will investigate whether R81 methylation regulates Smad6 function through gene translational levels, specifically the impact on Smad6 recruitment of co-repressors HDAC1/3 and CtBP.

Poster #: 52

**Title:** Survey of Shoulder Pain In Competitive Swimmers  
**Name:** Garin Wyberg  
**Faculty Advisor:** Jonathan Sum

**Background:** There are 2.5 million youth competitive swimmers in the U.S. and nonspecific shoulder pain is the most prevalent ailment in this population of athletes. Yardage swum and training hours have been highly associated with the presence of shoulder pain and supraspinatus (shoulder muscle) tendinopathy in both male and female elite youth swimmers. Although there have been recent studies examining training yardage and symptom prevalence in swimmers, the gender specific youth through high school aged category is still lacking. Therefore the appropriate age at which to begin an injury prevention program as well as considerations regarding program design with respect to symptomatic swimmers' gender and physical maturation are unknown. **Purpose:** The primary objective of this study is to determine the prevalence of shoulder pain and swimming related disability among youth competitive male and female swimmers. Secondary objectives are: (1) to determine if a history of prior shoulder injury and/or subjective reports of instability are related to current shoulder pain, (2) to determine if average weekly yardage and/or peak weekly yardage are related to shoulder pain and disability, and (3) to potentially utilize data obtained from this study to compare swimmers' pain/disability after implementation of a pain/injury prevention program **Methods:** Descriptive statistics

will be used to describe demographics of subjects and responses. T- tests will be used to determine if differences in symptoms exist among the age groups when comparing the pain ratings and symptom disability scores and chi-square tests will be used to determine if significant differences exist in the prevalence of pain among swimming groups. Pearson's product-moment correlation coefficient will be used to determine association between yardage and reported shoulder pain and disability. **Results:** n/a **Conclusion:** n/a



Poster #: 53

**Title:** Suture Provides Niche for Mesenchymal Stem Cells of Craniofacial Bones  
**Name:** Hu Zhao  
**Faculty Advisor:** Yang Chai

**Background:** Craniofacial bones are connected by sutures. It was generally proposed that sutures mainly function to connect the bones and to absorb shock. **Purpose:** In the current study, we are proposing that suture mesenchyme contains stem cell to support the craniofacial bone turnover and injury repair. **Methods:** *Gli1-LacZ* reporter mice were used to study the expression pattern of Gli1 in the craniofacial bones. Lineage tracing analysis were performed to trace the fate of the Gli1+ cells. *Gli1-Cre<sup>ERT2</sup>;R26DTA<sup>flax</sup>* strain was used for cell ablation analysis. Various other transgenic mouse strains were used to analyze the function and regulations of the Gli1+ cells in the suture mesenchyme. **Results:** Gli1 expression is restricted to the suture mesenchyme specifically after postnatal 21 days. Gli1+ cells in the suture mesenchyme do not express any osteogenic differentiation markers including Runx2, Sp7, ALPase or osteopontin. Lineage tracing analysis based on *Gli1-Cre<sup>ERT2</sup>;R26ZsGreen* mice indicates that Gli1+ cells give rise to the entire suture mesenchyme, the periosteum, the dura and then to all the craniofacial bones under physiological condition or upon injury. Transplantation experiments indicate that suture transplants rapidly expand the size and are capable of repairing large size defects in the host mice. In vitro cell culture indicate that mesenchymal cells isolated from the suture express typical MSC markers and possess osteogenic, chondrogenic and adipogenic potentials. Cell ablation analysis based on *Gli1-Cre<sup>ERT2</sup>;R26DTA* mice indicates Gli1+cell are indispensable for craniofacial postnatal growth and suture patency. **Conclusion:** Gli1+ cells in the suture mesenchyme are stem cells supporting the postnatal growth, turnover and injury repair of craniofacial bones. Our study reveals a novel function for craniofacial suture mesenchyme, providing a new perspective for understanding the onset of craniosynostosis and other suture deformities, as well as a potential new therapy for craniofacial disorders.





#### Poster #: 54

Title: Ameloblastin-Proteasome Subunit Alpha Type 3 Interaction Facilitates Ameloblastin Redistribution  
Name: Shuhui Geng  
Faculty Advisor: Malcolm Snead

Background: Enamel is the unique bioceramic tissue composed of highly organized carbonated hydroxyapatite (HAP) crystallites, which form extracellularly within an organic matrix during amelogenesis. The extracellular matrix, organized by matrix proteins self-assembly and protein-protein interactions, is competent to guide initiation, growth and arrangement of HAP crystallites that form the highly patterned rod-interrod microstructure observed in mature enamel. This hierarchical structure provides enamel with its unique material properties of wear resistance and fracture toughness. Ameloblastin, the most abundant of the non-amelogenin enamel matrix proteins, is initially distributed uniformly within the newly formed rods but redistributes to the rod-interrod boundaries following proteolytic processing. The redistribution of ameloblastin cleavage products is suggested to be involved in the establishment of enamel rod-to-interrod boundary. Purpose: This study is aimed to investigate how ameloblastin redistribution occurs during amelogenesis. We hypothesize that redistribution of ameloblastin is controlled by interactions with heretofore-unknown proteins within the matrix and/or located on ameloblast cells. Methods: The odontogenic epithelia of mandibular first molars from postnatal day 3 (PN3) mouse pups were used to construct a mouse ameloblast cDNA library. We screened this cDNA library by the yeast two-hybrid assay to identify the putative interacting protein(s) for ameloblastin. Immunofluorescence was performed on sagittal and tangential sections of PN3 mouse mandibular incisor to localize ameloblastin and the interacting protein(s). Cell lysate was prepared from enamel organ epithelium from PN3 mouse incisor and used for co-immunoprecipitation analysis to confirm the ameloblastin-protein interactions. Ameloblastin full-length protein (FL), N'-terminal domain (Np), C'-terminal domain (Cp), and candidate ameloblastin-interacting protein identified by Y2H screening were expressed in yeast cells and used in co-immunoprecipitation assay to determine the binding domain of the putative interacting protein(s) for ameloblastin. Results: Proteasome subunit  $\alpha$  type 3 (Psm3)

was identified to interact with ameloblastin in developing tooth. Immunostaining of Psm3 showed intense reactivity in the cytoplasm of ameloblasts and Tomes' processes. Confocal microscopy confirmed Psm3 co-distribution with ameloblastin at the ameloblast secretory end piece known as Tomes' process. The co-localized immunostaining revealed decussating pattern corresponding to the rods arrangement in mature mouse enamel. Co-immunoprecipitation assay of mouse ameloblast cell lysates with either ameloblastin or Psm3 antibody identified each reciprocal protein partner. Psm3 was co-immunoprecipitated with both ameloblastin-FL and -Cp by ameloblastin specific antibody from yeast cell lysate. Conclusion: These findings suggest that the interaction between ameloblastin and Psm3 may exert control over ameloblastin redistribution within the extracellular space in order to define the enamel rod-to-interrod boundaries essential to forming hierarchical structure.

#### Poster #: 55

Title: Orthodontic Records and Assessment  
Name: Kaitlin Marsh  
Faculty Advisor: Dennis Tartakow

Background: Orthodontic records and the assessment for treatment are very important when treatment planning an orthodontic patient. While some methods of data collection are accepted the standard, other less commonly used diagnostic tools are just as important and crucial in developing a diagnosis and treatment plan. Purpose: The aim of this study was to determine guidelines and additional salient diagnostic tools to be included in orthodontic record taking and to examine how each component contributes to the treatment plan of a new orthodontic patient. Methods: Classic orthodontic textbooks and contemporary journal articles were examined, as well as supportive and clinical reasoning was provided by our advisor, Dr. Dennis Tartakow. Results: These additional orthodontic records include, (a) extra-oral radiographs (submental vertex, and posterior-anterior); (b) extra-oral photograph (frontal open mouth view); (c) mounted, articulated diagnostic casts, with a ZOE paste bite registration; (d) a complete TMJ examination; (e) a complete periodontal exam; (f) a complete extra oral head and neck physical examination; and (g) referral to a physician when necessary. Finally, a diagnostic letter must be discussed with the patient, parent and/or legal guardian, and the consent form must be reviewed in their native language. Conclusion: While there are standard guidelines for what is included in an orthodontic record, there are additional important components that are less commonly used but equally as necessary in data collection. In conclusion, it is clear that the above methods of data collection should be included for each new orthodontic patient in order to develop a thorough diagnosis and treatment plan.

#### Poster #: 56

Title: A tale of Two Craniofacial Disorders: A Mechanism of Epigenetic Control of Neural Crest Formation  
Name: Erin Moran  
Faculty Advisor: Ruchi Bajpai

Background: Neural crest cells (NCC) arise as a migratory, multipotent cell population from neuroectoderm, a relatively lineage

restricted population. Formation of NCC is highly coordinated at the transcriptional level through dramatic shifts in chromatin organization, yet mechanisms by which NCC transcription is epigenetically controlled are not well understood. One such mechanism is that of CHD7, an ATP dependent chromatin remodeler, which is shown to promote NCC formation in an ATPase dependent manner. CHD7 physically associates with PHF6, a dual PHD finger protein mutated in Börjeson-Forssman-Lehmann Syndrome, where patients display enlargement of NCC derived craniofacial structures that are remarkably contrasting to CHD7 mutation CHARGE Syndrome. Purpose: To understand the mechanism of antagonism of PHF6 and CHD7, and the mechanism behind these two highly divergent disorders. Methods: We use *Xenopus laevis* embryology and NCC derived from human embryonic stem cells in order to understand the mechanism behind the antagonism of PHF6 and CHD7. Results: We have found that PHF6 is able to bind pre-marked enhancers in NCC precursor cells, and that PHF6 dominant-negative is able to prevent the CHARGE-like defects of CHD7 knockdown. Conclusion: PHF6, through its ability to bind pre-marked enhancers, may block CHD7 from being able to remodel these enhancers in order to activate NCC specific transcription.

#### Poster #: 57

Title: LRAP-Chitosan Hydrogel for Enamel Repair and Dentin Hypersensitivity  
Name: Kaushik Mukherjee  
Faculty Advisor: Janet Oldak

Background: Amelogenin-chitosan (AMEL-CS) hydrogel promotes in vitro biomimetic enamel regrowth. Leucine rich amelogenin peptide (LRAP), a 59 residue splice product, may also have a tentative biological role in regulating enamel mineralization with a potential application in biomimetic enamel repair and dentin hypersensitivity. Purpose: To test whether a smaller, cost-effective amelogenin-derived peptide like LRAP could (a) regulate biomimetic enamel regrowth (b) promote occlusion of the dentinal tubules and (c) act as an effective substitute to our previously synthesized full -length amelogenin chitosan hydrogel. Methods: Human third molars were sectioned longitudinally into 1mm thick tooth slices. To mimic carious lesions, the samples were immersed in a demineralising solution (pH 4.6) at 37 °C for 5 days. Twenty  $\mu$ l of LRAP-CS and AMEL-CS hydrogel were applied separately on the demineralised windows and the tooth slices were placed in a remineralizing solution (pH 7) at 37 °C for 3, 7 and 12 days. We characterized new crystal growth, morphology and composition using SEM and XRD. Results: De novo crystallites were formed on the carious model which gradually matured to a more densely organized apatitic aprismatic crystal structure (7th day). In dentin, an amorphous mineral deposition was observed that significantly occluded the exposed dentinal tubules after 12 days of remineralization. LRAP-CS hydrogel was effective in controlling organized growth of enamel-like apatite comparable to that of full-length AMEL-CS. Conclusion: Our results suggest that amelogenin-derived peptides like LRAP may be used to promote biomimetic enamel regrowth and tackle exposed dentin as an efficient treatment strategy for white spot lesions and dentine hypersensitivity.

#### Poster #: 58

Title: Matrix Metalloprotease-20 Prevents Occlusion of Proteins Inside Enamel Crystals  
Name: Saumya Prajapati  
Faculty Advisor: Janet Oldak

Background: Enamel proteases process the matrix proteins by cleaving specific functional domains and eventually degrading them to create space for hydroxyapatite crystals to grow. In an in vitro study we recently reported that during growth of calcite, full-length amelogenin gets trapped inside the crystals, affecting their morphology. Addition of MMP-20 prevented this occlusion and rescued crystal morphology. Purpose: To test the hypothesis that MMP-20 acts to prevent unwanted protein occlusion inside enamel apatite crystals during amelogenesis. Methods: We analyzed the proteins trapped inside growing crystals (MMP-20 knockout (KO) and wild type (WT) mice) by SDS-PAGE and Western Blot. Enamel from adult murine incisors was isolated and washed with a series of extraction buffers to remove adsorbed proteins followed by dissolution in 1M HCl. Enamel crystals were observed using AFM and HRTEM. Results: SDS-PAGE showed a significant difference in the amount of proteins in dissolved enamel crystals from MMP-20 KO mice as compared to that of WT. Western blot confirmed the presence of full-length amelogenin M180 entrapped in crystals isolated from MMP-20 KO mice. HRTEM showed increased areas of imperfection in the crystal lattices from MMP-20 KO mice. In situ AFM showed a decrease in the length and thickness and more associated protein in MMP-20 KO enamel crystals as compared to those of WT mice. Conclusion: Without functional MMP-20, amelogenin becomes trapped inside enamel apatite crystals. We suggest that protein occlusion affects enamel crystal size, growth morphology and maturation, leading to thin and hypomineralized enamel in MMP-20 KO mice.

#### Poster #: 59

Title: Antifungal Activity of Lichochalcone-A on *Candida albicans* Biofilms In Vitro  
Name: Dalia Selem  
Faculty Advisor: Ramiro Murata

Background: *Candida albicans* is a major fungal pathogen afflicting a range of disease from superficial mucosal diseases to deep seated mycoses. In the United States, candidiasis is considered the third leading cause of hospital-acquired infection, with reported mortality rate of 40-60%. Biofilm formation is a major virulence factor in pathogenicity of *C. albicans*, which is believed to cause a high antifungal resistance. Purpose: The aim of the present in vitro study was to investigate the influence of lichochalcone-A treatment on the formation and killing of *C. albicans* biofilms. Methods: *C. albicans* (ATCC: 90028) biofilms (n=9) were cultured (at  $2.5 \times 10^5$  cells/ml) in yeast nitrogen base medium, were grown in sterile 48-wells plate for 48 h at 37 °C, 5% CO<sub>2</sub> and were treated twice daily with lichochalcone-A (62.5  $\mu$ M) for 5 days. Fluconazole and solutions with 1% ethanol (v/v) served as positive and vehicle controls, respectively. Biofilms were analyzed for biomass, fungal viability, and polysaccharide composition. Results: Application of lichochalcone-A reduced the biomass and the polysaccharides composition

of *C. albicans* biofilms compared to those of the vehicle control. In addition, lichochalcone A showed reduction in fungal viability as shown by the decrease in the colony formation unit (CFU). Conclusion: Lichochalcone-A showed antifungal activity against *candida albicans* biofilms in vitro. Consequently, such natural compound may show promise to translate its application into clinical settings.

Poster #: 60

Title: *Slc26* Gene Family Participate in pH Regulation During Enamel Maturation  
Name: Kaifeng Yin  
Faculty Advisor: Michael Paine

Background: Based on the genome-wide transcripts profiling (rat) conducted previously by our lab, three members of *Slc26* gene family members--*Slc26a1*, *Slc26a6* and *Slc26a7*--are up-regulated during amelogenesis (maturation-stage/secretory-stage, m/s). Purpose: The purpose of this study is to investigate the potential role of *Slc26a1*, *Slc26a6* and *Slc26a7* at maturation-stage tooth development. Methods: First we conducted qPCR and immunoblotting to identify the expression patterns (m/s) of *Slc26a1*, *Slc26a6* and *Slc26a7* at both mRNA and protein level, using samples obtained from the incisor enamel organ of Wistar Hannover rats. Then immunohistochemistry was used to localize the gene products of *Slc26a1*, *Slc26a6* and *Slc26a7* in the maturation-stage enamel organ. In order to further elucidate the location details of these three genes within the milieu of maturation-stage ameloblasts, co-localization of *Slc26a1*, *Slc26a6* and *Slc26a7* with Ae2, Lamp1 and Cftr were conducted using immunofluorescence. Moreover, Co-immunoprecipitation was conducted between Cftr and *Slc26a1*, *Slc26a6*, *Slc26a7* respectively, to disclose the potential interactions of the gene products. Finally, the enamel phenotypes of *Slc26a1*-null and *Slc26a7*-null animal models (mice) were documented and the changes in the expression of other related genes in the mutant animals were detected by qPCR. Results: At mRNA level, *Slc26a1*, *Slc26a6* and *Slc26a7* are all up-regulated at maturation stage compared with secretory stage (fold changes: ~15.5, ~3.8 and ~8.1). At protein level, *Slc26a1*, *Slc26a6* and *Slc26a7* show similar expression patterns, which were confirmed by both immunoblotting and immunohistochemistry. In the maturation-stage ameloblasts lining along the surface of rat incisors, the gene products of *Slc26a1*, *Slc26a6* and *Slc26a7* co-localize with Cftr to the apical region of cytoplasmic membrane, which is different from the lateral-membrane localization pattern of Ae2. In addition, the distribution of *Slc26a7* was seen within the cytoplasmic/subapical region of ameloblast, presumably on the lysosomal membrane. However, there was hardly any overlap between *Slc26a7* and Lamp1 in their cytoplasmic distribution. From the protein complex pulled down by the antibody to Cftr, *Slc26a1*, *Slc26a6* and *Slc26a7* were separately detected by the subsequent immunoblotting, suggesting the direct interaction of each of these three genes with Cftr. Compared with their wild-type littermates, *Slc26a1*<sup>-/-</sup> and *Slc26a7*<sup>-/-</sup> animals showed mild abnormalities in enamel phenotypes. Among all the genes examined, *Cftr*, *Ae2*, *NBCe1*, *Car2*, *Slc26a6* and *Slc26a9* were significantly up-regulated in *Slc26a1*<sup>-/-</sup> and/or *Slc26a7*<sup>-/-</sup> animals compared with wild-type animals, which indicates

that deletion of *Slc26a1* or *Slc26a7* induces complimentary reactions from other related genes with similar functions. Conclusion: *Slc26a1*, *Slc26a6* and *Slc26a7* are involved in the pH regulation process during enamel maturation and their functional roles may be achieved by forming complex interactions with Cftr.



Poster #: 61

Title: Estrogen May Reduce Exercise-Induced Skeletal Muscle Damage in Young Women  
Name: Lindsey Anderson  
Faculty Advisor: Todd Schroeder

Background: Estrogen-containing hormone-therapy (HT) attenuates exercise-induced muscle damage in post-menopausal women. HT estrogen levels are much higher than those in oral contraceptives or natural circulation in pre-menopausal women. Purpose: To determine the exercise-related effects of pre-menopausal or oral contraceptive (OC) estrogen levels. Methods: 3 groups performed 100 maximal isometric contractions with neuromuscular-electrical-stimulation (NMES) on one quadricep. OC (N=9) performed NMES on day 13 of pill consumption. Non-OC high (HI; N=9) and low (LO; N=5) estrogen groups performed NMES on day 22 or 2 of the menstrual cycle, respectively; day 1=menses. Maximal voluntary isometric contraction (MVIC) was assessed before, 0 hours, 2 days, and 4-5 days post. Soreness was measured before, 2 days, and 4-5 days post with a 7-point Likert Scale of Muscle Soreness for Lower Limb. Results: Age, lean mass, and body fat were similar across groups. Body weight and BMI were lower in HI ( $p \leq 0.04$ ); MVIC-related outcomes were covaried for body weight. Baseline soreness and strength and relative work during NMES were similar across groups ( $p \geq 0.05$ ). Relative (%) MVIC was similar across groups for each time point ( $p \geq 0.05$ ); %MVIC was 4% lower in LO than OC or HI at 0 hours post-NMES. LO did not reach recovery ( $\geq 95\%$  MVIC) until 4-5 day post-NMES; HI and OC were recovered by 2 days post. Soreness was similar at all time points across groups ( $p \geq 0.05$ ); the mean difference was 1pt lower in LO than OC or HI at 2 days post-NMES which is clinically significant. Conclusion: Estrogen may reduce exercise-induced soreness and strength loss in young women.

Poster #: 62

Title: Hip Kinematics and Kinetics in Persons with Cam Femoroacetabular Impingement  
Name: Jennifer Bagwell  
Faculty Advisor: Christopher Powers

Background: Previous studies indicate that hip and pelvis kinematics may be altered during functional tasks in persons with cam femoroacetabular impingement Purpose: The purpose of this study was to compare hip and pelvis kinematics and kinetics during a deep squat task between persons with cam FAI and pain-free controls. Methods: Fifteen persons with cam FAI and 15 persons without cam FAI performed a deep squat task. Peak hip flexion, abduction, and internal rotation, and mean hip extensor, adductor, and external rotator moments were quantified. Independent t-tests ( $\alpha < 0.05$ ) were used to evaluate between group differences. Results: Compared to the control group, persons with cam FAI demonstrated decreased peak hip internal rotation ( $15.2 \pm 9.5^\circ$  vs.  $9.4 \pm 7.8^\circ$ ;  $p=0.041$ ) and decreased mean hip extensor moments ( $0.56 \pm 0.12$  Nm/kg vs.  $0.45 \pm 0.15$  Nm/kg;  $p=0.018$ ). In addition, persons in the cam FAI group demonstrated decreased posterior pelvis tilt at peak hip flexion ( $12.5 \pm 17.1^\circ$  vs.  $23.0 \pm 12.4^\circ$ ;  $p=0.024$ ). Conclusion: The decreased hip internal rotation observed in persons with cam FAI may be the result of bony impingement. Furthermore, the decrease in posterior tilt might contribute to impingement by further approximating the femoral head-neck junction with the acetabulum. Additionally, decreased hip extensor moments suggest that diminished hip extensor muscle activity may be the cause of decreased posterior pelvis tilt.

Poster #: 63

Title: Ultrasound Based Tendon Micromorphology Predicts Mechanical Characteristics of Degenerated Tendons  
Name: Yu-Jen Chang  
Faculty Advisor: Kornelia Kulig

Background: Tendon is a hierarchical fibrous connective tissue composed mainly of collagen fibers. The collagen fibers align in a bundle along the long axis of the tendon. The resulting tissue structure is visualized as a speckle pattern with notably parallel features on a sonogram. The mechanical characteristics of the tendon are related to the organization of the tissue architecture. When degenerated, the collagen bundle organization is disrupted and the water content in the extracellular matrix (ECM) is increased. These changes in collagen bundle architecture affect the mechanical characteristics of the tendon. Purpose: The purpose of this study was to study the relationship between tendon micromorphology quantified from a sonogram and tendon mechanical characteristics measured in vivo in individuals with and without focal changes in tendon thickness indicating degeneration. Methods: Micromorphology was performed by using a two-dimensional fast Fourier transform (FFT) on tendon images. Peak spatial frequency (PSF) was used to correlate to the collagen bundle organization within the ROI. Tendon force-elongation curve was determined by plotting tendon force against tendon elongation. Tendon stiffness was estimated as the slope of the linear region of the force-elongation curve. Elastic modulus of the tendon was also estimated from stress-strain curve. Results: The Peak

Spatial Frequency and the stiffness of the Achilles tendons show a high positive correlation ( $R^2=0.75$ ) in degenerated tendons, but a low correlation ( $R^2=0.31$ ) in healthy control subjects. A similar but more prominent relationship ( $R^2=0.8$ ) was observed between the PSF and the elastic modulus of the degenerated Achilles tendon. Conclusion: This is the first study that predicted the mechanical characteristics of degenerated human Achilles tendon using a non-invasive micromorphology analysis approach. These findings show potential to improve classification and severity of the degeneration, as well as the response of the tendon to intervention.

Poster #: 64

Title: Effects of Jump Strategy Modification on Energetics During Dance Jumps  
Name: Danielle Jarvis  
Faculty Advisor: Kornelia Klug

Background: Variations in vertical or horizontal components of a jump will result in modifications to center of mass trajectory; lower extremity joint demands may also be altered. Examination of the impact of modified task goals will provide insight regarding athletic performance and implications of lower extremity injuries. Purpose: to examine the influence of modified task goals on an entire jump including takeoff, flight, and landing Methods: Thirty healthy, experienced dancers performed saut de chat leaps in two conditions: traveling as far as possible (FAR) and jumping as high as possible (UP). Horizontal ground reaction force (GRF) impulses and sagittal plane mechanical energy expenditure (MEE) of the metatarsophalangeal (MTP), ankle, knee, and hip joints during both takeoff and landing were calculated and compared between conditions using paired t-tests. The angle between the legs was calculated when the center of mass reached peak height during flight. Results: During takeoff, braking GRF impulse was lower and propulsive GRF impulse was greater in FAR. MEE at the MTP, ankle, and hip joints was greater in FAR; MEE at the knee was lower in FAR. During flight, leg angles were similar, indicating consistent performance. During landing, braking GRF impulse was higher in FAR. MEE at the knee was greater in UP. Conclusion: Biomechanical demands on lower extremity joints during takeoff and landing were altered in response to modified task goals without altering performance during flight. Dancers experiencing pain or working through injuries may be more successful by approaching jumping with a goal focused to reduce demands at the injured joint.

Poster #: 65

Title: Movement Duration and Effort Determine Arm Choice  
Name: Sujin Kim  
Faculty Advisor: Nicolas Schweighofer

Background: Patients with stroke often exhibit decrease in the use of their more affected arm: Although capable of generating arm movements, they often chose not to. In addition, arm reaching movements of the more affected arm are typically slower than movements made with the non-affected arm in patients with stroke. In healthy subjects, we previously showed (Schweighofer et al. in



submitted) that expected effort plays an important role in arm choice. Purpose: Here, we hypothesize that both differences in expected effort and in expected movement duration between the more affected and the less affected limbs are factors underlying such decreased use in stroke survivors. Methods: Seven individuals with chronic right hemiparesis (mild to moderate impairment;  $46.1 \pm 9.0$  on Fugl-Meyer assessment) and seven age-matched non-disabled participants were recruited. All participants were right handed and performed the Bilateral Arm Reaching Test (BART; Han, Kim, et al. 2014) with two conditions: the free choice condition which the participants were asked to choose one arm or the other to reach the targets and the forced condition which the participants were asked to use their right arm (note right arm was the most affected arm for the stroke group) to reach the targets. In the free choice condition, affected arm choice was recorded while in the forced condition, hand kinematic data was recorded. Duration was computed from the movement start (above 5% of peak velocity) to the movement end (below 5% of peak velocity). Effort was modeled as the sum of squared joint torques during the movements, with the torques estimated via inverse dynamics of a 2 joint arm model. Mixed effect logistic regression was used to fit the data and to Log Likelihood ratio test and BIC were used to compare models with effort only, movement duration only, or both. Results: For both groups, movement duration and effort were the strong predictors of right arm choice. When movement duration and effort for the right arm (also affected arm for stroke group) are short and low, the participants chose their right arm to reach the targets. If we included only either movement duration or the effort in the model, arm choice patterns were differently explained for stroke and nondisabled groups. While effort was the only factor explaining arm choice shown in age-matched nondisabled group, either movement duration or effort played a key role to predict arm choice in patients with stroke. Conclusion: We plan to extend our results in the framework of delayed rewards discounting and to show the differences in reward decay rates among patients with stroke.

#### Poster #: 66

Title: Muscle Mass, Strength and Physical Function in Prostate Cancer Survivors  
Name: Jacqueline Kiwata  
Faculty Advisor: Todd Schroeder

Background: Androgen deprivation therapy (ADT), the mainstay of treatment for prostate cancer, is associated with declines in lean body mass (LBM), strength, and physical function. LBM and strength are correlated with physical function in older, eugonadal men, but it is unclear if they are determinants of functional performance in hypogonadal prostate cancer survivors (PCS) on ADT. Purpose: Determine whether baseline measures of LBM and muscle strength correlate with functional test performance in PCS on ADT. Methods: Eight PCS ( $62.6 \pm 9.3$  yr) on ADT were recruited as part of a larger ongoing trial. LBM was measured by dual-energy x-ray absorptiometry. Strength was assessed by 1-repetition maximum tests of the seated row and leg curl. Functional measures included stair climb, Star Excursion Balance Test (SEBT) and timed-up-and-go (TUG). Relationships between

outcomes were analyzed using Pearson correlations with statistical significance set at  $p < 0.05$ . Results: A strong correlation was observed between LBM and seated row strength ( $r = 0.95, p < .001$ ), but no significant associations were found between LBM and other outcomes. Strength measures were not correlated with functional performance. Stair climb was negatively correlated with SEBT ( $r = -0.83, p = 0.01$ ) and positively correlated with TUG ( $r = 0.84, p = 0.016$ ). Conclusion: LBM and strength were not associated with performance on balance, mobility and stair climbing. However, faster stair climbing was related to greater SEBT and faster TUG scores. These results suggest that determinants other than LBM and strength contribute to performance of functional tasks. Therefore, rather than focusing solely on LBM and strength, RT interventions for PCS on ADT might include functional task training to improve physical function.

#### Poster #: 67

Title: Motor Learning How to Move Fast in Young Non-Disabled Individuals  
Name: Hyeshin Park  
Faculty Advisor: Nicolas Schweighofer

Background: Short-term reach training improves reaching performance, but the learning mechanism how to move fast is still unknown. Purpose: Here, we test whether two sessions of intensive reach training lead to motor skill learning in young non-disabled individuals. If so, we investigate the skill learning mechanism. Methods: Ten participants ( $5F, 24.5 \pm 1.0$  yrs) were asked to reach circular targets (diameter 3 cm) with the index fingers of their dominant hands as quickly as possible. All subjects were asked to visit the laboratory for three consecutive days: on the first two days they received intensive training of 600 movements per day on 5 targets arrayed on an arc ranging from 50 to 130 degrees at 25 cm from the home position. Before and after training in the first two days, on the third day and 1 month later, subjects performed a test consisting of reaching 35 targets presented arrayed from 30 to 150 degrees and at 10, 15, 20, 25, and 30 cm. Results: Two-day intensive training showed significant increase in speed, long-lasting (1 month) improvement in performance, generalization to untrained movements, increased reliance on feedforward control (velocity profiles were initially asymmetric (right-skewed) but became symmetric with training), decrease in variability (decreased coefficient of variation in the peak acceleration), and improvement in efficiency of movement cost by increasing initial elbow height. Conclusion: Thus, short-duration and intensive reach training can induce true motor skill learning and the training results showed the characteristics representing motor skill learning in young non-disabled individuals.

#### Poster #: 68

Title: Knee Loading Deficits in Dynamic Tasks in Individuals Status-Post ACLr  
Name: Kristamarie Pratt  
Faculty Advisor: Susan Sigward

Background: Ability to perform dynamic single limb exercises without pain is used as clinical criteria to progress individuals to running following anterior cruciate ligament reconstruction (ACLR). However, it is not clear how demands of single limb loading tasks relate to demands of running. Purpose: To compare sagittal plane knee mechanics

during single limb loading task and running within one month of initiation of running. Methods: 15 individuals status post-ACLR ( $122 \pm 27$  days) were tested. Subjects performed run (RUN) and a dynamic single limb loading task (SL) to maximal knee flexion. Knee flexion excursion (kEXC) and peak extensor moment (kEXT) and power absorption (kPw) were calculated during deceleration in involved (IN) and uninvolved (UN) limbs.  $2 \times 2$  (task  $\times$  limb) repeated measures ANOVAs were performed; paired t-tests were used for significant interactions. Between limb loading symmetry was calculated as ratio between IN/UN for kEXT and kPw. Pearson's correlations were used to determine relationship between knee loading deficits across tasks. Results: Uninvolved limb had greater kEXC, kEXT and kPw than involved limb for both tasks. SL had greater kEXC than RUN and larger between limb differences (17 vs 14%). RUN had greater kEXT than SL and larger between limb differences (31 vs 23%). RUN had greater kPw, however between limb differences did not differ between tasks (34%). kEXT and kPw ratios during SL was correlated with ratios during RUN ( $r = 0.77$  and  $r = 0.79$ ). Conclusion: Loading symmetries were highly related suggesting that SL can provide information regarding readiness to initiate running. Large between limb deficits in kPw during less demanding task suggests that particular attention to progression of speed at which individuals perform dynamic exercises that require rapid attenuation of forces is warranted.

#### Poster #: 69

Title: Leg Flexor and Extensor Muscle Recruitment during Chick Embryonic Movement  
Name: SooYeon Sun  
Faculty Advisor: Nina Bradley

Background: Prior to hatching, chick embryos produce repetitive leg movements (RLMs) in ovo, featuring flexor and extensor muscle alternation at locomotor frequencies. Frequently, only repetitive ankle flexor activity accompanies RLMs. Purpose: Thus, the objective of this study was to determine if recruitment attributes differ between leg flexor and extensor muscles during RLMs. Methods: Embryonic day 20, ipsilateral hip and ankle muscles or bilateral ankle muscles were implanted for electromyographic (EMG) and kinematic recording of spontaneous muscle activity. Criteria for EMG sequence inclusion were 4 or more rhythmic bursts (1-10 Hz) in 1 or more muscles accompanied by repetitive leg movement. Flexor and extensor recruitment parameters were compared within-subject ( $N = 28$ ). The number of bursts and burst amplitude for flexor and extensor activity were compared. Results: Results indicated flexor muscles were more frequently recruited than extensors. Within limb, flexor bursts outnumbered extensor bursts: left ankle, 16/16 embryos; right ankle, 25/28; and right hip, 11/11. Also, flexor-only RLMs outnumbered extensor-only RLMs (average difference = 24 RLMs,  $N = 27$ ). However, flexor amplitudes were the least during flexor-only RLMs and greatest during sequences of repetitive flexor and extensor alternation ( $N = 24$ ). Conclusion: Our analyses provide evidence that locomotor drive can vary across motor pools in the embryo. Amplitude analyses suggest that during RLMs, flexor motor pools may be recruited at lower levels of locomotor drive than extensor pools. Our

findings may further indicate that spatial constraints on leg movements in ovo may selectively favor excitatory drive of flexor motor pools and/or inhibitory drive of extensor pools.



#### Poster #: 70

Title: Feasibility of Mapping Trunk and Hip Representation in Motor Cortex  
Name: Alaa Albishi  
Faculty Advisor: Beth Fisher

Background: Trunk and hip muscles contribute significantly to postural control, balance and locomotion. With aging, changes in activities of these muscles are noted. While modifications in motor behavior are linked to altered representational areas in primary motor cortex (M1), the relationship between M1 organization of the trunk and hip muscles and changes in motor behavior in older adults has yet to be established. Transcranial Magnetic Stimulation (TMS) has been used to identify muscle representation in M1. Mapping the trunk and hip muscles is challenging due to the small representations of these muscles in the medial motor cortex. Purpose: Establish a methodology to quantify the spatial representation of trunk and hip musculature in young and older adults. Methods: Two young females participated in the study. Motor evoked potentials (MEPs) were quantified in the external oblique, lumbar longissimus and gluteus medius using a double cone coil and surface electromyography. Motor thresholding and mapping were conducted during a submaximal active contraction (20% of maximum voluntary isometric contraction) for all three muscles. Average peak-to-peak amplitude of MEPs was calculated for each map location and utilized to determine the center of gravity (COG) for each muscle. Results: MEPs were elicited consistently in all three muscles. The COG for gluteus medius and external oblique were 1cm medial to that of lumbar longissimus in both participants, while the COG of external oblique was 2cm anterior to lumbar longissimus in both individuals. Conclusion: Initial data demonstrate that this methodology is feasible and can identify distinct trunk and hip representations in the motor cortex.

#### Poster #: 71

Title: Upper Extremity Function and Isometric Strength in Breast Cancer Survivors  
Name: Lindsey Avery  
Faculty Advisor: Christina Dieli-Conwright

Background: Rehabilitation from mastectomy in breast cancer survivors (BCS) is challenged



by reduced range of motion and strength associated with disuse. The PENN Shoulder Scale (PSS) and the Disability of the Arm, Shoulder and Hand (DASH) questionnaires are used to quantify self-reported upper limb impairment. Purpose: To examine the associations between self-reported upper extremity function using DASH and PSS with active range of motion (AROM) and isometric strength (IS) of the surgically affected limb in BCS. Methods: Thirty-one BCS (ages 52.4±9.4 years) were recruited from LAC+USC Hospital and Norris Comprehensive Cancer Center. Investigators measured AROM during external rotation (ER) at 90° abduction and shoulder forward flexion (SFF) and IS during scapular elevation (SE) and external rotation (ER) using a hand-held dynamometer. Participants then completed DASH and PSS questionnaires. Pearson correlations were used to determine associations between DASH, PSS, and AROM and IS. Results: Mean PSS and DASH scores (±SD) were 72.8±19.8 points and 18.9±15.9 (both out of 100 points). No statistically significant relationship was detected between PSS scores and AROM (ER,  $p=0.14$ ,  $r=-0.26$ ; SFF,  $p=0.08$ ,  $r=-0.30$ ) or IS (ER,  $p=0.46$ ,  $r=-0.12$ ; SE,  $p=0.39$ ,  $r=-0.15$ ) or between DASH scores and AROM (ER,  $p=0.28$ ,  $r=0.17$ ; SFF,  $p=0.50$ ,  $r=0.10$ ) or IS (ER,  $p=0.60$ ,  $r=0.13$ ; SE,  $p=0.76$ ,  $r=0.05$ ). Conclusion: The PSS and DASH were not related to AROM or IS in BCS. These self-reported assessment tools may not be appropriate for predicting upper body strength or range of motion in BCS.

#### Poster #: 72

Title: Development of a Modified Reaching Performance Scale for the WMFT  
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 previous function. Currently, there are no widely applied outcome measures that adequately represent how a movement is performed. A common outcome measure used in research, the Wolf Motor Function Test (WMFT) scores tasks on time and functional ability. However, it does not specify the way in which the movement was performed. The Reaching Performance Scale (RPS) was developed to try to quantify movement quality for a simple cone reaching task. Purpose: To adapt the RPS so that it may be applied to the WMFT. This will allow retrospective analysis of study data, and in future studies allow more information about movement quality to be obtained without increasing the testing burden on the participant or clinician. Methods: Three raters applied the RPS to the soda can task of the WMFT. The score definitions were rewritten to reflect the difference in the task. After revision, each rater viewed 40 videos (10 participants x 4 assessments) of the WMFT soda can task. This was repeated a week later to test both inter- and intra-rater reliability. Following this, the definitions were refined and the process is being repeated. Results: Initially poor RPS sub-item reliability was found, although the ICC for total score was good. Further development is expected to improve the reliability of the scores. Conclusion: It is feasible to adapt the RPS to an item of the WMFT, although substantial time to make revisions and retest are required.

#### Poster #: 73

Title: Inertial Measurement Units Detect Knee Loading Deficits Following ACL Reconstruction  
Name: Ming-Sheng Chan  
Faculty Advisor: Susan Sigward

Background: Reduced knee extensor moments persist well after 3 months following ACL reconstruction. Knee extensor moment asymmetries are often present in the absence of observable knee flexion deficits making them difficult to detect clinically. Inertial measurement units (IMU) are able to detect gait spatiotemporal asymmetries, but it is not known if variables measured with IMUs are related to knee moment asymmetry during gait. Purpose: To determine the relationship between knee extensor moment asymmetry and IMU-measured sagittal plane shank angular velocity asymmetry during gait in individuals 3 months post-ACLr. Methods: 8 subjects (98.4 ± 12.7 days post-ACLr) performed 4 walking trials. Sagittal shank angular velocity was measured with tri-axial gyroscopes within IMUs attached to the anterior lower leg bilaterally. Knee extensor moments were quantified using motion analysis. Peak shank angular velocity (skAV) and knee extensor moment (kEXT) were identified during loading response. skAV and kEXT asymmetry were calculated as the ratio between involved and uninvolved limbs. Pearson's product correlations were used to determine the relationship between skAV and kEXT ( $\alpha \leq .05$ ). Results: On average, skAV and kEXT ratios were 0.90 ± 0.11 and 0.77 ± 0.35 at 3 months, respectively. skAV and kEXT ratios were positively correlated at 3 months ( $r = .822$ ;  $p = .012$ ). Conclusion: Decreased skAV in the involved limb during loading response suggests alter heel rocker mechanics 3 months post-ACLr. skAV asymmetries are correlated with knee extensor moment asymmetry. The strong correlations suggest that IMUs can provide important information regarding knee loading deficits in individuals following ACLr. A larger sample size is needed to determine the clinical feasibility of IMU use for detection loading asymmetries.

#### Poster #: 74

Title: Repetitive Transcranial Magnetic Stimulation to Modulate Cortical Excitability after Stroke  
Name: Yu-Chen Chung  
Faculty Advisor: Beth Fisher

Background: Although low-frequency repetitive transcranial magnetic stimulation (rTMS) has been demonstrated to be safe and feasible after stroke, its effectiveness in modulating the excitability of the non-lesioned hemisphere and improving paretic hand function has not been consistently reported. In order to optimize the application of rTMS in stroke rehabilitation, it is essential to understand the factors that may impact its efficacy. Purpose: to determine potential participant characteristics that may impact the effectiveness of rTMS. Methods: Ten individuals with sub-acute stroke received one session of 1-Hz rTMS over the representative area of the extensor digitorum communis in the non-lesioned primary motor cortex (M1). The excitability of the non-lesioned M1 was measured before and after rTMS as the amplitude of the resting motor evoked potential (MEP). Participants were divided into responders and non-responders, based on changes in MEP

following rTMS. Participant characteristics (age, stroke duration, lesion location and initial paretic hand function) were compared between the groups. Results: Three participants showed reduced excitability following rTMS and were categorized as responders. No significant difference in stroke duration, initial hand function and lesion location was found between responders and non-responders. Further analysis showed that age was correlated with the amount of reduction in excitability, suggesting that the efficacy of inhibitory rTMS was greater in younger participants. Conclusion: Our results suggest that the ability of rTMS to modulate brain excitability following stroke may be a function of age. The findings attest to the further need to determine the subject-specific characteristics that would enable prediction of a good outcome following rTMS.

#### Poster #: 75

Title: Influence of Different Positioning Devices on Infant Leg Movement  
Name: Joyce de Armendi  
Faculty Advisor: Beth Smith

Background: Positioning devices might encourage or constrain infant movement. Purpose: Determine whether devices influence leg movement characteristics in infants with typical development (TD) and at risk (AR) of developmental delays. Methods: Infants with TD ( $n=10$ ) and AR ( $n=7$ ), 2-8 months old, participated. Movement sensors measured linear acceleration and angular velocity (20 Hz) while infants were in supine, a gym, or a car seat for 4 min. We used MatLab to calculate leg movement quantity and peak acceleration. Results: Preliminary analysis shows that infants with TD moved more than infants AR in supine (TD M 229, SD 141; AR M 196, SD 133). Compared to supine, infants with TD maintained quantity in the gym (M 246, SD 170) while infants AR increased to narrow the group difference (M 218, SD 134). Infants decreased in the car seat (TD M 130, SD 106; AR M 86, SD 63), maintaining the group difference. Infants with TD had equal peak acceleration (m/s<sup>2</sup>) than infants AR in supine (TD M 4.4, SD 1.5; AR M 4.4, SD 2.3). Compared to supine, infants with TD increased and AR decreased acceleration in the gym (TD M 4.6, SD 1.8; AR M 4.2, SD 2.4) while infants had lower acceleration in the car seat and maintained the group difference (TD M 3.8, SD 1.3; AR M 3.3, SD 2.0). Conclusion: Positioning device selection and developmental classifications influenced leg movements. Infants showed lower measurements in the car seat. TD infants showed similarities between supine and the gym, while AR infants increased in the gym.

#### Poster #: 76

Title: Support Impulse Joint Contributions Following a Transition to Barefoot Running  
Name: Andrea Du Bois  
Faculty Advisor: George Salem

Background: Relative to shod rear-foot strike (RFS) running, a forefoot strike (FFS) is associated with a shift in mechanical demand from the knee to the ankle. Barefoot running results in a similar shift in demand even though habitually shod runners do not innately adopt a FFS during barefoot running. It is unknown whether the altered joint demands are a function of foot strike or running barefoot. Purpose: To examine the relative contribution of the ankle, knee

and hip to the support impulse in habitually shod runners during a novice bout of barefoot running. Methods: 22 habitually shod RFS runners performed shod and barefoot running; participants were grouped according to their barefoot foot strike pattern (5 FFS; 9 mid-foot strike, MFS; 8 RFS). The support impulse is the cumulative ankle, knee and hip extensor moments during absorption. The relative contributions of the ankle (ANK), knee (KNE), and hip (HIP) were calculated as a percentage. Results: All barefoot runners demonstrated increased ANK ( $p \leq 0.028$ ). MFS demonstrated reduced KNE and HIP ( $p \leq 0.021$ ), while FFS demonstrated a trend towards decreased KNE ( $p = 0.095$ ). FFS and MFS had larger ANK and lesser KNE than RFS ( $p \leq 0.021$ ). When shod, FFS presented with greater ANK than RFS ( $p \leq 0.007$ ). Conclusion: Similar to previous reports, there was an increase in ankle demands. MFS runners demonstrated reduced knee and hip demands and FFS runners demonstrated a trend towards reduced knee demands. These findings suggest adopting a FFS/MFS can reduce knee injury risk. However, due to increased ankle demands, it is important to gradually transition to barefoot running.

#### Poster #: 77

Title: Application of Uncontrolled Manifold Analysis to Overuse Injury  
Name: Abigail Fietzer  
Faculty Advisor: Kornelia Kulig

Background: Too little variability is associated with poor adaptability and predisposition to injury. Decreased variability occurs with overuse/recurrent injury (low back pain, and ankle sprain/instability), aging and fatigue. There appears to be an optimal amount of variability allowing the highest level of performance while maintaining adaptability and protecting against injury. Overuse injuries are a large and growing problem in society, with prevalence up to 90% in some populations. Overuse injuries common, notoriously resistant to treatment, associated with a high activity cessation rate (30-90%), and have recurrence rates of 20 to 70%. Uncontrolled manifold analysis (UCM) was developed to seek out structures stabilizing particular task-level performance variables or goals. The data cloud shape relative to the manifold determines the degree to which there is performance-stabilizing synergy. The data cloud location along the manifold demonstrates a preferred sharing pattern, similar to optimization. VUCM variability does not affect task-level performance variables, while VORT variability does. To date, few studies have applied UCM analysis to more ecologically relevant tasks of sit-to-stand, walking, and hopping. Purpose: To demonstrate the appropriateness of applying uncontrolled manifold analysis to the examination of human movement variability in subjects with overuse injury. Methods: Narrative literature review Results: The lack of variability associated with overuse/recurrent injury is likely of the VUCM. Recent evidence indicates that a training paradigm to increase VUCM but maintain low VORT can be developed. Thus, application of the UCM method to examine cohort differences in the structure of variability between those with and without overuse injury may provide important insights into risk factors and provide an important starting point for the development of interventions that prevent the development or recurrence of overuse injury.

without overuse injury may provide important insights into risk factors and provide an important starting point for the development of interventions that prevent the development or recurrence of overuse injury. Piloting will begin in stationary and directional hopping in persons with Achilles tendinopathy and age/activity matched healthy controls.

Poster #: 78

Title: Impacts of Autonomy-Supportive versus Controlling Instructional Language on Motor Learning  
Name: Andrew Hooyman  
Faculty Advisor: Carolee Winstein

Background: The perceived control over one's environment has been postulated as a basic human psychological need. It may then be assumed that lack of this perception may impact one's ability to both perform and learn optimally. Within the context of motor learning and physical rehabilitation perceived autonomy may benefit motor skill acquisition and reconstitution. Purpose: The authors examined the influence of autonomy-supportive (ASL), controlling (CL), and neutral instructional language (NL) on motor skill learning (cricket bowling action). We hypothesized that the ASL group would have improved performance and learning of the motor skill compared to the NL and CL groups. Our secondary hypothesis is that incorporation of autonomy support within practice would also improve secondary outcomes such as perceived autonomy, positive affect, and self-efficacy. Methods: Prior to and several times during the practice phase, participants watched the same video demonstration of the bowling action but with different voice-over instructions. The instructions were designed to provide the same technical information but to vary in terms of the degree of choice performers would perceive when executing the task. In addition to measurements of throwing accuracy (i.e., deviation from the target), perceived choice, self-efficacy, and positive and negative affect were assessed at the end of the practice phase and after a retention test without demonstrations and instructions on Day 2. Results: ASL resulted in perceptions of greater choice, higher self-efficacy, and more positive affect during practice than CL, and enhanced learning as demonstrated by retention test performance. Thus, granting learners autonomy appeared to endow them with confidence in their ability, diminished needs for control of negative emotional responses, and created more positive affect, which may help consolidate motor memories. Conclusion: We interpret the results of this study that instructions containing autonomy supportive language aided in the motor memory consolidation compared to instruction containing controlling language. The future direction of this research is to incorporate autonomy-support within physical rehabilitation paradigms.

Poster #: 79

Title: Effect of Positioning Devices on Infant Movement  
Name: Crystal Jiang  
Faculty Advisor: Beth Fisher

Background: Infant movement can be used as an indicator of developmental progress. This study explores infant leg and foot movement, in various environmental contexts: when constrained in a bumbo or car seat or when

encouraged to move in a gym. Purpose: We aim to determine if positioning devices affect infant movement rates, and, if so, whether the effects are similar in infants with typical development (TD) and at risk or with developmental delay (AR). Methods: Video data were recorded of 13 infants with TD and 13 AR placed in supine, a car seat, a bumbo seat, or in supine underneath a gym. Trained behavior coders identified start and stop for leg and foot movements. Results: Preliminary analysis for infants with TD showed the average quantity of leg movements in 4 minutes was: 265 in supine, 245 in a standard car seat, 164 under a jungle gym and 77 in a bumbo seat. Average quantity of foot movements in 4 minutes was: 84 in a bumbo seat, 20 in a standard car seat, 7 in supine, and 2 under a jungle gym. Conclusion: Movement rates were affected by positioning devices. No change in leg movements, but more foot movements were observed when infants were in the car seat. Less leg, but more foot movements were observed when in the bumbo seat. Less leg and foot movements were observed when under a jungle gym. Future directions will analyze infants AR and statistically test results.



Poster #: 80

Title: Is DTI a Useful Biomarker of Responsiveness to Stroke Neurorehabilitation?  
Name: Bokkyu Kim  
Faculty Advisor: Carolee Winstein

Background: DTI measures of Corticospinal tract (CST) are associated with upper extremity (UE) motor impairment and function in conditions of acute, subacute and chronic stroke. Less well understood is whether or not DTI measures are better predictors of responsiveness to neurorehabilitation than other performance-based measures. This study is part of a longitudinal Phase-I clinical trial of rehabilitation in chronic stroke (ClinicalTrials.gov ID: NCT 01749358). Purpose: To determine if a DTI measure of CST is a better predictor of responsiveness to neurorehabilitation than commonly used motor performance outcomes. Methods: Those with mild to moderate motor impairment and stroke chronicity (average chronicity: 3.0 years) participated (N=25). DTI scans and clinical assessments were acquired before and after 12 sessions (over 4 months) of a structured UE therapy program. Imaging data were processed using BrainSuite14a (<http://brainsuite.org/>). CST fractional anisotropy (FA) was quantified from each hemisphere and FA asymmetry index (CST-FAAI) was calculated. Wolf Motor Function Test (WMFT) time and Fugl-Meyer UE assessment (FMA) were acquired as primary clinical outcomes of function and impairment, respectively. Linear regression was used to determine the relationship

between predictors and dependent measures. Results: Baseline CST-FAAI, WMFT time, and FMA were significantly correlated with pre-post change in WMFT but not FMA. Importantly, baseline WMFT and FMA were more strongly correlated with change in WMFT than was baseline CST-FAAI. Conclusion: These results demonstrate that a DTI measure of CST in chronic stroke can be used as a biomarker for predicting responsiveness to neurorehabilitation, but it is no better than performance-based clinical measures.

Poster #: 81

Title: Feasibility of Immersive Virtual Reality 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). Unlike conventional gait training on a treadmill, VR can provide more motivating and interactive environments. Purpose: There is a need to evaluate feasibility of using immersive VR in PD. Methods: A VR environment consisting of a cityscape was specifically designed for the present study and included buildings and an approximately 800 meter straight pedestrian path. Participants completed a simulator sickness questionnaire and a stress arousal checklist pretest. Then participants walked on the treadmill while wearing a Head Mounted Display (HMD) displaying the VR scene for 20 minutes in 5 minute intervals. While walking, heart rate, center of pressure and variability of gait were collected. A body mapping test was given pre- and posttest. After the test, a series of questionnaires were given measuring preference of VR training, symptoms of simulator sickness, stress arousal and the sense of presence within the VR. Results: In a pilot sample of healthy controls, there was no evidence of simulator sickness except for slight dizziness with eyes closed. The participants were able to adjust to the virtual environment in less than 1 minute and responded that they could actively search the environment with vision. This study is ongoing and will include continued collection of data in individuals with PD. Conclusion: We believe that our findings can inform the design and implementation of VR-based rehabilitation and assessment tools for individuals with PD.

Poster #: 82

Title: Distinctive Sensorimotor Control of Dynamic Fingertip Force in Parkinson's Disease  
Name: Na-hyeon Ko  
Faculty Advisor: Francisco Valero-Cuevas

Background: A loss of dexterous hand function is common in Parkinson's disease (PD). Current clinical measurements have no resolution to detect subtle changes in sensorimotor control of fingertip although continuous control of fingertip force vectors is essential for dexterous manipulation. Purpose: The purpose of study is to investigate dynamic sensorimotor control of fingertip force in PD, using a challenging spring compression task. Methods: The task consists of compressing a slender spring prone to buckling, which requires very low force magnitudes (< 3N for full compression). We measured the level of compression force (F), force velocity (F'), and

RMS for both hands in 21 individuals with PD (PD\_aff and PD\_lesaff) and for both hands in 40 individuals without disability (C\_dondom and C\_nondom) during a hold phase at the maximal level of compression. Then, we correlated these force outcome measures with the UPDRS motor scores for its clinical implications. Results: We found no difference in the maximal compression level among four hands. However, F' and RMS in the PD\_aff were significantly greater than those of C\_dondom and C\_nondom. F' and RMS increased with the increase in F in C\_dondom; however, this trend was not found in the PD\_aff. The UPDRS motor scores were significantly correlated with RMS in the PD\_aff ( $\rho = 0.572, p = 0.041$ ). Conclusion: In conclusion, the sensorimotor control of dynamic fingertip force in the PD group was more variable than the control group; the force variability was independent from the level of compression force. However, interestingly, the greater variability was correlated with less motor impairment.

Poster #: 83

Title: Measuring Interhemispheric Communication via the Ipsilateral Silent Period  
Name: Yi-Ling Kuo  
Faculty Advisor: Beth Fisher

Background: The ipsilateral silent period (ISP) is an index of interhemispheric inhibition (IHI). ISP decreases with age, suggesting the normal inhibitory mechanism is shifted toward excitatory processes during aging; yet these changes can be ameliorated by long-term engagement in aerobic training. Prolonged ISP has also been found in stroke survivors due to excessive inhibition from the unaffected hemisphere toward its affected counterpart. Given that ISP is a valuable and often cited measure to quantify IHI across different populations, it is essential that ISP is measured in a reliable manner. Our previous preliminary data showed that both the consistency of ISP duration and onset latency were influenced by the amount of force exerted voluntarily during TMS stimulation in non-disabled young adults. ISP measurements for first dorsal interosseous (FDI) were more consistent under submaximal muscle contraction in comparison with maximal contraction, which is what has been utilized in previous studies. Purpose: Extend our preliminary findings to another hand muscle: abductor pollicis brevis (APB), with an important role in functional thumb opposition. Methods: Subjects are instructed to press isometrically using their dominant side's thumb abduction in 30, 50 and 100% of maximal volitional contraction. The subjects hold the predetermined contraction level while a TMS pulse was applied over the non-dominant hemisphere. Results: We will present duration and onset latency of ISP for APB across the three conditions of muscle contraction. Conclusion: Comparing the current results with the previous ones helps determine whether ISP for hand muscle is most consistent under a submaximal muscle contraction condition.

Poster #: 84

Title: Influence of Femur and Tibia Rotations on Patellofemoral Joint Stress  
Name: Tzu-Chieh 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 secondary to abnormal lower extremity kinematics in the frontal and transverse planes. To date, the influence of tibia and femur rotations on PFJ stress is unknown. Purpose: To determine the influence of frontal and transverse plane rotations of the femur and tibia on PFJ stress. Methods: Patella cartilage stress profiles for two healthy participants were quantified utilizing subject-specific finite element models. Input parameters included: subject-specific joint geometry, quadriceps muscle forces, and weight-bearing PFJ kinematics. Using a nonlinear FE solver, quasi-static loading simulations were performed to quantify patella cartilage stress during a static squatting maneuver (45° knee flexion). The femur and tibia were then rotated along their respective axes from 0° to 10° (2° increments) in both frontal and transverse planes from the natural position. Results: In the transverse plane, femur internal rotation resulted in the greatest PFJ stress. In the frontal plane, femur adduction resulted in a more modest increase in average hydrostatic pressure. Tibia rotations had a minimal impact on PFJ stress. Conclusion: Patella cartilage stress appears to be influenced to a greater degree by femur rotations as opposed to tibia rotations. This is logical given the fact that the patella articulates with the femoral trochlea and thus motions of the femur would influence contact mechanics to a greater degree than tibia rotation.

#### Poster #: 85

Title: Relationship Between Knee Extensor Moment and GRFs During Gait Post-ACLR

Name: Paige Lin

Faculty Advisor: Susan Sigward

Background: Clinically, individuals are expected to restore normal gait mechanics by 3 months post-anterior cruciate ligament reconstruction (ACLR). However, biomechanical studies report that large knee extensor moment asymmetries are still present in the absence of large kinematic differences. This suggests that individuals may be modulating ground reaction forces to limit knee loading. Purpose: To determine the relationship between knee extensor moment, ground reaction force, and knee flexion angle symmetry between limbs during gait. Methods: 13 individuals (8 females, 24.2±9.2yrs) performed 3 walking trials at 3 months (87.9±8.9days) post-ACLR. 3D kinematics (250 Hz), ground reaction forces (1500Hz) and anthropometrics were used in inverse dynamics to identify knee flexion angle (kFLEX), knee extensor moment (kEXT) and posterior (pGRF) and vertical (vGRF) ground reaction force peaks during loading response. Between limb symmetry was calculated as the ratio between involved and uninvolved limbs. Pearson's product-moment correlations were used to determine the relationship between knee loading deficits; significance  $\alpha \leq 0.05$ . Results: On average, kFLEX and kEXT ratios were  $0.97 \pm 0.18$  (range: 0.72-1.34) and  $0.77 \pm 0.31$  (range: 0.26-1.36), respectively. pGRF and kEXT ratios were correlated ( $r=0.706; p=0.007$ ). kEXT ratio was not correlated with vGRF ratio ( $r=0.290; p=0.337$ ) or kFLEX ratio ( $r=0.440; p=0.132$ ). Conclusion: Larger pGRF asymmetries were strongly related to larger kEXT asymmetries during gait at 3 months post-op, indicating that smaller pGRFs are related to smaller kEXT. This suggests that individuals post-ACLR modulate braking forces, not vertical forces or knee flexion angle, to limit knee

extensor moments. Future studies should investigate how gait mechanics modulate braking force and knee loading and the mechanisms that underlie these movement patterns.

#### Poster #: 86

Title: Effect of Positioning Devices on Infant Arm Movement Characteristics

Name: Isabelle Mason

Faculty Advisor: Beth Smith

Background: Infants with developmental delay often lag on integrating mind, body and behavior. One reason for this could be that these move less and, as a result, their movement skills and central nervous systems develop at a slower rate. Purpose: Certain positioning devices are thought to increase infant movement, while car seats are seen as restraints to motion. Our focus lies in how devices affect arm movements in infants with typical development (TD) and in infants with or at risk for developmental delay (AR). Methods: 13 TD infants and 13 AR infants participated, ages 1-10 months. We attached movement sensors to their arms and recorded their spontaneous movements with sensors and video for 4 minutes in each of following conditions (randomized across infants): supine, bumbo seat and jungle gym (encourage arm movement), car seat (constrain movement). Video data were analyzed by trained coders to identify start, stop and type of arm movements. Results: Preliminary results are from one infant per group. In the gym condition, TD3 made an average of 15 arm movements in 30-seconds, and AR1 made an average of 17. Of TD3's movements, 50.2% involved physical touching or interacting with the gym, and in AR1, 95.2% of movements involved interacting with gym. Conclusion: The sample size is too small to make inferences regarding quantity of movement and development rates. However, it is interesting to note that infant AR had a similar quantity of movements compared to the infant with TD, but a much higher percentage of the movements were direct interactions with the gym.

#### Poster #: 87

Title: A Comparison of Techniques to Quantify Dynamic Margins of Stability

Name: Tatri Mukherjee

Faculty Advisor: James Finley

Background: A number of studies have looked into dynamic postural control strategies during activities such as standing, walking, and walking while turning. This is mainly because activities like turning require dynamic control of the center of mass (COM), to maintain it within the base of support (BOS). Typically, calculation of the COM's kinematics requires a full body marker set which has several disadvantages such as: 1) long preparation time, 2) tedious data analysis process, 3) undetected markers, 4) errors due to noise. Hence simple kinematic models, which take into account fewer markers, would be useful to determine the COM and the dynamic margins of stability (MoS). Previous studies have relied on simplified models to estimate the kinematics of the COM and the MoS. However, the data obtained from these models has not been validated. Purpose: To validate three simplified kinematic models by comparing the estimated MoS computed using these simple models to the MoS obtained from the full body marker set. Methods: Young healthy adults were recruited and asked to perform 3 activities: 1) walking, 2) step turning, and 3) figure of eight walking while

wearing a full body marker set. The fore-aft and mediolateral margins of stability were calculated using each method and the results were compared using an ANOVA. Results: Data collection for this study is ongoing. Conclusion: We expect that validation of the simplified model can be useful in assessing the effect of rehabilitative interventions on dynamic postural control abilities in research and clinical settings

#### Poster #: 88

Title: Hip and Ankle Moments During Forward Reach: Comparison Across Strategies

Name: Tulika Nandi

Faculty Advisor: George Salem

Background: It has been demonstrated that the hip strategy (HS) is chosen instead of ankle strategy (AS) only when large or rapid external perturbations are encountered. This has led to the hypothesis that use of HS during self-initiated movements that are relatively safe or involve small center of mass (COM) excursions indicates poor balance, possibly due to deficits in ankle musculature. Purpose: To elucidate the biomechanical role of the hip during self-initiated standing forward reach. Methods: 5 young participants stood with their right shoulder flexed to 90°. They were instructed to reach forward as far as possible without taking a step and without raising their heels off the floor. 3 trials each were collected with 2 different instructions – do not bend the hip (AS) and bend the hip (HS). 2 force plates and an 11 camera motion capture system were used to obtain moments, and whole-body COM and center of pressure (COP) excursions. Results: Reach distance normalized by height was significantly higher during HS ( $\Delta = 4.5 \pm 0.7$  cm;  $p < 0.001$ ). This was accompanied by a significantly higher peak hip extensor moment ( $\Delta = 0.41 \pm 0.12$  Nm/kg;  $p = 0.002$ ). The maximum COM and COP excursions and peak ankle plantarflexor moment were not significantly different between strategies. Conclusion: Using HS allowed participants to reach further without increasing the balance risk as assessed by COM and COP excursions. Therefore, use of HS may not necessarily be a last resort indicating absence of ankle strength and the hip should not be ignored during assessment and retraining of balance.

#### Poster #: 89

Title: Determining If Opal Sensors Affect Frequency of Infants' Leg Movements

Name: Emily Perkins

Faculty Advisor: Beth Smith

Background: Currently, infants defined as "at risk" for developmental delay are followed clinically, but it is a challenge to accurately identify early which infants are typically-developing or delayed. These individuals normally would not receive any interventions until around age 2 when doctors can identify toddlers as developmentally delayed. Early identification of delayed infant neuromotor control is necessary for early targeted intervention to promote development. Purpose: We are using wearable sensors to record full-day infant movements in order to predict outcomes for at-risk infants. Our goal here is to determine whether wearing the sensors affects leg movements. Methods: Participants were 13 typically-developing infants and 13 at-risk infants, ages 2 to 8 months. We recorded 4 minutes of video per infant of spontaneous supine movements for each leg with and without sensors. Trained behavior coders identified when a leg movement started and stopped. Results:

Preliminary analysis shows no apparent difference between quantity of leg movement in 4 minutes when infants were wearing movement sensors on their legs (M 150, 95% CI 90-250) compared to when they were not wearing sensors (M 130, 95% CI 90-180). Conclusion: Preliminary analysis supports that wearing movement sensors does not affect quantity of infant leg movements. Next steps include determining whether leg movements in early infancy relate to developmental rate and later functional outcomes.

#### Poster #: 90

Title: Muscle Activation Patterns During a Standing Voluntary Leg Lift

Name: K. Michael Rowley

Faculty Advisor: Kornelia Klug

Background: Low back pain is a highly prevalent condition with 80% of adults experiencing an episode once in their lifetime and about half suffering from recurrent episodes. Distinct postural patterns persist in this population during periods of symptom remission. For instance during voluntary arm raise tasks, deep fibers of the lumbar multifidus (MF) and the transversus abdominis (TrA) activate later than in healthy controls. Purpose: The purpose of this study was to investigate these patterns during voluntary leg flexion, a task related to activities of daily living such as gait and stair climbing. Methods: One healthy subject was instrumented with surface and fine-wire electromyography in postural muscles including MF and TrA. The subject flexed the right leg in response to a light cue in four conditions. Onset times were averaged across four trials for each condition and plotted relative to the onset of the rectus femoris, considered the prime mover of combined leg flexion. Results: Relative to rectus femoris onset at 0 ms, on average TrA activated at 19.4 ms in the unistructured condition, 35.2 ms in the fast condition, -210.0 ms in the dual attention condition, and -68.2 ms in the fatigued condition. Contrary to what was expected, MF was activated prior to leg flexion and shut off shortly after the onset of the rectus femoris, remaining off during the period of sustained flexion. Conclusion: The unexpected findings of MF require more thought and indicate that this task requires fundamentally different control from the arm flexion tasks previous investigated.

#### Poster #: 91

Title: Predictors of Loading Rate in Heel-strike Runners

Name: Yo Shih

Faculty Advisor: Christopher Powers

Background: High loading rates are thought to contribute to lower extremity injuries in runners. Also, studies show that loading rates are higher in heel strikers than forefoot strikers during running. However, not all heel strikers exhibit high loading rates. Purpose: To date, it is not known what kinematic or kinetic factors are predictive of high loading rates. Methods: Twenty male (age,  $27.1 \pm 7.0$  yr; height,  $1.74 \pm 6.9$  m; weight,  $71.1 \pm 8.2$  kg) and 20 female heel-strike runners (age,  $26.2 \pm 5.8$  yr; height,  $1.65 \pm 7.4$  m; weight,  $60.6 \pm 6.6$  kg) were recruited for this study. Kinematic and kinetic data were collected while participants ran at a controlled speed of 3.4 m/s along a 14 meter runway with a force plate mounted flush to the floor. Lower extremity joint kinematics, kinetics, energetic variables and leg/joint stiffness during initial loading were analyzed. Step-wise multiple



the best predictor(s) of loading rate. Results: Leg stiffness from initial contact to the impact peak was the first variable that entered the stepwise regression model of loading rate ( $R^2=0.728$ ). The second variable that entered was the knee angle change from initial contact to the impact peak ( $\Delta R^2 = 0.04$ ). No other variables entered into the final model. Conclusion: Our findings suggest that increased lower extremity compliance immediately following initial contact protects against high loading rate of runners. Further study is needed to test the feasibility of manipulating leg stiffness and knee angle change immediate following initial contact to minimize loading rates.

Poster #: 92

Title: Risk Factors Associated with Shoulder Injury in High-intensity Exercise  
Name: Corbin Skinner  
Faculty Advisor: Jonathan Sum

Background: High-intensity exercise is a form of training that is gaining popularity. The effects of high-intensity exercise have not been thoroughly investigated. More recently, high-intensity exercise has been linked to major injury. Purpose: The objective of this pilot study is to investigate the effects of participating in high-intensity exercise and potential risk factors associated with shoulder injury; the target population is individuals 18 to 40 years of age that are intending to participate in a regular high-intensity exercise regimen who have no prior experience. This study will allow us to estimate the proportion of subjects who sustain a shoulder injury as well as explore any factors or conditions that clearly predispose a subject to a shoulder injury. Methods: Using questionnaires (the Penn Shoulder Score, the DASH, and our own survey), we intend to collect qualitative data prior to participation, and every month thereafter, up to 12 months. We will enroll subjects over one year or until we have enrolled 100 subjects and will follow subjects for one year. Standard graphical and statistical methods will be used to summarize results and patterns. Results: Results from this study will help us identify (1) what categories of shoulder function could be most affected by high-intensity exercise and (2) what previously existing factors of a person (i.e. demographics, activity levels, and relevant medical history) may contribute to an increased risk of shoulder injury in high intensity exercise. Conclusion: (Refer to "Results")

Poster #: 93

Title: Validation of Inertial Sensors for Determining Infant Leg Movement Rate  
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 portable, fast quantitative analysis method for measuring infant movement will support objective assessments and a better understanding of infant neuromotor development. Purpose: The use of data from inertial sensors to determine the quantity, type and quality of infants' leg movements performed across a full-day measurement for further use in the differentiation of infants with typical, delayed or impaired neuromotor development. Methods: Inertial sensor data were collected

from 12 infants with typical development for 8-13 hours per day. There were 2 months between visits and a total of 3 visits per infant. A sensor was attached to each leg, recording accelerometer and gyroscope measurements at 20 Hz. During each visit video data were recorded. From the sensor data, we created an algorithm to define a leg movement. The algorithm was compared to the gold-standard video data. Results: A subject-based algorithm was developed to define a leg movement. Each change of direction of the limb is counted as a discrete movement. The comparison of kick count between algorithm and video inspection for a 20s section for 23 different data sets showed an error of around 5.75% on average. Conclusion: We have shown that inertial sensors can identify infant leg movements from a full-day, in-home recording. This is a very efficient way of having a portable in-home device for quantifying full-day infant movement to help the early detection of movement impairment.

Poster #: 94

Title: Cortical Activation Associated with Muscle Synergies of Female Pelvic Floor  
Name: Moheb Yani  
Faculty Advisor: Jason Kutch

Background: Human pelvic floor muscles have been shown to operate synergistically with a wide variety of muscles, which has been suggested to be an important contributor to continence and pelvic stability during functional tasks. We recently showed that muscle synergies of the human male pelvic floor appear to involve activation of motor cortical areas associated with pelvic floor control (Asavasopon et al., 2014); however, these synergies remain untested in healthy adult females, and the rules by which these synergies are controlled require further attention. Purpose: Here, we hypothesize that activations in motor cortical regions associated with the human female pelvic floor activation are part of the neural substrate for such synergies. Furthermore, we hypothesize that the synergies of the human female pelvic floor are graded, where a change in one muscle activation may be associated with changes in the activation patterns of the other synergetic muscles. Methods: We will use electromyographic recordings to test whether in females: (1) pelvic floor muscles activate synergistically during voluntary activation of gluteal muscles, but not during voluntary activation of finger muscles; (2) pelvic floor muscles activation level does not change when activation level of the gluteal muscles changes; and, (3) the onset of pelvic floor muscles activation does not change when activation level of the gluteal muscles changes. Furthermore, we will use functional magnetic resonance (fMRI) to test whether in females a region of the medial motor wall of the precentral gyrus consistently activates during both voluntary pelvic floor muscles activation and voluntary gluteal muscles activation, but not during voluntary finger muscles activation. Finally, we will test whether EMG and fMRI activation patterns are sex dependent. Results: N/A Conclusion: N/A

Poster #: 95

Title: Examination of Flexor Bias in the Late Stage Chick Embryogenesis  
Name: Zhixin Zhang  
Faculty Advisor: Nina Bradley

Background: Previous studies reported that during late-stage embryogenesis in the chick, muscle bursts for repetitive limb

movements (RLMs) were observed more frequently in tibialis anterior (TA, ankle flexor) than in lateral gastrocnemius (LG, ankle extensor). The apparent dominance of TA RLM bursts suggested that there may be a flexor bias in embryonic locomotor drive. It was proposed that the flexor bias may be partially attributed to the constrained posture imposed by the eggshell; however, it has yet to be determined if the flexor bias is reduced when the constraint is removed. Purpose: The aim of this study is to determine if leg flexor and extensor burst parameters differ between spatially constrained (control) and unconstrained (foot-free, FF) RLMs. Methods: EMG recordings from a previously published study of RLMs were re-analyzed for 3 embryos to test for differences in drive to leg flexor and extensor motor pools. Burst counts and normalized burst integrated amplitude (percentage of muscle's maximum amplitude) were calculated and compared between control and FF conditions within embryo. Results: Results indicated that burst count was greater for TA than LG in both conditions for all experiments (control: 2.6x-4.8x; FF: 1.9x-5.1x). Normalized integrated amplitude was greater for TA than LG during control conditions in 2 of 3 experiments (34-36% increase) and during FF conditions in all experiments (98-141% increase). Conclusion: Our results suggest that ankle flexor muscles are more frequently and strongly recruited than extensors during RLMs under both control and FF conditions. Further, locomotor drive to flexors does not appear to differ between conditions.



Poster #: 96

Title: Military Community Reintegration as Transition between Figured Worlds  
Name: Alison Cogan  
Faculty Advisor: Florence Clark

Background: Community reintegration after military deployment is a challenging, nonlinear process of adjustment to civilian life. However, most existing theoretical perspectives about the process place the burden on the individual or family unit rather than considering the community's role. A new way of characterizing this transition is warranted. Purpose: The purpose of this project is to explore the process of community reintegration as an occupational transition between military and family life, using the concepts of figured worlds, positive withdrawal, and moral moods. Methods: The theoretical constructs of figured worlds, positive withdrawal, and moral moods were applied to accounts of military transitions from recent research

and first-person narratives. Results: Figured worlds are socially constructed units that are characterized by particular people and activities, and that shape identities. When one is immersed in the figured world of the military during a deployment and is, therefore, isolated from other worlds, changes in identity result, making the transition back to the world of family life challenging. Further, all members within the family figured world also experience identity shifts. Positive withdrawal, which is a consciousness about limiting one's participation, describes purposeful limited engagement with a figured world. Moral moods help one to process of one's experience as one moves in between worlds. Conclusion: The constructs of figured world, positive withdrawal, and moral moods are found to be useful ways to describe the reintegration experience for both service members and families, and the complex shifts in identity associated with the transition process.

Poster #: 97

Title: The Influence of Social Interaction on the Latino Paradox  
Name: Lucia Florindez  
Faculty Advisor: Florence Clark

Background: Despite facing health disparities including low income and low education, Latinos in the United States have a significantly higher life expectancy rate than Caucasians and Blacks, an epidemiological phenomenon called the "Latino Paradox." Many attempts have been made to explain this phenomenon, but few approaches have used a neurological lens. Purpose: Further assess the relationship between stress and social support in Latinos by presenting a way to account for the Latino Paradox that is grounded in neuroscience research. Methods: A scoping review of literature from 1980 to 2014, written in English, and published in peer-reviewed journals provided no results connecting neural implications directly with the Latino Paradox. Criteria were expanded to include studies that addressed social support related to stress, birth weight, levels of depression; a second review was conducted to find studies that discussed the neural impact of stress. These searches yielded over 180 studies that were reviewed by title and abstract for inclusion. A final sample of 20 articles representing 4 themes were charted and summarized. Results: Studies were arranged into thematic groups: infant mortality, acculturation/immigrant status, disease burden, and impact of stress. All studies concluded that social support was an important mitigating factor in buffering the negative effects of stress. Conclusion: This relationship between stress levels and social interaction suggests a neurological explanation for the Latino paradox as related to family and social structure. Close interpersonal relationships typically characterize the social dynamics of Latino families, and such components are linked with better overall perceived health levels.

Poster #: 98

Title: Post Hip Fracture: Interdisciplinary Care Collaboration for Continuous Quality Care  
Name: Heather Gillies  
Faculty Advisor: Natalie Leland  
Background: Interdisciplinary care collaboration during a post-acute care episode is pivotal for delivering continuous high quality care. Purpose: To elucidate

interdisciplinary high quality post-acute care in the context of hip fracture rehabilitation from the perspective of rehabilitation providers. Methods: Thirteen rehabilitation provider focus groups of 99 clinicians (occupational therapists, occupational therapy assistants, physical therapists, and physical therapy assistants) were conducted in skilled nursing facilities (SNFs) throughout Los Angeles County. Purposive sampling ensured SNFs covering all key characteristics known to impact care delivery were included. Focus groups elicited providers' perspectives of best practices for hip fracture rehabilitation. Sessions were audio-recorded and transcribed. Rooted in a grounded theory approach, a systematic analysis of the transcripts was conducted to identify major themes and sub-themes using Atlas-ti. Results: Secondary to different practice cultures and organizational structures, interdisciplinary care collaboration strategies varied across SNFs. Bottom-up strategies included speaking face-to-face with nursing staff; directly training individual Certified Nursing Assistants (CNAs); and collaboration with assessments. Top-down organizational strategies included providing group in-services; an interdisciplinary "stand-up" meeting; written communication supports using a 24-hour nursing log; and electronic charting. Facilities that didn't emphasize collaboration expressed a lack of support or follow through from nursing staff. Conclusion: Rehabilitation providers use various combinations of verbal and written communication to ensure continuity of care and critical components include both bottom-up and top-down strategies. Failure to collaborate may impede the quality of care.

Poster #: 99

Title: Mindfulness in Rehabilitation: A Scoping Review  
Name: Mark Hardison  
Faculty Advisor: Shawn Roll

Background: Mindfulness is used to help patients focus nonjudgmentally on the experience of the present moment which improves health-related outcomes such as pain and anxiety. Because mindfulness interventions are theoretically compatible with the holistic approach of occupational therapy (OT), there is an emerging literature suggesting a use for mindfulness in OT practice. Purpose: A scoping review was conducted to describe how mindfulness is used in rehabilitative contexts for body-related disorders, identify the potential applicability to occupational therapy, and illuminate gaps in the current research. Methods: PubMed, CINAHL, SPORTDiscus, and PsycINFO were searched using the terms "therapeutics, rehabilitation, or alternative medicine" and "mindfulness". Abstracts were screened and full text manuscripts read for eligibility by 2 reviewers. Articles were included if they described clinical applications of mindfulness interventions for body-related disorders, had relevance to rehabilitation in occupational therapy, and were provided in a rehabilitative context. Results: The search produced 1524 original abstracts, of which 188 articles were read in full, and 16 were included. Included articles showed preliminary support for the use of mindfulness interventions for physical dysfunction most consistently having resolved pain and improved adaptation to illness. Studies were generally cohort design without control. Only one intervention used an OT as the primary intervener. Conclusion: Mindfulness may be a useful

tool for rehabilitation providers, yet the level of evidence remains low for the translation of these interventions to the setting of OT. More research is warranted to evaluate the utility and efficacy of mindfulness interventions provided by OTs for body-related disorders.

Poster #: 100

Title: Qualitative Synthesis of Narrative Research in Spinal Cord Injury Rehabilitation  
Name: Carol Haywood  
Faculty Advisor: Mary Lawlor

Background: A ubiquitous challenge in rehabilitation and disability research is rooted in the methods by which experiences are defined. With quantitative measures dominating the gold standards of rehabilitation research, individuals' feelings, functions, and experiences are typically outlined in uniform surveys or assessment scales. By default, this means that a person is limited to reporting only within the range of values provided. Purpose: The purpose of this review was to examine narrative research on the lived experiences of individuals with a spinal cord injury (SCI) in order to determine how the existing body of qualitative research can inform rehabilitation practices for this population. Methods: A qualitative synthesis was performed using modified versions of the methods outlined by Thomas and Harden (2008) and Walsh and Downe (2005). The methods were divided into four stages: (1) framing and initiating the literature search with ongoing appraisal of findings, (2) categorical and thematic analysis of individual studies, (3) translation of themes among studies, and (4) development of meta themes. Thirty-eight articles with an analysis of narrative data from SCI survivors were reviewed. Results: The synthesis of these publications generated strong evidence for implications of SCIs, which extended beyond traditional models of rehabilitative care to affect identity and engagement in daily life. Though individual experiences after a SCI vary, this synthesis revealed the potential of a SCI to significantly shift one's position, perspectives, and priorities in life. Conclusion: The collection of narratives and overarching themes illustrate the value of narrative data for research and intervention development for individuals with a SCI.

Poster #: 101

Title: Visualization and Quantification of Corticothalamic Somatotopies in Humans  
Name: Emily Kilroy  
Faculty Advisor: Lisa Aziz-Zadeh

Background: The primate motor-thalamic pathways are somatotopically organized, beginning in precentral motor cell bodies and maintained in the axons as they project and terminate on ventral thalamic neurons. The medial-lateral organization of this somatotopy within the thalamus has been well described in non-human primate studies (Nambu, 2011; Vitek, 1994) but has yet to be visualized in human populations in vivo. To address this we used atlas-based fiber tractography on diffusion spectrum imaging (DSI) data to quantify the organization of white matter projections connecting precentral motor areas with the thalamus in humans. Purpose: The purpose of this study is to visualize the somatotopy of the motor-thalamic pathway in vivo humans. Methods: Diffusion spectrum imaging was performed on sixty neurologically healthy participants

(31 female) on a 3T Siemens Verio 3T Scanner. A twice-refocused spin-echo EPI sequence acquired 51 slices in 257 directions (FoV = 231 x 231, voxel size = 2.4 x 2.4 x 2.4, max-b value 5000 s/mm<sup>2</sup> TR = 9,916 ms, TE = 157 ms). All images were processed using a q-space diffeomorphic reconstruction method described by Yeh & Tseng (2011). A group averaged template atlas, the CMU-60, was then produced by averaging the spin distribution function in each voxel across all subjects. This provides a composite map of the underlying voxelwise diffusion structure that can be independently analyzed as a representation map of normative white matter pathways. Deterministic fiber tractography was performed between the precentral gyrus (pass through ROI), including lateral aspects of the central sulcus, and the thalamus (endpoint ROI). A principle component analysis was performed along the precentral gyrus ROI to identify the direction of the spatial distribution of the fiber endpoints along the precentral gyrus (z axis). Multivariate ordinary least squares regression model was then used to estimate how moving along the precentral gyrus shifted a fiber direction in the thalamus (coronal plane) represented as a vector from lower to upper extremity representations. Rayleigh's statistic for circular data (Berens, 2009) was performed to measure vector direction against a null hypothesis of a uniform circular distribution. In order to get a sense of how consistent these shifts are observed across subjects, we performed the same analysis on each individual subject in the data set. Results: In congruence with histological studies, we observed motor-thalamic projections ending in the ventrolateral and ventromedial aspects of the thalamus. A consistent somatotopic organization of the motor-thalamic projections was detected across all subjects such that streamlines starting in ventrolateral aspects of the precentral gyrus (upper extremities) terminated more medially within the thalamus than streamlines originating in the doromedial precentral gyrus (lower extremities). As a fiber's position moved down the cortical somatotopy, from dorsal to ventral positions along the gyrus, there was a consistent lateral-to-medial shift in the thalamus. In the left hemisphere this shift also included a slightly dorsal tilt, while in the right hemisphere there was a slight ventral bias to the shift. There was substantial variability in the vectors across subjects; however, a Rayleigh's test found that the overall population vector was consistently oriented in a lateral-to-medial direction in both the left (z = 6.39, p < 0.001) and right (z = 11.56, p < 0.002) hemispheres. Conclusion: These findings are highly consistent with previous ex vivo neuroanatomical work in primates and demonstrates how atlas-based tractography can provide a reliable quantitative mapping of microstructural topographies in human corticothalamic pathways.

Poster #: 102

Title: Rehabilitation Techniques for Chemotherapy-Related Cognitive Dysfunction  
Name: Alix Sleight  
Faculty Advisor: Florence Clark

Background: Chemotherapy-related cognitive dysfunction (CRCDD) impacts memory, attention, concentration, language, multitasking, and organizational skills and decreases participation and quality of life for cancer survivors. Occupational therapists and

other rehabilitation professionals can address symptoms of CRCDD through evidence-based interventions. Purpose: To identify and summarize the literature on rehabilitation interventions and coping techniques for CRCDD in cancer survivors. Methods: A scoping review of articles cited in PubMed, MEDLINE, PsycINFO, and CINAHL was performed. To be included, articles must have been published in a peer-reviewed scientific journal between 1996 and 2014, written in English, and included a quantitative or qualitative nonpharmacological study of interventions and/or coping strategies for adult cancer survivors experiencing CRCDD. Results: Ten articles met the inclusion criteria for final review. Six studies tested the efficacy of rehabilitation treatments on CRCDD. Three involved cognitive behavioral therapy (CBT), while three tested neuropsychological and/or cognitive training interventions. Four qualitative studies investigated coping strategies used by survivors with CRCDD. Conclusion: CBT-based treatments and neuropsychological/cognitive training methods may ameliorate symptoms of CRCDD. The most commonly-reported coping strategy is utilization of assistive technology and memory aids. Further research is needed about efficacious rehabilitation techniques for this population.

Poster #: 103

Title: Role of Occupational Therapy in Oncology Care  
Name: Alix Sleight  
Faculty Advisor: Florence Clark

Background: Cancer survivorship is on the rise. 1.6 million adults and over 80,000 adolescents, young adults, and children are diagnosed with cancer in the United States each year. During cancer treatment and survivorship, individuals may experience fatigue, pain, weakness, cognitive deficits, anxiety, depression, and adjustment to new roles and routines, among other difficulties. Purpose: To identify and summarize the literature regarding past, current, and future roles of occupational therapy (OT) in oncology. Methods: A scoping review of articles published in PubMed was performed. Inclusion criteria were: published in a peer-reviewed scientific journal between 1990 and 2015, written in English, and included key words "occupational therapy" and "cancer" or "oncology". Results: Eighty articles met the criteria for final review. The majority of studies were quantitative, followed by guidelines for practice and then qualitative articles. Breast cancer was the most commonly represented single diagnosis (n=19). Twenty-seven of the 80 total articles (34%) included studies or review articles with direct implications for OT; however, of these articles, only nine specifically examined the efficacy of OT interventions. Additionally, only 19% (n=15) of articles were published in OT journals, and in 23% of articles (n=18), occupational and physical therapy were grouped together as one undifferentiated intervention. Conclusion: OTs are well-situated to address the myriad issues experienced by the oncology population. However, there is currently a dearth of research focusing on the unique role of OT interventions in cancer care. Without strong evidence to inform and support practice, OT interventions may be underutilized. OT researchers and practitioners must take action to support involvement in oncology.

Poster #: 104

Title: Enhancing Quality of Life for Individuals with Dementia

Name: Carin Wong

Faculty Advisor: Natalie Leland

**Background:** The management of negative behavioral symptoms among residents with dementia is a challenge that nursing homes face in delivering quality care. Traditional medication-based treatments have resulted in adverse patient outcomes. Thus, there is a growing interest in non-pharmacological approaches to promote the quality of life among these nursing home residents. **Purpose:** Examine non-pharmacological interventions targeting negative behaviors among residents with dementia in nursing homes in an effort to increase their quality of life. **Methods:** A scoping review of intervention studies was conducted and included articles published from 1987 to 2014, written in English, published in peer-reviewed journals, measured negative behavioral symptoms as a primary patient outcome, and included a sample of nursing home residents 60 years of age or older diagnosed with dementia. Five hundred forty-two articles were initially reviewed by title and abstract, resulting in 96 articles, of which 75 full text articles were then obtained and reviewed to meet the inclusion and exclusion criteria. The final sample of 22 articles was charted and summarized. **Results:** Twenty-two studies addressed interventions targeting negative behavioral symptoms in older adults with dementia residing in nursing homes. Four types of interventions were identified: occupation-based interventions (n=14), context and environment interventions (n=5), exercise interventions (n=2), and daily routine-based interventions (n=1). **Conclusion:** These findings suggest that non-pharmacological interventions can reduce negative behavioral symptoms for older adults with dementia residing in nursing homes. There is a need for future research to examine interventions that integrate the four types of non-pharmacological interventions.



Poster #: 105

Title: Potential Risk Factors for Craniosynostosis

Name: Nicole Arieh

Faculty Advisor: Yang Chai

**Background:** Craniosynostosis is the premature closure of one or more of the cranial vault sutures, which are fibrous connections between adjacent skull bones. Approximately 1 in every 2000 to 3000 infants are affected by craniosynostosis.

Early surgical treatment is necessary to prevent further deformations as well as to avoid hearing loss, developmental deficits, and the effects of pressure on the brain. **Purpose:** To create an animal model to study craniosynostosis and the different factors that may regulate craniosynostosis. **Methods:** A transgenic approach was used to permanently label Gli1-positive cells and track their fate. We then analyzed the Gli1-positive cells after suture transplants and mimicked injury to determine the role of Gli1-positive cells in injury repair. In addition, DTA was used to deplete Gli1-positive cells and the phenotypes of the sutures in the mouse model were analyzed. We reduced Gli1-positive cells in *Twist1*<sup>-/-</sup> mutant mice and performed phenotypic and genotypic analysis as well as uCT imaging. **Results:** Our group recently described that the neurovascular bundle serves as a niche for Gli1-positive mesenchymal stem cells (MSCs) in the mouse incisor. We further discovered that MSCs in the cranial sutures are Gli1-positive and that loss of these cells results in suture fusion. We hypothesized that transplanting healthy MSCs into synostotic sutures in a mouse model of craniosynostosis (*Twist1*<sup>-/-</sup>) could restore suture patency. **Conclusion:** *Twist1*<sup>-/-</sup> mice exhibit craniosynostosis. Plans for the future will be to further study *Twist1* as a regulator of craniosynostosis as well as other possible risk factors.

Poster #: 106

Title: Gingival Mesenchymal Stem Cell (GMSC) Based Treatment Modality for Peri-implantitis

Name: Daniel Chee

Faculty Advisor: Alireza Moshaverinia

**Background:** Peri-implantitis is one of the most common inflammatory complications in dental implantology. Similar to periodontitis, in peri-implantitis, destructive inflammatory changes take place in the tissues surrounding a dental implant. Bacterial flora at the failing implant sites consists of Gram-negative anaerobic bacteria including *Actinobacillus actinomycetemcomitans* (Aa), which resemble the pathogens in periodontal disease. **Purpose:** We demonstrate the effectiveness of silver lactate (SL) containing RGD-coupled alginate hydrogel scaffolds as a promising stem cell delivery vehicle with antimicrobial properties. **Methods:** Gingival mesenchymal stem cells (GMSCs) and human bone marrow mesenchymal stem cells (hBMMSCs) as the positive control were encapsulated in SL-loaded alginate hydrogel microspheres and stem cell viability, proliferation, and osteo-differentiation abilities were analyzed. **Results:** Our results showed that SL exhibited antimicrobial properties against *Aggregatibacter actinomycetemcomitans* (Aa) in a dose-dependent manner with 0.50 mg/ml showing the greatest antimicrobial properties and cell viability. At this concentration, SL-containing alginate hydrogel was able to inhibit Aa growth on the surface of Ti discs and significantly reduced the bacterial load in Aa suspensions. Silver was effectively released from the SL-loaded alginate microspheres for up to 4 weeks. GMSCs and hBMMSCs encapsulated in the SL-loaded alginate microspheres were able to differentiate into osteoblast-like cells, as confirmed by the intense mineral matrix deposition and high expression of osteogenesis related genes. **Conclusion:** Altogether, our findings confirmed that GMSCs encapsulated in RGD-modified alginate hydrogel containing

silver lactate is a promising candidate for bone tissue engineering with antimicrobial properties against Aa bacteria in vitro.

Poster #: 107

Title: Bisphosphonate Uptake in Areas of Tooth Extraction or Periapical Disease

Name: Simon Cheong

Faculty Advisor: Sotirios Tetradis

**Background:** Medication-related osteonecrosis of the jaws (ONJ) is a serious complication of treatment with antiresorptive agents, affecting patients with cancer or metabolic bone disease. ONJ lesions mainly occur after extraction of teeth deemed unrestorable or around teeth with active periodontal or periapical disease. A puzzling question is the nearly exclusive selection of the disease for the jaws, although the remaining skeleton appears to be spared. **Purpose:** Various hypotheses have been proposed to explain the jaw predilection to osteonecrosis in the presence of BPs. Among them, increased bone turnover of the jaws compared with the remaining skeleton and oversuppression of bone turnover suggest a preferential uptake of BPs to the maxilla and mandible. Because socket healing or dental disease shows higher bone turnover, the authors hypothesized that preferentially high BP accumulation would be observed in these areas. **Methods:** Maxillary molars were extracted or the crowns of mandibular molars were drilled to induce pulp exposure. Animals were injected with fluorescein-labeled zoledronic acid (5-FAMZOL) 200 mg/kg at various times after intervention and fluorescence was measured at healthy versus intervention sites. Fluorescence imaging at 520-nm wavelength and 25-ms exposure was performed. Data were analyzed by t test and mixed effects linear models were constructed. **Results:** A statistically significant, time-dependent uptake of 5-FAM-ZOL was detected in the areas of extraction socket and in the alveolar ridge around teeth with periapical disease compared with the healthy contralateral sites of the same animals. **Conclusion:** These data suggest that sites with increased bone turnover, such as extraction sites or areas of periapical inflammation, are exposed to higher BP doses than the remaining alveolar ridge and could explain, at least in part, the susceptibility of such areas to ONJ.

Poster #: 108

Title: A New Perspective on Gnathology and Occlusion Using Numeric Simulation

Name: Raymond Cheung

Faculty Advisor: Pascal Magne

**Background:** The finite element method (FEM) is a sophisticated tool to demonstrate the effect occlusion on stress distribution in teeth restorations. **Purpose:** Using the FEM, this study investigated stress peaks on a maxillary first molar occlusal veneer subjected to clenching (MIP), working (W) and nonworking (NW) movements by the antagonistic molar. **Methods:** Maxillary and mandibular first molars were digitized with a micro-CT scanner. The 2D images were converted into a 3D model using Mimics software. Standard triangle language files of enamel and dentin surfaces were exported into 3-Matic software to optimize meshing operations. Finite element models were then created using Marc/Mentat mechanical simulation software. The starting position for each load case was close to MIP. The models

were subjected to nonlinear contact analysis to simulate occlusal loading of 500N total force from the antagonist first molar directed axially (clenching) and from the working and non-working side. Major principal values of stresses were recorded and stress peaks compared. **Results:** Highest stresses were observed with the simulated NW interference, followed by the working contacts and the clenching in MIP. For NW, stress peaks concentrated along the central groove, oblique ridge and LDG. The same pattern was found in W but including the BDG instead of LDG. No such tensile forces were found during clenching. **Conclusion:** The present numerical simulation reveals clearly the harmful effect of occlusal interferences in term of tensile stress within the restorations and occlusal topography.

Poster #: 109

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 laboratory 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 1x10<sup>5</sup> 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 hematoxylin and eosin histology 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 #: 110

Title: Three-dimensional Analysis of the Innervation of the Developing Palate

Name: Behzad Danesh-Panahi and Helia Jafari

Faculty Advisor: Yang Chai

**Background:** Cleft palate is one of the most common malformations in humans and requires complex interdisciplinary care. Therefore, prevention is the ultimate objective and this will be facilitated by a complete understanding of the normal formation of the palate. **Purpose:** It is known that nerves contribute to the regulation of patterning and



cell differentiation in diverse organs. However, the function of the nerves in different aspects of palatogenesis is yet to be elucidated. As a first step, we present here a three dimensional description of the anatomy of the nerve in the palatal shelves at a key developmental stage. Methods: Heads of wild type mouse embryos at developmental stage E13.5 were sectioned coronally. Immunostaining using an antibody to beta3-tubulin was performed on sections using conventional methods to detect mature neurons. The 3D reconstruction of the trigeminal nerve was carried out using the software BioVis 3D. Results: In this study we generated a three-dimensional anatomical image of the innervation of the palatal shelves. We confirmed previous observations showing that nerves are restricted to the oral region of the palatal shelves and in close relationship with the rugae. In addition, we also observe an interesting pattern along the anterior-posterior axis. Hard palate and soft palate are innervated by different branches of the trigeminal nerve, which might be related to the different tissues composing these two structures. Conclusion: Understanding the anatomic structure and position of the nerve in the palatal shelves is the first step to elucidate its functions during development. Based on our 3D reconstruction and other data not shown here, it is tempting to speculate that the nerve controls the oral-nasal and anterior posterior pattern of the palatal mesenchyme as well as the epithelium, particularly the rugae.

**Poster #: 111**

Title: Epigenetic Control of Mesenchymal Stem Cells in the 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. This repressive mark is removed by KDM6A. EZH2 and KDM6A 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 and Kdm6a 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 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 #: 112**

Title: Zebrafish Transgenesis with Human Enhancer-reporters Identify Lineage Restricted CNCC subpopulations  
Name: Eddie Karabidian  
Faculty Advisor: Ruchi Bajpai

Background: The neural crest cells (NCC) are a transient, multipotent, migratory cell population that gives rise to distinctive craniofacial structures depending on their site of origin in the neural tube, paths they follow for migration and final destination. Although common features of NCC have been extensively studied distinguishing features among NCC subtypes are not well known. Purpose: Enhancers are tissue specific gene regulatory elements. They are DNA sequences that typically have binding sites for several different activators and repressors. They allow spatiotemporal control of gene expression. Identifying lineage-restricted enhancers will be important for understanding development of diverse craniofacial structures and generating specific cells for tissue repair. Methods: Our hypothesis is that human neural crest enhancers, identified in our lab using enhancer specific histone modifications, will show lineage restricted expression domains in an embryonic context. We generated several stable transgenic zebrafish carrying a human enhancers tagged with green fluorescent protein (GFP) by to12 mediated transgenesis. The onset and pattern of expression of each enhancer line was analyzed with respect to known NCC markers at various developmental stages and imaged using fluorescent stereomicroscope or a confocal microscope. Results: I discovered that different human NCC enhancer constructs express GFP in distinctive patterns on the craniofacial region of zebrafish embryos. We identify enhancers that are activated in discrete regions of the neural tube that contribute to NCC in specific arches, reveal alternate migratory routes followed by NCC emerging from the same part of the neural tube and NCC that give rise to specific structures in the developing face. Conclusion: We will utilize these enhancer-reporter lines to study the effects of craniofacial disease associated genes by Crisper-cas9 based knockout strategy.

**Poster #: 113**

Title: Generation of Human Neural Crest Cells for Cell Replacement Therapy  
Name: Tiffany Lee  
Faculty Advisor: Ruchi Bajpai

Background: In vertebrates, the dorsal aspect of the diencephalon-telencephalon- boundary (DTB) and diencephalon express WNT8B, marking a restricted region of the developing neural tube. Within the neural tube these cells go on to generate the hippocampus, the center for memory and learning. The cells migrating out from this region form the anterior-most neural crest, which migrates supraorbital and contributes to the developing cranial mesenchyme covering the forebrain and midbrain. In vitro generation of human neural crest cells destined to form cranial mesenchyme has the potential to understand craniofacial development and utilize them for cell replacement therapy. Purpose: The goal of this research is to generate human DTB-specific neuroectodermal cells and follow their differentiation into region restricted neural crest cells using a human WNT8B enhancer identified in our lab. Methods: Using immunofluorescopy for GFP and

Wnt-8b, human stem cell lines carrying a WNT8B enhancer driven green fluorescent protein (GFP) reporter were characterized and the specificity of the WNT8B-GFP reporter was assessed. Endogenous WNT8 expression patterns in chick neural tube and human neurospheres were compared, and DTB-derived neural crest cells were purified. Results: Several human embryonic stem cell lines with Wnt-8b-GFP were generated. The pluripotent cells were differentiated into neuroectoderm, and GFP-positive cells were analyzed during the differentiation time course. Conclusion: Similar to the embryonic developmental pattern of WNT8B, the enhancer we identified is not active in human pluripotent cells or early neuroectoderm derivatives, but turns on in cells representing the DTB and diencephalon.



**Poster #: 114**

Title: Antifungal Activity of Quercetin on *Candida albicans* Biofilm  
Name: Meng Lin  
Faculty Advisor: Ramiro Murata

Background: *Candida albicans* is a fungal pathogen that is responsible for candidiasis. Flavonoids have been demonstrated to have antifungal effects on various biofilms in many studies, and research has indicated Quercetin in systematic health. Purpose: To study the effect of Quercetin on *Candida albicans* biofilm. Methods: *C. albicans* (ATCC 14053) biofilm were grown in 24-well plates with Difco Yeast Mold (YM) medium, incubated at 37°C, 5% CO<sub>2</sub>. The medium was changed daily. On Day 2, treatments of Quercetin, 250µM and 500µM soluble concentrations, were given twice a day. Fluconazole and solutions with 1% DMSO (v/v) will served as positive and vehicle controls respectively. Treatments continued onto Day 5, when data were collected, then analyzed for colony forming units (CFU/ml) and insoluble polysaccharide. Biofilms were plated for colony counting and insoluble polysaccharide analysis. Results: In comparison to vehicle group and positive control with 86.957% decrease of insoluble polysaccharide, Quercetin at 250µM and 500µM concentrations showed decrease 91.926% and 85.093%, respectively. However, both concentrations presented 42.857% decrease in CFU, while the positive control showed 85.714% decrease. Conclusion: Our data suggest that Quercetin disrupt the extracellular matrix and displays antifungal activity.

**Poster #: 115**

Title: Flavonoid Antifungal Effects on *C. albicans* and Host Transduction Pathways  
Name: Chris Patuwo  
Faculty Advisor: Ramiro Murata

Background: Oral candidiasis is the most common fungal infection in humans and has shown increased resistance to traditional

antifungal drugs. Extracellular proteinases, secreted aspartyl proteinase (SAP) and phospholipase B (PLB), are key determinants mediating pathogenicity and suitable targets in drug development. Purpose: Flavonoids, myricetin and quercetin, show activity against *Candida albicans* (CA) and provide promising candidates for therapeutics. These studies aimed to determine the antifungal activity of myricetin and quercetin and to elucidate their mechanisms by investigating the expression and secretion of CA virulence factors and host cell inflammatory cytokines. Methods: Minimum inhibitory concentrations (MIC) were determined after 24h by adding serial dilutions of myricetin (0.7-70µM) and quercetin (4.5-45µM). Fluconazole and solutions with 1% DMSO served as positive and vehicle controls respectively. Co-culture of *C. albicans* (ATCC: MYA 2876) at 2.5x10<sup>3</sup> cells/mL and fibroblasts (ATCC: CRL2014) at 1.0x10<sup>5</sup> cells/mL were cultured in EMEM-medium, 10% FBS, treated with myricetin and quercetin (1xMIC) at 37°C, 5% CO<sub>2</sub> for 24h and harvested and evaluated for (n=9): A) Cell/Fungal viability; B) Extracellular host inflammatory cytokines (ELISA for IL-1α, IL-1β, IL-6, IL-8, IL-10, and GSM-CSF); c) host gene expression of inflammatory response; D) *C. albicans* gene expression for SAP and PLB; e) SAP and PLB activity and f) Architecture analyses by fluorescence microscopy. Results: Myricetin and quercetin inhibit *C. albicans* growth and an MIC was established as 30µM and 25µM respectively. The compounds decreased secretion of pro-inflammatory cytokines (p<0.05), while increasing secretion of anti-inflammatory cytokines. In addition, the treatment decreased host expression of these cytokines and CA expression and activity of virulence factors, SAP1 and PLB-1 (p<0.05). The compounds also markedly altered the density and architecture of the fungal colonies. Conclusion: Myricetin and quercetin demonstrate their therapeutic potential, not only through inhibition of fungal growth and virulence, but also in modulating the host inflammatory responses.

**Poster #: 116**

Title: The Antifungal Activity of Geraniol Against *Candida albicans*  
Name: Stephanie Ting  
Faculty Advisor: Ramiro Murata

Background: Oral candidiasis is a significant opportunistic infection that often presents as a complication in people with immunodeficiency. The infection is conventionally managed with antifungals such as fluconazole. However, there is a recent increase in oral candidiasis that is resistant to these current drugs. This necessitates the search for novel therapeutics. Purpose: The aim of this in vitro study was to test the antimicrobial activity of the geraniol against *C. albicans* as well as its toxicity to oral fibroblasts. Methods: The minimum inhibitory concentration (MIC) of geraniol was determined according to NCCLS guidelines. *C. albicans* at 2.5x10<sup>3</sup> cells/mL was cultured in RPMI-medium at 37°C in 5% CO<sub>2</sub> for 24 hours and inoculated with geraniol (5 - 20mM). Fluconazole and solutions with sterile milli-Q water served as positive and vehicle controls respectively. The MIC was determined after 24 hours. The candida cell suspensions were plated on agar and incubated overnight at 37°C. Colony

forming units were counted after 24 hours. Growth of colonies indicated that geraniol was fungistatic at that concentration. No growth indicated that geraniol was fungicidal at that concentration, which is the minimum fungicidal concentration (MFC). Cytotoxicity assays were performed on fibroblasts treated with geraniol at concentrations 5-20mM. Toxicity was evaluated using fluorometric quantification of cellular viability. Results: Geraniol inhibits *C. albicans* growth and an MIC was established between 8mM and 11mM. The MFC was determined to be 17mM. At the concentrations tested, geraniol was not toxic to oral fibroblasts. Conclusion: Geraniol has an inhibitory and fungicidal effect on *C. albicans* growth. There is no toxicity of geraniol at the tested concentrations.

Poster #: 117

Title: Effects of Adhesive Incorporated with Antibacterial Agents against *S. mutans* Biofilm  
Name: Nichole Tomblin  
Faculty Advisor: Ramiro Murata

Background: Dental caries is the most prevalent oral infectious disease in the world. It is usually treated by removal and replacement of infected tooth tissues with restorative materials, including adhesively bonded resin composites. Most restorations fail within 5-7 years due to development of secondary caries. By incorporating antibacterial agents into an adhesive system we hope to increase the resistance of composite restorations against secondary caries and enhance the durability of such restorations. Drugs investigated include epigallocatechin gallate, myricetin, and tt-farnesol. Their minimal inhibitory concentrations (MIC) and minimal bactericidal concentration (MBC) will be investigated, followed by being incorporated into scotchbond adhesive. Purpose: To evaluate the antimicrobial activity of natural compounds against *Streptococcus mutans* and further evaluate its success of disrupting the biofilm once incorporated with universal adhesive system. Methods: The effects of epigallocatechin gallate, myricetin and tt-farnesol on *S. mutans* UA159, their minimal inhibitory concentration - MIC and minimal bactericidal concentration - MBC were determined. 100x, 500x and 1000x MIC of the drugs were mixed with scotchbond adhesive. Scotchbond adhesive served as negative control. The adhesive was light cured onto polymerized composite discs and placed in brain-heart infusion (BHI) broth containing 1% sucrose for 5 days with *S. mutans* incubated at 37°C in 5% CO<sub>2</sub>. BHI media was changed daily. Biofilms (n=12) were harvested on Day 3 and Day 5. Samples were diluted and plated for colony-forming unit (CFU) to determine biofilm viability. Biofilm samples were also collected and prepared for insoluble (ASP/IPS) and soluble glucans analysis. Results: In MIC and MBC investigation, myricetin and epigallocatechin gallate did not demonstrate significant antimicrobial activity. For tt-farnesol, showed in vitro antibacterial activity, at 150µM. After tt-farnesol was incorporated into the Scotchbond to be tested for effectiveness against *S. mutans* biofilm. Initial trials have shown that both 150µM and 75mM both show biofilms have been reduced to 76%, while 150mM has shown biofilms being reduced to 2% as compared to control groups. Conclusion: Among the drugs, tt-farnesol

is the only drug that disrupts biofilm. Once mixed with the adhesive, it most effectively disrupts biofilm at the 150mM.

Poster #: 118

Title: MicroCT Analysis of Mouse Models in Mandible & Maxilla Development  
Name: Stefan Vila  
Faculty Advisor: Yang Chai

Background: Mutant mouse models can be used to mimic human facial malformations such as cleft palate. These models contribute to the understanding of the regulatory mechanisms of facial bone development with the hope of developing therapeutic methods in order to prevent and rescue congenital birth defects. Purpose: To analyze abnormal development of the mandible and maxilla using quantitative methods in order to further investigate the role of Tgfb and Msx1 in craniofacial morphogenesis. Methods: Three wild type and mutant (*Tgfb2<sup>+/+</sup>;Wnt1-Cre* & *Msx1<sup>-/-</sup>*) mice for each genotype were generated at three different ages (E16.5;E18.5;P0), imaged using microCT (Scanco V1.28) with a resolution of 10 µm and reconstructed in 3D using Avizo 7.0 software. Mandibles and maxillae were labeled on each scan and volumetric comparison was carried out between wild type and mutants. Results: We found the volumes of mutant *Tgfb2<sup>+/+</sup>;Wnt1-Cre* mandibles and maxillae are significantly reduced in comparison to wild type mice at E16.5, E18.5 and P0. The volumes of mutant *Msx1<sup>-/-</sup>* mandibles are reduced at E16.5 but not at E18.5 or P0. The volumes of *Msx1<sup>-/-</sup>* maxillae are significantly reduced in comparison to wild type mice at E16.5 but relatively unchanged at E18.5 and P0. Conclusion: Our data indicates that these models can be used to study the development of facial bone malformations. Further studies are needed to understand the mechanisms underlying the facial bone malformations in these models.

Poster #: 119

Title: Antifungal Activity of Pinocimbrin against *Candida albicans*  
Name: Keane Young  
Faculty Advisor: Ramiro Murata

Background: Oral candidiasis is an opportunistic infection that often presents as a complication to existing conditions. The infection is conventionally managed with antifungals such as nystatin and fluconazole; however, there is a recent increase in candidiasis that is resistant to these current drugs. Flavonoids are natural products commonly found in plants that have shown to have biological activity against *Candida albicans*. Purpose: The objective of this in vitro study was to test the antifungal activity of the flavonoid Pinocimbrin against *C. albicans*. Methods: *C. albicans* (ATCC: 90028) at 2.5 x 10<sup>3</sup> cells/ml was cultured in RPMI-medium at 37°C in 5% CO<sub>2</sub> for 24 hours (n=9) according to NCLLS guidelines. The minimal inhibitory concentration - MIC of Pinocimbrin were determined by testing a range from diluting 0.5 µM - 500 µM. Fluconazole (3 µM) and solutions with 1% DMSO served as positive and vehicle controls respectively. The MIC was determined after 24h. Results: Pinocimbrin showed inhibition against *C. albicans* growth and an MIC was established between 100 µM-150 µM. Conclusion: Pinocimbrin shows inhibitory effects on fungal growth.



Poster #: 120

Title: Biofilms in Restorative Dentistry  
Name: Daniel Chee  
Faculty Advisor: Alireza Moshaverinia

Background: One of the main contributing factors to the progression of dental caries and periodontal diseases is the formation and presence of dental bacterial biofilms. During the preparation of indirect restorations, tooth structure is exposed to the oral microbiota, resulting in the adsorption of salivary biopolymers that form the pellicle. During restorative procedures, the initial exposure of the tooth surface to the oral environment may range from a few minutes to a few hours. This, together with leakage under the restorations, may allow the development of the biofilm to a level where it could either result in cementation failure or recurrent caries under the definitive restoration. Purpose: This clinical report describes the structure and characteristics of the biofilm formed under a cemented restoration, confirming the need to develop new cementation protocols to disrupt and minimize the formation of biofilm before cementing definitive restorations. Methods: A second right mandibular molar was chosen to investigate the structure and characteristics of the biofilm under a cemented restoration. After months of permanent cementation, the tooth was extracted and evaluated with confocal laser scanning and scanning electron microscopy. Fluorescence in situ hybridization (FISH) was used for the identification of biofilm bacteria. CLSM analysis was utilized to confirm the presence of bacteria at the occlusal interface. Moreover, SEM was used to identify the morphology of bacteria in the biofilm. Results: Fluorescence in situ hybridization technique confirmed biofilm growth in the interface between the restoration and the tooth structure. The results of CLSM analysis with immunofluorescence staining also confirmed the presence of biofilm at the occlusal interface between the tooth and the restoration. The results of SEM analysis agreed with CLSM and showed the presence of a biofilm layer at the interface between the tooth and the cemented crown. SEM images confirmed the presence of 2 distinct strata within the biofilm: the inner layer, which is the calcified part of the biofilm and the outer layer, which is less calcified and is the growing part of the biofilm. SEM analysis showed the presence of bacteria with coccus-like morphological structure inside the biofilm layer. Conclusion: The presence of biofilm at different areas of the teeth may help to explain why restorations fail either due to recurrent decay or failure of cementation, as the biofilms can contaminate

cementation protocols. Based on these observations, we suggest the development of new and thorough cementation protocols to disrupt and eliminate biofilms before the cementation of definitive restorations.

Poster #: 121

Title: Unusual Cyst Like Lesion in a Teenager Treated Using Antibiotics  
Name: Moshe Eizdi  
Faculty Advisor: Parish Sedghizadeh

Background: In the clinical management of periapical radiolucencies, it is difficult to ascertain whether there is active infection, a bone cavity or cyst, or just acute inflammation. Theoretically, definitive diagnosis could only be achieved by surgical access to the bony site with biopsy and culture. However, surgery is not always possible clinically, especially when the radiolucency is diffused over several teeth. This is the first time a case report shows healing of a large cyst-like periapical lesion without local intervention. This case report serves as a useful baseline for future treatments of periapical lesions. Purpose: To assess and treat large cyst-like periapical lesions via a non-interventional systemic antibiotic therapy rather than surgical removal or invasive endodontic therapy. Methods: A 12-year old boy presents to the clinic with a chief complaint of pain in the left anterior maxilla upon mastication. Patient had a recent history of trauma to his left maxillary incisors. A complete head and neck, intraoral and radiographic examination reveals tender swelling of the buccal gingiva in the, and a radiolucency (cyst-like) around teeth #9 and #10. Periodontal probing, vitality testing, percussion and palpation tests were completed. An incision and drainage was performed in the area of the buccal swelling. Antibiotic was prescribed (amoxicillin 250 mg three times a day every eight hours) for a two-week course. Patient presents for a re-evaluation during a one, six and a twelve weeks follow-up. Results: Using a scheduled antibiotics regimen we significantly reduced patient's pain in the above area. More importantly patient's swelling was gone with no further pain on percussion or palpation. In addition, the periapical cyst like radiolucency around teeth #9 and #10 was resolved with evidence of radiographic bone fill. Conclusion: Non-invasive antibiotic therapy alone was successful in healing large bone cyst-like in this teenager. By using a local regimen of Amoxicillin, we were able to avoid any future surgeries such as periapical surgery, which may damage adjacent tooth structure and even possibly devitalize neighboring tooth structure. As long as we know, this is the first time a case report shows healing of a large cyst-like periapical lesion without local intervention.

Poster #: 122

Title: Comfort of Senior Dental Students with Pediatric Dentistry Upon Graduation.  
Name: Nora Ghodousi  
Faculty Advisor: Julie Jenks

Background: A written survey was administered to senior dental students when signed out of pediatric dentistry. Survey results are being utilized to improve the undergraduate pediatric dentistry training. Purpose: The purpose of this study is to determine the comfort level of senior dental students with pediatric dentistry upon graduation. The survey seeks information of pediatric dentistry training including



dental examinations, treatment planning, dental prophylaxis, and operative treatment. Methods: Comparison groups include Male vs female; Mobile clinic vs non-Mobile clinic involved students, students applying for advanced education in pediatric dentistry vs students not applying for advanced education in Pediatric Dentistry, Pediatric Study Club vs non-Pediatric Study club involved students, Pediatric selective vs non-Pediatric selective students, and students involved in community service vs students not involved in community service are analyzed. Results: The response rate for the survey is 92%. Students participating in Community Health Center rotations, Pediatric selective, Pediatric Study Club, and AYUDA feel more comfortable providing initial dental exams and treatment planning. Pediatric selective and students involved in Pediatric Study Club feel more comfortable providing dental prophylaxis and fluoride treatments. Students that volunteer in the USC Pediatric Clinic, Pediatric selective, Pediatric Study Club, and AYUDA feel more comfortable performing operative dental procedures. Conclusion: Students involved in Pediatric Study Club, Pediatric selective AYUDA, and Community Health rotations feel more comfortable treating Pediatric patients. Students noted Mobile Clinic rotation and the Junior USC Pediatric Clinic rotation as helpful experiences in their overall undergraduate pediatric dentistry training. This information will aid in administering future undergraduate Pediatric Dentistry training.

#### Poster #: 123

Title: Dissolution of Endodontic Files via Novel Electrochemical Process: Systematic Review  
Name: Rajan Gupta

Background: Retrieval of broken files have always been a challenge. Current techniques present some limitations related to canal morphology, reduction of root strength, and operator ability. Purpose: Our aim is to review a new concept of retrieval of fractured instruments from root canals based on an electrochemical process. Methods: The novel concept of retrieval of fractured instruments by an electrochemical process is based on dissolution of metal alloy in aqueous environments, and it requires the existence of 2 electrodes and an electrolyte. The electrolyte might have a composition that varies according to the metal to be dissolved; it is essential that the metal has susceptibility for dissolution in it. Therefore, once the introduced cathode an inert metal, the transfer of electrons from the broken metal file to be dissolved to the cathode tends to occur which increases if potential difference is applied. In-vitro Studies were performed to determine the cytotoxic effects of the dissolved products on periodontium and apical bone. Recent studies tried to determine dissolution using different file system Results: Current studies were performed using Ni-Ti files, whereas cyclic fatigue separation failure is more common with stainless steel files. Conclusion: This technique seems quite promising in the coming future. Efficiency under clinically acceptable time for an endodontic re-treatments has been overlooked in the current literature. There is a need for studies focusing on alteration in the diameter of the broken files in order to engage the smallest file for faster removal. Nevertheless, further in-vitro and in-vivo studies are necessary to develop and improvise this novel technique.

#### Poster #: 124

Title: Dental Related Incidents at the Emergency Department at USC (2011-2013)  
Name: Ankit Keshav, Omar Kholaki  
Faculty Advisor: Ramon Roges

Background: Sports dentistry at USC is the health interface used not only in the treatment and prevention of traumatic oral/facial injuries, but is also the preventive dental health care interface for the treatment of oral disease and health. Purpose: The purpose of this retrospective study was to investigate the relative dental and oral maxillofacial trauma incident rates for athletes in the various scholarship sports at USC that have sustain dental related trauma and dental emergency needs. Methods: Retrospective non-identified patient data for USC student athletics sports dentistry patients was collected from 2011 to the 2013. Total patient visits for trauma, emergency dentistry were obtained to define a relationship of sports trauma injury or dental emergency without trauma for the various sports at USC. Results: The basketball sports dentistry trauma treatment rate was highest for all sports evaluated with 35 incidents for 31 athletes for the two year period. The football trauma rate was less with 50 trauma incidents for 114 athletes. However, the severity of football related incidents appeared higher with diagnosed concussion, TMJ injury, and orofacial lacerations. The baseball dental trauma incident rate was 5 incidents for 35 athletes and included maxillary fracture, laceration and dental avulsion, and dental fracture. Conclusion: Calculation and oversight of trauma incident rates in conjunction with injury severity information provides administrative information to both the coaching and training staffs for athlete supervision. Trusted dental professionals play an important role in the competitive athletic environment, providing important protective devices and treatment as required and requested.



#### Poster #: 125

Title: Dental Anxiety and Dental Treatment among Adults in Dental School  
Name: Yagnik Patel

Background: Dental anxiety is a state in which a person is apprehensive about an upcoming dental procedure that is experienced by up to 20% of the dental treatment seeking population. Dental anxiety appears to differ by type of treatment. For example, higher levels of anxiety have been reported among patients undergoing extraction and root canal treatment procedures as compared to other dental procedures. Periodontic and endodontic patients report higher levels of anxiety than patients receiving diagnostic or prophylactic treatment, periodontal treatment has been identified as the most anxiety provoking procedure followed by root canal, extraction and orthodontic procedures. Mostly, these population-based studies were

done outside United States. Few studies examining the prevalence and correlates of dental anxiety have been conducted in the States; off those that have been conducted, they were done in the 1900's. To understand the construct of dental anxiety better, the study aimed to determine whether dental anxiety was associated with dental treatment types (Diagnostic and Preventive, Restorative and Rehabilitative, and Surgical), along with answering the limitations of earlier studies. This study aimed to test the hypothesis that dental anxiety is more prevalent among patients who have received a higher number of surgical procedures than in patients receiving other types of procedures. Purpose: Primary Aim: To examine the association between dental treatment type with dental anxiety among those who received treatment at Temple University Dental School adjusting for covariates. Secondary Aim: To examine whether Oral Health Related Quality of Life and Blood-Injury-Injection Phobia moderates the relationship between dental treatment type and dental anxiety. Methods: A cross-sectional study using existing clinical data of individuals aged between 18-75 years old (N=98), who visited the Temple University Kornberg School of Dentistry (TUKSoD) for treatment during the year 2011-2012 was conducted. Patients were recruited through the ongoing flow of patients, including new patients through axiUm, the electronic scheduling program, referral from area dental professionals, community research and advertisements. A random-digit-dialing method was used to contact the participants. Eligible participants were fluent in spoken and written English, interested in dental treatment and provided written informed consent for the study. Temple's Institutional Review Board reviewed and approved the study. Results: Half of the sample were African-American (50%, N= 49), 54 % (N=53) were female. The prevalence of high, medium and low level of dental anxiety was 21% (N=21), 49% (N=48), and 30% (N=29) respectively. A significant association between dental anxiety and the diagnostic and preventive treatment was observed (F= 3.241, p=.043). Increasing age (OR= 1.057; p=.043), poor Oral Health Related Quality of Life (OHRQoL) (OR= 1.063; p=.035), and fear to Blood-Injection-Injury (B-I-I) (OR=1.165, p=0.01) were significantly associated with high anxiety. Conclusion: Findings from this study indicate that diagnostic and preventive treatment type is associated with low anxiety. Gender, Low income, Age, OHRQoL and B-I-I phobia influence the level of anxiety among adult dental patients. Dental anxiety is a significant determinant of regular dental visits. This findings could further our understanding of individuals presenting with symptoms of anxiety during a dental visit. The dental profession along with the public health department should consider this factors in planning programs to improve the access to dental care services alleviating dental anxiety, as well as programs comprising of anxiety coping training for dental professional.

#### Poster #: 126

Title: Association between Vit D and Gingival Inflammation in Pregnant Women  
Name: Vivek Singh

Background: 1,25 Dihydroxyvitamin D3 was shown to inhibit antigen induced T cell proliferation and cytokine production. There has been evidence of the beneficial role of Vit D for various autoimmune disease in animal

studies. However, there is scarcity of evidence for the anti-inflammatory effect of vitamin D from clinical studies in humans. Also the range serum concentration of vitamin D [25(OH)D] exhibiting anti-inflammatory effects in human is still obscure. Few studies have suggested the beneficial role of Vit D for periodontal disease due to anti-inflammatory effect. Marginal gingivitis could be a useful model to evaluate the anti-inflammatory effect of Vit D. The association of Vit D with gingivitis has not yet been investigated in pregnant females. The purpose of this study is to evaluate the anti-inflammatory effect of Vit D in pregnant females by modeling the association between serum concentration of 25-hydroxyvitamin D and gingival inflammation. Purpose: To find the association between serum concentrations of 25-hydroxyvitamin D and gingival inflammation in a cohort of pregnant women. Hypothesis: There is a positive Association between serum concentrations of 25-hydroxyvitamin D and gingival inflammation in a cohort of pregnant women. Methods: A longitudinal study of a cohort of women from a RCT of vitamin D supplementation during pregnancy. Descriptive statistics generated for gingival inflammation by 25(OH)D status. Bivariate analysis conducted at both the person and tooth site levels. Multivariable regression models were developed for gingival inflammation at the site level using 25(OH)D as the explanatory factor after controlling for other potentially important factors. These other potential predictors included age and dental cleaning during pregnancy. For these potential predictors, bivariate associations with gingival inflammation at visit 2 and visit 10 were assessed using simple regression for prevalence (% of women with gingival inflammation) and Spearman correlations for counts data (%sites BOP) at the person levels (not site level). Those variables that were significant as alpha=0.05 were used in stepwise selection multivariable models, and the final model included variables that were jointly significant at alpha = 0.05, plus 25(OH)D. Generalized estimating equation models (GEE) were used for binary outcomes (y/no), and negative binomial GEE models for count outcome(% site BOP) All statistical tests were conducted using SAS 9.1 for Windows with p values below 0.05 considered as statistically significant. Results: The study depicts : a.) clinically significant inverse relationship between 25OHD and gingival inflammation b.) clinically and statistically significant higher concentrations of 25OHD in whites compared to blacks c.) clinically and statistically significant positive relationship between 25OHD and age d.) levels around 67nmol/ml could be the clinically significant dose of vitamin D where optimal anti-inflammatory activity is seen. Conclusion: The result of the present study shows that there is an inverse relationship between gingivitis and Vit D, after adjusting for age/race/ethnicity/sex, as an example of its anti-inflammatory effect. This relationship is stronger at Visit 10 than at Visit 2. By quintile of 25(OH)D, the women in the highest quintile had approximately 28% and 57% lower proportion of periodontal sites with bleeding on probing (BOP), compared to lowest quintile at Visit 2 and Visit 10 respectively. Further analyses are ongoing. Higher serum 25(OH)D concentration may reduce the gingival inflammation in pregnant women.





Poster #: 127

Title: Novel Extraction Socket Devices for Ridge Preservation

Name: Neema Bakhshalian

Faculty Advisor: Homa Zadeh

Background: Tooth extraction initiates a cascade of events resulting in ridge atrophy. Ridge preservation (RP) strategies have been utilized to reduce the magnitude of remodeling. To address some of the challenges in RP, pre-formed devices have been developed to seal extraction sockets, named SocketKAP and to provide support to sockets with dehiscence, named SocketKAGE. Purpose: To evaluate the efficacy of the pre-formed devices, SocketKAP and SocketKAGE, in addressing the challenges in RP by sealing the extraction sockets and providing support to sockets with dehiscence. Methods: Fifty-nine sockets were divided into following groups: A) untreated control, B) closed with SocketKAP, C) filled with anorganic bovine bone (ABBM) and closed with SocketKAP, D) untreated dehiscence control, E) dehiscence treated with ABBM, SocketKAGE and SocketKAP. Pre-operative CBCTs were obtained followed by digital-subtraction of the test teeth and then merged with pre-operative scanned cast images, allowing measurements of volumetric ridge contour following tooth extraction. Results: All the groups showed significant reduction of ridge contour and alveolar bone especially in the crestal 3mm with over 90% contour reduction in the control group. SocketKAP alone significantly reduced the amount of contour reduction in the crestal 3mm by 22% while SocketKAP plus ABBM significantly reduced the amount of alveolar bone and ridge contour reduction by 45 and 34%, respectively. In sites with dehiscence, the treatment significantly reduced the alveolar bone and ridge contour reduction in the crestal 3mm by 34 and 18%, respectively. Conclusion: SocketKAP without grafting reduced remodeling of the crestal 3mm of ridge contour while ABBM plus SocketKAP reduced loss of the crestal 6mm of ridge contour for intact sockets. ABBM+SocketKAGE+SocketKAP reduced atrophy of the crestal 3mm of alveolar bone for sockets with dehiscence.

Poster #: 128

Title: Amelogenin-Chitosan Hydrogel for Enamel Regrowth: An In Vitro pH-Cycling Study

Name: Ruha Bapat

Faculty Advisor: Janet Oldak

Background: We recently reported that amelogenin-chitosan (CS-AMEL) hydrogel promotes in vitro biomimetic enamel

regrowth, with a dense enamel-restoration interface improving the effectiveness and durability of restorations. Purpose: To examine the stability and efficacy of CS-AMEL hydrogel for biomimetic repair of human enamel with erosive or caries-like lesions in a pH-cycling system, and to explore its potential for the prevention, restoration, and treatment of defective enamel. Methods: Tooth slices were etched with 30% phosphoric acid for 30 seconds to produce erosive lesions and were placed in demineralization solution (pH 4.6 at 37°C) for 3 days to produce white spot lesions. The samples were subjected to pH cycling by placing the samples in demineralization solution for 5 hours followed by remineralization solution (pH 7) for 18 hours for 7 days at 37°C. Twenty  $\mu$ l of CS-AMEL hydrogel was applied on the lesion surface before and after demineralization periods. The newly-grown crystals were characterized by scanning electron microscopy and X-ray diffraction. Results: After pH cycling, a synthetic layer of oriented apatite crystals was formed on enamel surfaces treated with CS-AMEL hydrogel in both the erosion and caries models. On the erosive lesion surfaces, the newly-grown crystals had a needle-like shape and were arranged parallel to each other. The depth of the caries lesion was significantly decreased from  $\sim 100 \mu$ m to  $\sim 50 \mu$ m following treatment with the CS-AMEL hydrogel in a pH-cycling system. Conclusion: Our results demonstrate that the CS-AMEL hydrogel is stable in an acidic environment and is effective in restoring erosive and carious lesions.

Poster #: 129

Title: *Malva sylvestris* Activity in Cells Infected by *Aggregatibacter actinomycetemcomitans*

Name: Bruna Benso

Faculty Advisor: Ramiro Murata

Background: The current treatment of inflammatory disease is focused on controlling cytokine and adhesion molecule expression. Natural products have been played an important role in the development of new drugs. Purpose: The objective of this study is to investigate *Malva sylvestris* extract and fractions activity in a coculture model of cells infected by *Aggregatibacter actinomycetemcomitans* DS7-1. Methods: *Malva sylvestris* extract (EEM) was obtained by exhaustive maceration and liquid-liquid partition was conducted to obtain the fractions. All samples were monitored by high performance liquid chromatography (HPLC). An antimicrobial effect of the EEM and fractions was investigated using a transwell inserts and toxicity was evaluated using fluorometric quantification of cellular viability. *A. actinomycetemcomitans* ( $1 \times 10^6$  CFU/mL) was inoculated on Day 2 and the medium with the microorganism was added to the insert, passing through the upper layer of cells (OBA-9) and reaching the bottom cell layer (HGF-1). 75  $\mu$ g/mL of EEM and fractions was added and incubated at 37°C for 24 hours. After 24h supernatant was collected and 12 inflammatory cytokines were determined by ELISA assays (Multi-Analyte ELISA Array - Qiagen). Gene expression of inflammatory response in Quantitative Real-Time PCR was performed (RT<sup>2</sup> Profiler PCR Arrays; Inflammation Cytokines & Receptors). All statistical analysis was performed using GraphPad Prism version 5.00 (GraphPad Software, San Diego,

CA). Values of  $p < 0.05$  were considered significant. Results: Results showed that the treatment with EEM, chloroform and aqueous fractions were effectively controlling cytokines and regulating some key genes related to the inflammation process. IL-6 and IL-8 were genes under expressed comparing to the vehicle control and significantly less expressed less releasing of cytokines in Elisa array ( $p < 0.05$ ). Conclusion: These data suggest the anti-inflammatory activity of EEM and fractions and the putative pathway may involve the downregulation of chemokine receptor; however, more studies are needed to further elucidate the mechanism of action.

Poster #: 130

Title: Evaluation of Antimicrobial Activity of Curcumin on *Candida albicans*

Name: Emily Chen

Faculty Advisor: Ramiro Murata

Background: *Candida albicans* is an opportunistic human fungal pathogen that has presented increased antimicrobial resistance, emphasizing the need for a new and more effective treatment. Secreted aspartyl proteinase (SAP) and phospholipase B (PLB) are key virulence factors that contribute to the pathogenicity of *C. albicans*, and could be essential to the discovery of new treatments. Natural polyphenols, like curcumin, can be an attractive solution because of their various pharmacological activities including antioxidant, anti-inflammatory, antiviral, and antibacterial activities. Purpose: The objective of this project is to determine the antimicrobial activity of curcumin on *C. albicans*. Methods: The antimicrobial activity of curcumin (1.5625-400  $\mu$ M) was tested in vitro against *C. albicans* (ATCC: SC5314/MYA2876,  $5 \times 10^3$  to  $2.5 \times 10^3$  CFU/mL grown in RPMI 1640 at 37 °C in 5% CO<sub>2</sub>) to determine the minimum inhibitory concentration (MIC). It was compared to the vehicle control (1% DMSO), and positive control (Fluconazole). Cytotoxicity assays were performed on fibroblast cells (ATCC: CRL2014,  $1 \times 10^5$  cell/mL grown in DMEM/10% FBS at 37 °C in 5% CO<sub>2</sub>) treated with 1.5-640  $\mu$ M curcumin. Cell viability and morphological characteristics were observed by fluorometric method and microscope. The SAP and PLB activity after treatment at 10x and 20x MIC was observed. Results: The MIC of curcumin on *C. albicans* was 12.5  $\mu$ M. The percentage of viable fibroblast cells decreased as concentration of curcumin was increased. The treatment decreased the activity of virulence factors SAP-1 and PLB-1. Conclusion: Curcumin exhibits therapeutic potential through its inhibition of fungal growth and virulence factors, and its nontoxic qualities.

Poster #: 131

Title: Soft Palate Development in Mouse: A Comprehensive Study

Name: Alexandre Grimaldi

Faculty Advisor: Yang Chai

Background: Cleft palate is one of the most common birth defects, and over the last decades tremendous efforts have been made towards understanding hard palate development. However, little is known about soft palate muscle morphogenesis and tissue-tissue interactions guiding it. Appropriate surgical repair to restore physiological functions of the soft palate in patients with cleft palate is a current challenge

for surgeons, and complete restoration is rarely achievable. Purpose: First, our study focuses on describing the murine soft palate morphology, the orientations and attachments of all 4 muscles and comparing them with the human anatomy. Then we highlight the development of soft palate muscles in mice, in relation to the surrounding mesenchyme, tendons, nerves, and vasculature. Methods: We performed dissections, histochemistry and immunohistochemistry on mouse embryos, newborns and adults and recreated a 3D model of the murine soft palate. Results: First, we found that the morphology, orientation and attachment of the mouse soft palate is very similar to human, validating the use of the murine model for future studies. Then our data suggests that the Tensor Veli Palatini (TVP) and Palatoglossus (PLG), but not the Levator Veli Palatini (LVP) or Palatopharyngeus (PLP), express differentiation markers (Myosin Heavy Chain) before fusion of the palatal shelves. Moreover, the differentiation of the LVP and PLP occurs from the middle portions to the lateral portions, suggesting that a pool of undifferentiated myoblasts is required in the middle of the LVP and PLP during fusion. Innervation was detected in the oral side of the soft palate and in the TVP and PLG before fusion. Conclusion: Taken together, our results give a comprehensive view of the development and morphology of the murine soft palate, setting the stage for further molecular analyses. We are currently investigating how cleft palate affects the formation of the soft palate muscles using different mutant mouse models.

Poster #: 132

Title: FaceBase 2.0: A Resource for the

Craniofacial Research Community

Name: Thach-Vu Ho

Faculty Advisor: Yang Chai

Background: The Facebase consortium consists of 11 interlinked projects selected by the National Institute of Dental and Craniofacial Research (NIDCR) to generate genetics and imaging data on craniofacial development. Craniofacial abnormalities account for half of all congenital malformations. The etiology of orofacial clefts, the most common craniofacial abnormalities, remains unknown for many patients and the phenotypes vary considerably. 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;Tgfb $\beta$ 2<sup>fl/fl</sup>*, *Wnt1-Cre;Alk5<sup>fl/fl</sup>*, *Msx1<sup>-/-</sup>*, and littermate control mice were generated at different embryonic stages, E13.5 to E18.5, and post-natal P0. All mutant strains were maintained in a C57BL/6J background. Results: We generated 65 micro-CT scans of mutants and littermate controls. Microarray and gene expression analyses are currently being performed for each of the genotyped strains to allow the craniofacial research community access to comprehensive physical, molecular, and genetic data analysis. Conclusion: The goal of FaceBase Consortium is to develop a resource for the craniofacial research community, with a focus on mid-face development and orofacial

clefts. The availability of a wide variety of data from different craniofacial models via the Facebase Consortium allows the craniofacial research community to study the development of the mid-face region and the molecular mechanisms underlying craniofacial abnormalities.

Poster #: 133

Title: Differences in Prescription Medications and Supplements Used in Geriatric Patients  
Name: Thin Sandar Khine  
Faculty Advisor: Reyes Enciso

Background: Eighty percent of people 65 years of age and older have one or more chronic medical conditions. Drug therapy is often key to their medical management. Greater consumption of prescription and over-the-counter medications in this population puts them at higher risk for medication-related problems. Purpose: To understand differences in number of medications and supplements taken by patients by age and gender. Methods: Over 300 charts of older adults were reviewed for demographics (age, gender). All medications and supplements were charted and the most common of those were calculated for each age category and gender. Results: Among 388 patients (58.2% females), the five most common medications in the 65-74 years old and the 75-84 were anti-hypertensives, cardiovascular drugs, anti-cholesterol, pain relief and gastrointestinal agents; in the 85+ the most common were anti-hypertensives, cardiovascular, pain relief, anti-Alzheimer's and anti-cholesterol medications. The five most common supplements were Vitamins (n=157), Minerals (n=84), Fish oil (n=22), Potassium supplements (n=21) and Ferrous sulfate (n=15). The median number of medications increased with age from 4.0 (65-74yo), to 5.0 (75-84), to 6.0 (85+). Females were taking significantly more prescribed medications than males (5.0 vs. 4.0; p=.002). Conclusion: The five most common medications were very similar in all age ranges, except in the 85+ years old where anti-Alzheimer's medications were part of the five most common. The two most prevalent prescription medications in all patients were anti-hypertensives and cardiovascular drugs.

Poster #: 134

Title: Collapsing Maxillary Segments Before Grafting in Patients with Missing Premaxilla  
Name: Min Kyeong Lee  
Faculty Advisor: Stephen Yen

Background: In some patients with bilateral cleft lip and palate (BCLP), the premaxilla may be congenitally absent or surgically removed at an early age. When lateral segments are expanded, a void that extends from canine to canine can be created. Since large clefts require greater amount of bone, vascular supply, and soft tissue, alveolar bone grafting following expansion is challenging. Past attempts to restore the missing premaxilla using cortical and cancellous bone had limited success. Free fibula grafting offered an alternative treatment option, with the disadvantage of donor site morbidity. A third option which eliminates the surgical challenge of bone grafting is placement of a dental prosthesis between mobile, ungrafted lateral segments. Purpose: In this study, we present a novel alternative approach to restore archform in patients with missing

premaxilla: 1) collapse lateral segments, 2) graft alveolar bone at the reduced cleft site, and 3) restore archform by surgically assisted rapid palatal expansion (SARPE). The goal of approximating lateral segments is to create adequate soft tissue for a surgical flap which facilitates not only the closure of oral antral fistulae, but also the subsequent bone graft. Methods: Two patients with a diagnosis of BCLP who were missing the premaxilla were identified as candidates for the collapse-graft-expansion protocol. Lateral segments were collapsed using power chains across maxillary canines, reducing alveolar cleft size. Iliac crest bone graft was performed to fill the cleft. Occlusal radiographs were taken at least 3 months following graft. When bony continuity was established, the collapsed arch form was re-established using archwire or SARPE. Results: In both patients, constricting lateral segments prior to bone grafting eliminated the need for additional soft and hard tissues and allowed the employment of a graft procedure similar to that of conventional autogenous bone grafts. As in other bone graft procedures performed on patients with cleft lip and palate, a potential complication of the novel collapse-graft-expansion protocol is the introduction of scarring that may interfere with maxillary growth. Subsequent orthognathic surgery may correct part or all of the deficiency. Patients who underwent the collapse-graft-expansion protocol will be followed to monitor long-term outcomes and any other complications. Conclusion: Collapsing lateral segments to facilitate bone grafting followed by expansion may serve as a new model for restoring large cleft defects. This method may be a viable option for surgical teams in remote areas without orthodontic support.

Poster #: 135

Title: Culture Constraints Induce Epigenomic and Genomic Instability in Pluripotent Stem Cells  
Name: Annie Lynch  
Faculty Advisor: Ruchi Bajpai

Background: Human pluripotent stem cells (hPSCs) are vital to biomedical research and regenerative medicine. Long term propagation and exponential amplification of undifferentiated and karyotypically normal hPSCs is imperative to successful manipulation of these cells and for their use in future cell replacement therapies. However, discrepancies arise on passaging or stable proliferation of hPSCs and have been attributed to methods of passaging. While enzymatic passaging allows efficient scaling up over manual dissection of individual colonies, recent research has indicated that enzymatic passaging may be responsible for chromosome instability. In contrast, others have described a similar enzymatic technique as a 'golden method' for stem cell amplification. This study aims to determine the underlying cause of the reported genomic instability in enzymatically passaged pluripotent stem cells. Purpose: In 1800's, Thomas Malthus, in his studies of population dynamics suggested that if population expansion did not go hand in hand with expansion of food and space resources, limiting resource conditions result in a population crash, where only a few survive. This idea was extended by Darwin suggesting constraints induce genetic variations. We are testing the idea that culture constraints induce genomic instability in PSC's. Methods: We have treated PSC's

as a population and determined the optimal carrying capacity of the culture conditions. We then passaged cells under permissive and constrained conditions and tracked the morphology, karyotype, differentiation-potential and ensuing DNA damage/repair. We also estimated plating efficiencies and growth rates of enzymatically passaged cells. Results: We found that manual or enzymatic passaging does not induce karyotypic changes upon long term culturing. Our results indicate that enzymatic passaging improves re-plating efficiency and allows exponential growth of PSC's. Conclusion: Since human PSC's are not contact inhibited but matrix associated, the rapid growth of the population results in nutritional deprivation and space constraints. Thus, inducing first differentiation, then epigenomic variation and finally genomic instability.

Poster #: 136

Title: Attitudes, Behaviors, and Needs of Team Dentists  
Name: Lesley McGovern  
Faculty Advisor: Ann Eshenaur Spolarich

Background: Elite athletes strive to attain superior levels of health and fitness; however, many have high levels of oral disease. Dental pain and dysfunction could alter level of performance during practice and competition. Many dentists work with sports organizations, but knowledge about their scope of practice and needs were unknown. Purpose: The purpose of this study was to gather baseline data about practice behaviors, attitudes, and needs of team dentists, and to identify if/ how often oral screenings were conducted on athletes, and barriers to implementing regular oral screening programs. Methods: An online survey was developed and pilot-tested, and IRB approval obtained. Dentist members of the Academy for Sports Dentistry (n=491) were invited to participate. Data collected included league affiliation, services provided, and type of oral screenings performed. Dentists' attitudes regarding athletes' treatment and preventive needs, practice behaviors, and self-identified needs were assessed. Descriptive statistics were used to analyze data. Results: Results revealed 79.5% (n=116) of team dentists had a league affiliation. The most frequently provided services were emergency treatment and mouthguards (95.5%), restorative treatment (78.5%), oral hygiene instruction (63%), and prophylaxis (61%). Of the 80% (n=90) of dentists who perform oral screenings, 41% (n=36) screen all athletes prior to the season with individualized follow-up examinations. The most commonly cited barrier to screenings was lack of awareness of the importance of oral health. Conclusion: Although the majority of team dentists do perform oral screenings, a lack of awareness about oral health importance supports the need for improved educational strategies.

Poster #: 137

Title: Treatment-plan Model for Hypodontia in Craniofacial Patients  
Name: Prarthit Mehta  
Faculty Advisor: Stephen Yen

Background: Congenital Hypodontia occurs in 77% patients with cleft lip and palate, 50% with cleft palate, 33.3 % with Treacher Collins syndrome and 27% with hemifacial microsomia. Given a much higher prevalence of hypodontia in craniofacial than non-craniofacial patients,

a treatment plan model for hypodontia is needed for both growing and non-growing patients. Purpose: To provide a decision making tree for hypodontia treatment options. Methods: Using patients from the craniofacial team at Children's Hospital Los Angeles, this project describes a case series that illustrates the decision making tree and the outcomes of treatment. The first factor considered is age; the second factor is the number of missing teeth; the third factor is vertical dimension; the fourth factor is functional occlusion and the fifth factor is anatomy of supporting tissue. Results: Factor 1: Treatment is age-specific as growing patients require a temporary solution such as a retainer or lingual arch with teeth when the jaw dimensions can change whereas adult patients need a permanent solution that could include implants, crowns, bridges and partial dentures. Hybrid solutions include Maryland bridges using microdonts for support and torque control, acrylic temporary bridges built over a metal framework. Factor 2 and 4 : The number of missing teeth is balanced against the need for a functional occlusion and esthetics as some teeth may not need to be replaced if there is no functional or esthetic gain. Factor 3: The loss of vertical dimension may require more crown height and a surgical, prosthodontic or orthodontic treatment plan. Factor 5: The fifth factor evaluates the alveolar ridge and soft tissue to determine whether surgery is needed to restore and replace hard or soft tissue as a method for replacing missing dimensions to the tissue. Conclusion: Multidisciplinary approaches involving orthodontics, oral surgery, periodontics and prosthodontics are needed to provide an array of solutions for the growing and non-growing craniofacial patient with hypodontia.

Poster #: 138

Title: AMOR in the Reconstruction of Alveolar Ridge Defects  
Name: Seiko Min  
Faculty Advisor: Homa Zadeh

Background: Surgical reconstruction of large mandibular defects remains a challenge for clinicians. Techniques using autogenous grafts have been considered as the gold standard. However, these procedures have several disadvantages such as donor site morbidity and limited availability. The application of recombinant human bone morphogenetic protein (rhBMP)-2 in oral and maxillofacial surgery has been proposed as an alternative to autogenous bone harvesting. Despite the promising prospect, there are a number of disadvantages with the application of BMPs, including (i) the requirement for super-physiologic doses (ii) inability to sustain local levels of growth factor, (iii) lower efficacy of recombinant protein and (iv) high cost. A novel tissue engineering strategy has been developed in our laboratory to take advantage of the specificity and diversity of monoclonal antibodies (mAbs). A chimeric anti-BMP-2 mAb has been generated and immobilized on a scaffold to capture endogenous BMPs, inducing osteogenic differentiation of mesenchymal stem cells and accelerate bone regeneration. This process has been referred to as Antibody Mediated Osseous Regeneration (AMOR). The advantages of AMOR include: (i) endogenous BMP-2 is captured by antibodies (ii) the temporal and spatial process of osteogenesis is orchestrated by expression of endogenous BMP-2 and



(iii) increased bioavailability and half-life of captured BMP-2. In recent studies conducted by our research group, we have investigated the ability of specific anti-BMP-2 antibodies to mediate AMOR in vivo, using the rat calvarial defect model. Purpose: The aims of the present study were to: 1) Examine the efficacy of AMOR in conjunction with two novel devices, namely socket cap used for obturation of socket orifice and socket cage, used for provision of space in sites with facial dehiscence for ridge preservation and augmentation procedures following tooth extraction. Methods: Six young adult male Macaca fascicularis monkeys were used for dehiscence defect models. First premolar was extracted in each monkey followed by the removal of the facial plates using a surgical bur to create dehiscence defects. Experimental group received chimeric anti-BMP-2 mAb immobilized on absorbable collagen sponge (ACS) with or without socket cap and socket cage. The control group was treated similarly, where instead of specific mAb, isotype-matched control mAb was used. Animals underwent serial cone beam computed tomography (CBCT) at 6 and 12 weeks for linear measurement of bone width and height at different point as well as bone volume at different level. Histologic observations and histomorphometric analysis were also performed. Results: Quantitative and qualitative assessment in all studies revealed significantly increased bone volume and greater remaining alveolar bone width and height within sites implanted with socket cage, anti-BMP-2 mAb and protected with socket cap, compared with control sites. Histomorphometric analysis showed significant greater in bone formation within the dehiscence defect site than control site. Histology observation also revealed active bone formation within dehiscence defect area in experimental group. Conclusion: The results of the various craniofacial defect models have demonstrated the efficacy of a novel tissue engineering approach utilizing anti-BMP-2 mAb in conjunction with specific devices designed to maintain the alveolar contour and protect graft material.



Poster #: 139  
Title: *WNT8B* Enhancer Activation Marks Hippocampal Precursor Cells  
Name: Jennifer Oki  
Faculty Advisor: Ruchi Bajpai

Background: Enhancers are regions of the genome where protein complexes assemble; they provide the on-off switch for gene expression. Tissue specific control is critical for embryogenesis because timing and localization of gene expression is paramount in development when cells need to frequently change characteristics. This research studies an enhancer activated in precursor hippocampal cells. The hippocampus is the region of the brain associated with memory and learning. A

shrunken hippocampus is one of the pathology hallmarks in Alzheimer's disease. Purpose: This research will be useful for stem cell replacement therapy for patients with a deteriorated hippocampus and it will provide a tissue culture model for generating hippocampal cells in vitro so all diseases affecting the hippocampus can be easily studied. Methods: We developed a technique to generate and distinguish cells with an activated *WNT8B* enhancer. We established a stable human embryonic stem cell (ESC) line with a *Wnt8b* enhancer-GFP marker using lentivirus mediated transgenesis. Then the ESCs were differentiated toward neurulation, which produces progenitor cells of the central nervous system. In this differentiation environment the ESC become many cell types, and the *WNT8B* enhancer is only activated in a subset that will become hippocampal. Cells with an activated *WNT8B* enhancer can be identified and isolated from the rest. Results: An enhancer of the human *WNT8B* gene is activated in embryonic neural tube cells that will differentiate into hippocampus tissue later in development. This enhancer can be used as a marker to generate a homogenous population of pre-hippocampal cells. Conclusion: Pre-hippocampal tissue will provide a model for studying pathology of Alzheimer's disease in a dish and provide methods for engineering hippocampus cells for stem cell replacement therapy.

Poster #: 140  
Title: MicroCT and Signaling Analysis Reveal Regulatory Mechanisms of Craniofacial Development  
Name: Shery Park  
Faculty Advisor: Yang Chai

Background: Growth factor signaling regulates tissue-tissue interactions to control organogenesis and tissue homeostasis. Specifically, transforming growth factor beta (TGF $\beta$ ) signaling plays a crucial role in the development of cranial neural crest (CNC) cell-derived bone, and loss of *Tgfb2* in CNC cells results in craniofacial skeletal malformations. Our recent studies indicate that non-canonical TGF $\beta$  signaling is activated whereas canonical TGF $\beta$  signaling is compromised in the absence of *Tgfb2* (in *Tgfb2*<sup>fl/fl</sup>; *Wnt1-Cre* mice). A haploinsufficiency of *Tgfb1* (aka *Alk5*) (*Tgfb2*<sup>fl/fl</sup>; *Wnt1-Cre*; *Alk5*<sup>fl/+</sup>) largely rescues craniofacial deformities in *Tgfb2* mutant mice by reducing ectopic non-canonical TGF $\beta$  signaling. However, the relative contributions of canonical and non-canonical TGF $\beta$  signaling in regulating specific craniofacial bone formation remain unclear. Purpose: To define new anatomical landmarks, perform comprehensive morphometric analysis, and analyze 3D microCT images. Methods: We generated 10  $\mu$ m resolution microCT images of E18.5 *Tgfb2*<sup>fl/fl</sup>; *Wnt1-Cre* (R2 CKO), *Tgfb2*<sup>fl/fl</sup>; *Wnt1-Cre*; *Alk5*<sup>fl/+</sup> (R2 CKO; R1+/-), and control mice. Images were reconstructed in 3D using Avizo 7.0 software for Results: We compared the size and volume of CNC-derived craniofacial bones (frontal bone, premaxilla, maxilla, palatine bone, and mandible) from E18.5 control, *Tgfb2*<sup>fl/fl</sup>; *Wnt1-Cre*, and *Tgfb2*<sup>fl/fl</sup>; *Wnt1-Cre*; *Alk5*<sup>fl/+</sup> mice. By analyzing 3D microCT images, we found that different craniofacial bones were restored to different degrees in *Tgfb2*<sup>fl/fl</sup>; *Wnt1-Cre*; *Alk5*<sup>fl/+</sup> mice. Conclusion: Our study provides comprehensive information on anatomical landmarks and the size and volume of each craniofacial bone, as well as insights into the extent that canonical and non-canonical TGF $\beta$  signaling cascades contribute to the formation of each CNC-derived bone.

Poster #: 141  
Title: Assessing Success of Restorations Provided via a Mobile Dental Clinic  
Name: Meha Patel  
Faculty Advisor: Santosh Sundaresan

Background: Mobile dental clinics (MDC) are often used to provide access to children living in rural or underserved areas, as well as migrant communities. There is no available published research on the longevity of restorations provided by mobile dental clinics with students as main providers under the supervision of Faculty. Purpose: To assess success of restorations provided in a MDC. Methods: Dental charts (n=3,086) of patients seen over a six year interval were reviewed and searched for repeat visits. A total of 113 patients attended the MDC twice during this time period and existing restorations were assessed. Results: The mean age of the patients was 9.9 $\pm$ 3.04 years (range 4-18). Overall, 99.1% were Hispanic and 0.1% Caucasian. From 1st visit to 2nd visit, our data shows a significant decrease in deciduous decay (ds) (mean and SD = 3.2 $\pm$ 5.2 vs. 0.9 $\pm$ 2.3, p<.001) and permanent decay (DS) (5.9 $\pm$ 5.9 vs. 3.2 $\pm$ 4.4, p<.001), as well as an increase in permanent fillings (FS) (1.5 $\pm$ 3.0 vs. 5.1 $\pm$ 5.4, p<.001). The success rate (at a mean interval between visits of 14 months) for restorations in the primary and permanent dentition was 82.8% and 84.6%, respectively, comparable to prior published data of 84.4% success in primary dentition with dental students as providers (Bucher 2014) and 86.6% success in permanent dentition in a private practice (Rasines Alcaraz 2014). Reasons for failure included secondary caries, fracture, and restoration loss. Conclusion: MDC's can be effective in providing successful restorative care in the field to children and adolescents at rates similar to that seen in other dental student clinics and private practices.

Poster #: 142  
Title: Effect of Artificial Saliva on Transcriptome of Pro-inflammatory Cytokines/Chemokynes  
Name: Maria Marquezin  
Faculty Advisor: Ramiro Murata

Background: Artificial saliva (AS) is a solution that contains substances that moisten a dry mouth, thus mimicking the role of saliva in lubricating the oral cavity and controlling the existing normal oral microbiota. Purpose: The aim of this study was to determine if components of commercially available artificial saliva are responsible for the proinflammatory response in normal adult human oral fibroblasts (HGF1) as a model in vitro. Methods: 3% concentration of human saliva was used as negative control and the same concentration was used for AS group for 24 hours of exposition. To determine the effects of AS on gene expression, a qRT-PCR array analysis were performed. Gene expression was determined by Qiagen software. Results: The expression of *C3*, *CCL19*, *CXCL1*, *CXCL2*, *CXCL3*, *CXCL5*, *CXCL6* (Regulation of Inflammatory Response), *CCL5* (Chronic Inflammatory Response), *NFKB1* (Humoral Immune Response), *IL6*, *IL8* (Proinflammatory Interleukins) and *IL1RN* (Acute-Phase Response) were downregulated by AS treatments. Conclusion: Our findings demonstrate that the exposure of HGF1 to AS modulate the inflammatory response of these cells when compared to human saliva.

Poster #: 143  
Title: Dosage Dependent Role of *CHD7* During Neural Crest Differentiation  
Name: Kaivalya Shevade  
Faculty Advisor: Ruchi Bajpai

Background: CHARGE is a multiple malformation disorder which involves defects in neural crest derived tissues. It has been shown that mutations of the chromodomain helicase DNA-binding protein gene *CHD7* (a chromatin remodeler) are a major cause for CHARGE syndrome. A lot of phenotypic variation has been observed in CHARGE patients with *CHD7* mutations. *CHD7* was shown to be necessary for neural crest formation. The phenotypic variation observed in CHARGE could be attributed to defects in fate choices that these neural crest cells make during development. These fate choices could in turn be controlled by a chromatin remodeler such as *CHD7*. Purpose: To identify whether phenotypic variation seen in CHARGE syndrome dependent on *CHD7* dose. Methods: We used human embryonic stem cell differentiation to model human neural crest development in a dish. We perturbed *CHD7* gene expression by inducible knockdown using lentivirally expressed shRNA. Immunofluorescence stainings were performed to reveal different cellular states during migration from neuroectodermal spheres in culture. Results: During human neural crest differentiation first delamination takes place followed by mesenchymal transition. We found that *CHD7*; a chromatin remodeler, is essential for this two step differentiation of neural crest. Downregulation of *CHD7* delays delamination and migration of neural crest. We also elucidate that different levels of *CHD7* knockdown result in different cellular identities (neural vs mesenchymal) during differentiation, thereby shedding light on the dosage dependent role of *CHD7* during neural crest differentiation. Conclusion: Neural and mesenchymal fate choices are dependent of the levels of *CHD7* during differentiation. Thus the variation observed in CHARGE due to defects in the neural and mesenchymal differentiation could also be due to varying levels of *CHD7*.

Poster #: 144  
Title: PRMT5 Promotes Epithelial-mesenchymal Transition in Oral Cancer Cells  
Name: Juan Xia  
Faculty Advisor: Jian Xu

Background: Protein arginine methyltransferase 5 (PRMT5) has been implicated in various cancers. Its high expression has been related to cell proliferation, so many labs propose to knocking down PRMT5 as an approach to reduce cell proliferation. Purpose: We tried to determine whether the roles are the same for PRMT5 in cancer proliferation and metastasis. Methods: Westernblot and RNAi methods were used to examine the protein changes of EMT marker. Results: Our results showed that TGF- $\beta$  could induce oral cancer cell EMT. When oral cancer cell line SCC25 was treated with TGF- $\beta$ , the epithelial marker Claudin-1 decreased significantly and the mesenchymal marker vimentin and N-cadherin increased significantly. Knocking down PRMT5 promoted TGF- $\beta$ -induced epithelial-mesenchymal transition (EMT) in oral cancer cell line SCC25, as indicated by the expedited decrease of epithelial marker Claudin-1 protein and increase of mesenchymal marker vimentin and N-cadherin protein. Conclusion: Here we highlighted the importance of PRMT5 expression in the process of epithelial-mesenchymal transition, which might be related to oral cancer metastasis.



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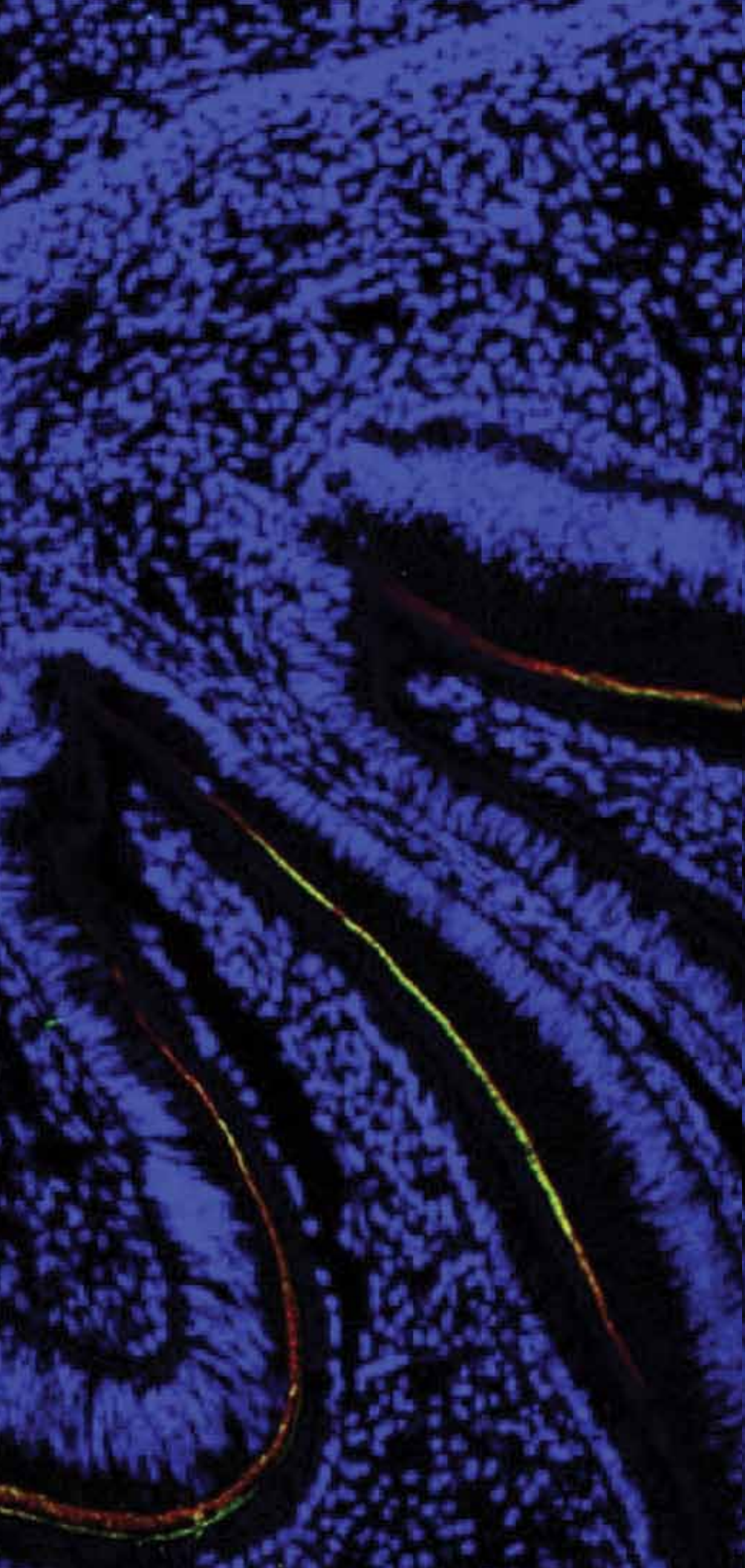
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