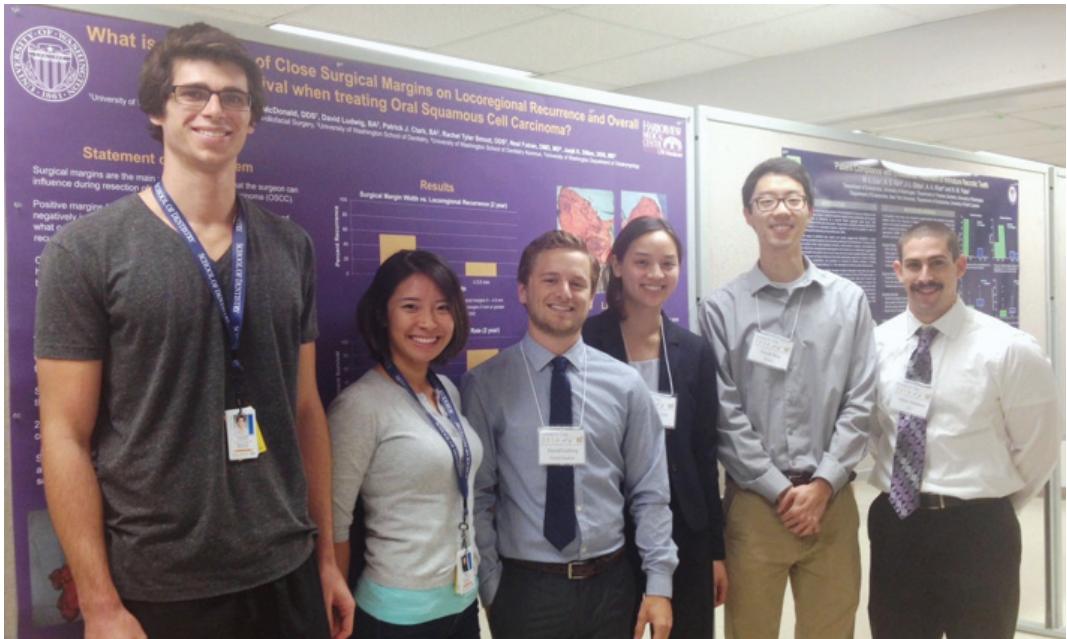


# Research Day

# 2015



UNIVERSITY OF WASHINGTON · SCHOOL OF DENTISTRY



**FRIDAY, SEPTEMBER 25, 2015**

Sponsored by the School of Dentistry Office of Research | 206-543-5599 | [dentres@uw.edu](mailto:dentres@uw.edu)

Research Day Co-Sponsors:

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Seattle Section, American Association for Dental Research

# Research Day

# 2015



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## SCHEDULE OVERVIEW

- 8:15 a.m. WELCOME, HEALTH SCIENCES T-625  
*DR. LINDA LERESCHE, Associate Dean for Research*
- 8:20 a.m. RECOGNITION OF DENTAL STUDENT RESEARCH COMPETITION WINNERS  
*DR. LINDA LERESCHE, Associate Dean for Research*

## ORAL SESSION

- 8:30 – 9:30 a.m. KEYNOTE ADDRESS  
BUDDY D. RATNER, PhD  
*Professor, Department of Bioengineering and  
Department of Chemical Engineering  
Director, UW Engineered Biomaterials (UWEB 21)  
Think Regenerative for Dental and Craniofacial Reconstruction -  
It's Coming!*
- 9:35 – 9:55 a.m. JEFFREY SCOTT MCLEAN, PhD  
*Acting Associate Professor of Periodontics  
Disrupting Microbial Social Networking #Epic\_Oral\_Fail*
- 10:00 – 10:20 a.m. WHASUN "SUN" OH CHUNG, PhD  
*Research Professor of Oral Health Sciences,  
Director of SURF Research Program  
Titanate-Metal Complex: A Novel Antimicrobial Compound  
in the Age of Increasing Bacterial Resistance*
- 10:25 – 10:45 a.m. DONALD CHI, DDS, PhD  
*Associate Professor of Oral Health Sciences  
Xylitol and Dental Caries Prevention in Children: Non-Linearity of  
the T1-T4 Translational Research Process*

## POSTER SESSION

- 11:00 – 12:30 p.m. POSTER SESSION, SOUTH CAMPUS CENTER 316

**R**esearch and Research Training at the University of Washington School of Dentistry are strong in both scope and diversity, covering fields ranging from microbiology and immunology to population and public health research.

For Fiscal Year 2014, the University of Washington ranked twelfth in the nation in the amount of funding received from the National Institute of Dental and Craniofacial Research (NIDCR) (\$4.8 million).

In addition to NIDCR support, the School of Dentistry attracted funding from a variety of other government agencies (National Institute on Drug Abuse, Washington State Department of Health, Health Resources and Services Administration) and non-governmental sources including strong support from private industry, the Hack Estate, the Dr. Douglass L. Morell Dentistry Research Fund, and from alumni of our various programs. In Fiscal Year 2014, UW's School of Dentistry received support from the following awards:



## **FY 2014 GRANTS & CONTRACTS, UW SCHOOL OF DENTISTRY**

### **NIH TRAINING SUPPORT**

- Short-term support for 4 dental students (TL-1)
- Individual Predoctoral NRSA (2)
- Mentored Clinical Science Research Career Development Award (2)
- International Research Training Grant in Epidemiology (1)
- Interdisciplinary Regular Research Training Award (T90) (1)
- Interdisciplinary Research Training Award (R90) (1)

### **FEDERAL RESEARCH SUPPORT**

- Individual Research Awards (2)
- Small Research Grant (1)
- Exploratory/Developmental Grants (1)
- Health Resources and Services Administration (2)

### **OTHER RESEARCH SUPPORT**

- Montana State Department of Health & Human Services (1)
- Public/private colleges, institutions (2)
- Associations, foundations and non-governmental organizations (13)
- Industry sponsored contracts (1)
- Short-term support for 7 dental students and 4 faculty projects (Morell)
- Short-term support for 2 dental students (Dental Alumni)

# KEYNOTE SPEAKER

**THINK REGENERATIVE  
FOR DENTAL AND CRANIOFACIAL  
RECONSTRUCTION – IT'S COMING!**

## **Buddy Ratner PhD**

Director of University of Washington  
Engineered Biomaterials (UWEB21) Engineering  
Research Center  
Darland Endowed Chair in Technology  
Commercialization  
Professor of Bioengineering and  
Chemical Engineering



Dr. Buddy D. Ratner is the Director of University of Washington Engineered Biomaterials (UWEB21) Engineering Research Center and the Darland Endowed Chair in Technology Commercialization. He is Professor of Bioengineering and Chemical Engineering, University of Washington. Dr. Ratner received his PhD (1972) in polymer chemistry from the Polytechnic Institute of Brooklyn. Dr. Ratner is a fellow of the American Institute of Medical and Biological Engineering (AIMBE), AVS (formerly the American Vacuum Society), American Association for the Advancement of Science (AAAS), American Chemical Society (ACS), Polymer Division of the American Chemical Society (POLY) and the International College of Fellows Biomaterials Science and Engineering. In 2002 Dr. Ratner was elected a member of the National Academy of Engineering, USA. He has been involved in the launch of seven companies and won numerous awards including the AVS Welch Award (2002), Society for Biomaterials Founders Award (2004), the BMES Pritzker Distinguished Lecturer Award (2008), the Acta Biomaterialia Gold Medal (2009), the Galletti Award (2011) the George Winter Award of the European Society for Biomaterials (2012) and the University of Washington School of Medicine Lifetime Innovator and Inventor Award (2014). His research interests include biomaterials, tissue engineering, regenerative medicine, polymers, biocompatibility, surface analysis and plasma thin film deposition.

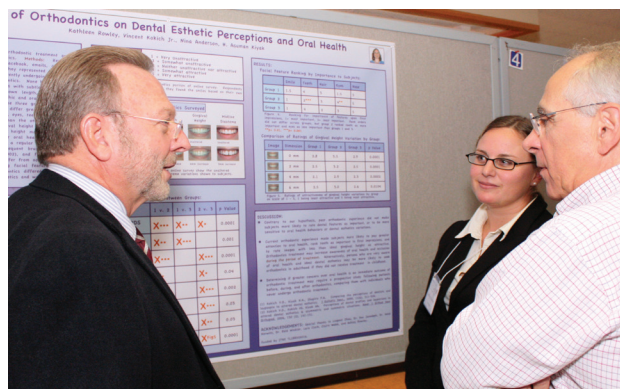
# UNIVERSITY OF WASHINGTON FACULTY PRESENTATIONS

## DISRUPTING MICROBIAL SOCIAL NETWORKING #EPIC\_ORAL\_FAIL

**Jeffrey S. McLean, PhD**

Acting Associate Professor of Periodontics

Dr. McLean's research career began at the Pacific Northwest National Laboratory in Richland, Washington. He then took a faculty position at the nonprofit, genomics-centered J. Craig Venter Institute. Dr. McLean recently joined the Periodontics department here at the University of Washington School of Dentistry. He received his PhD at the University of Southern California and his MSc at the University of Guelph in Canada. His research has been primarily devoted to developing innovative methodologies, tools and novel genomic approaches to study microbial interactions within oral biofilm communities. Currently, his NIH-funded research employs the latest next generation sequencing techniques such as single cell genomics, metagenomics/metatranscriptomics as well as global metabolomics to characterize the microbial functions that help maintain the overall healthy state of the oral microbiome. Recent publications from the McLean lab and collaborators have expanded our knowledge of ultrasmall bacteria living in the oral cavity, the temporal dynamics of supragingival communities, and the possible protective effects of oral bacteria against invading gut pathogens, as well as exploring the impact of using targeted antimicrobial peptides for dental caries therapeutics.



## **TITANATE-METAL COMPLEX: A NOVEL ANTIMICROBIAL COMPOUND IN THE AGE OF INCREASING BACTERIAL RESISTANCE**

**Whasun Oh Chung, PhD**

Research Professor, Director of SURF Research Program

Dr. Chung is a Research Professor in the Department of Oral Health Sciences and the Director of SURF Research Fellowship in the School of Dentistry (SOD). She received her PhD in Pathobiology from University of Washington in 1999 and has been at the SOD ever since. During her time at the SOD, Dr. Chung has obtained independent funding through NIH and other granting agencies as a PI and has collaborated with wide-ranging colleagues in various biomedical research fields, resulting in over 110 manuscripts, invited book chapters and abstract presentations. Dr. Chung has an expertise in epithelial innate immunity and in host-microbial interactions relevant to oral health. Her research interests include epigenetics in periodontal health and disease, cross-communication between epithelial receptors in gingival innate immune responses, and Titanate-metal complexes as novel antimicrobials in dentistry. She and her collaborators received the United States Patent on the “Use of Titanium-Based Materials as Bactericides” in October 2013. She has served on numerous NIH review panels and journal editorial boards, but one of the duties Dr. Chung enjoys the most is teaching students at all different levels. She has mentored over 45 graduate, dental and undergraduate students, many of whom have been recognized internationally and nationally for their outstanding work. Dr. Chung’s passion outside of her work is the time with her family.



## **XYLITOL AND DENTAL CARIES PREVENTION IN CHILDREN: NON-LINEARITY OF THE T1-T4 TRANSLATIONAL RESEARCH PROCESS**

**Donald Chi, DDS, PhD**

Associate Professor of Oral Health Sciences

Dr. Donald Chi is an Associate Professor of Oral Health Sciences at the University of Washington. He is dual board certified in pediatric dentistry and dental public health. His research program focuses on ways to improve access to dental care for low-income children with special health care needs. He is a Consultant to the American Academy of Pediatric Dentistry (AAPD) Council on Scientific Affairs and is Chair of the AAPD Evidence Based Dentistry Committee. Dr. Chi teaches public health to dental students and residents, and devotes his extramural clinical practice to treating Alaska Native children in Alaska’s YK Delta and young patients at the Odessa Brown Children’s Clinic in Seattle.

# FACULTY, STAFF, FELLOWS AND STUDENT POSTER PRESENTATIONS

## 1. Salwa Al-Noori Oral Health Sciences **Nitrous Oxide Evokes Neuroendocrine Stress and Heat Conservation Responses**

Al-Noori S, Cimpan A, Maltzer Z, Zou J,  
Kaiyala K, Ramsay D

**Objectives:** Little is known about Nitrous oxide's (N<sub>2</sub>O) effects on neuroendocrine stress responses or mechanisms that alter body temperature.

**Methods:** To assess hypothalamic-pituitary-adrenal (HPA) neuroendocrine responses and sympathetic autonomic neuroendocrine responses during initial N<sub>2</sub>O administration, we measured plasma corticosterone (CORT), norepinephrine (NEPI), and epinephrine (EPI) during an initial 2-h 60% N<sub>2</sub>O session (N=5 male rats, values are mean ± SE). In a separate study, using dual probe telemetry implants and infrared thermography (IRT), we assessed the effects of nine repeated N<sub>2</sub>O administrations compared to control (con) administrations on core temperature (T<sub>c</sub>), BAT temperature (T<sub>bat</sub>) and tail temperature (T<sub>tail</sub>).

**Results:** CORT (ng/ml) increased from 38±25.3 at baseline to 528±174.5 during N<sub>2</sub>O (p=0.09). NEPI (pg/ml) increased from 237.0±34.9 at baseline to 387±42.2 (p=0.04). EPI (pg/ml) increased from 170.0±51.4 at baseline to 316±132.2 during N<sub>2</sub>O (p=0.15). Both T<sub>c</sub> and T<sub>bat</sub> decreased significantly during initial N<sub>2</sub>O administration (T<sub>c</sub>: n=11 con, 12 N<sub>2</sub>O; N<sub>2</sub>O minus con difference averaged over 90 min (DT) = -0.5±0.12 C, p=0.001. T<sub>bat</sub>: n=11 con, 12 N<sub>2</sub>O; DT = -1.0±0.14 C; p <0.001). N<sub>2</sub>O administration unexpectedly inhibited T<sub>tail</sub> (n=6 con, 7 N<sub>2</sub>O; DT = -1.6±0.36 C; p = 0.001). In the 9th session, N<sub>2</sub>O inhalation increased T<sub>c</sub> (DT = 0.7±0.23 C; p = 0.007), a hyperthermic sign reversal, yet neither T<sub>bat</sub> nor T<sub>tail</sub> differed from control (T<sub>bat</sub>: DT = 0.1±0.25 C; p = 0.7; T<sub>tail</sub>: DT = 0.1±0.91 C; p = 0.9).

**Conclusions:** 60% N<sub>2</sub>O evokes classical HPA and sympathetic neuroendocrine stress responses,

and may promote hypothermia via reduced BAT thermogenesis accompanied by tail vasoconstriction as a compensatory mechanism to limit body heat loss. After repeated N<sub>2</sub>O administrations rats exhibit a hyperthermic T<sub>c</sub> but a normalized T<sub>bat</sub>, suggesting induction of a hyperthermia-promoting thermogenic adaptation of undetermined origin.

Supported by: National Institute on Drug Abuse Grant R03DA033453 and University of Washington Dr. Douglass L. Morell Dentistry Research Fund



2. Richard Presland  
Oral Health Sciences, Medicine  
(Dermatology), Oral Medicine, and  
Seattle Cancer Care Alliance  
**Identification of Two Salivary Proteins  
Associated with Early-stage Oral  
Chronic Graft-versus-Host Disease**

Presland R, Alshehri W, Missaghi M, Schubert M,  
Lloid M

**Objectives:** Chronic graft-versus-host disease (cGVHD) is a frequent and serious complication of allogeneic hematopoietic stem cell transplantation (allo-HSCT) that presents as an autoimmune-like inflammatory condition. cGVHD typically occurs in at least 50% of patients who undergo allogeneic HSCT. To date, a number of groups have identified protein biomarkers for non-oral (e.g. skin) and oral cGVHD, but as yet none have been validated. Previously, we carried out semi-quantitative mass spectrometry analysis of saliva from patients with oral cGVHD, and showed that the proteins IL-1 receptor antagonist (IL-1ra) and cystatin B were decreased in oral cGVHD patients compared to allo-HSCT patients without oral cGVHD.

**Methods:** Here, we further examined expression of these markers in early stage oral cGVHD patients (N=23, mean age=55 yrs), who were diagnosed with cGVHD 10-14 months after alloHSCT, and compared levels of protein expression to a control allo-HSCT group with no oral cGVHD (N=16, mean age=51 yrs) studied 8-14 months post-allo-HSCT.

**Results:** The expression of both IL-1ra and cystatin B, measured by ELISA assays, were significantly decreased in oral cGVHD patients compared with non-cGVHD controls ( $P < 0.001$ ). ROC analysis demonstrated sensitivity and specificity for the two markers of  $>80\%$ , with an AUC value of 0.9.

**Conclusions:** These findings identify two oral cGVHD biomarkers with known functions in regulating inflammation and programmed cell death. The reduced expression of these proteins in oral cGVHD patients is consistent with the dysregulated inflammation and cell death that occurs in this disease.

Supported by: University of Washington  
Dr. Douglass L. Morell Dentistry Research Fund

3. Juliet Dang  
Oral Health Sciences  
**Identification and Characterization of  
Novel HPVs in Oral Rinse Samples**

Dang J, Kiviat N, Feng Q, Bruce G,  
Zhang Q

**Objectives:** From our past study we discovered and fully cloned three novel types of HPVs in healthy patients. We hypothesize that there are new, not yet identified oncogenic HPVs in a subset of head and neck cancer patients, which will be detected using next generation sequencing (NGS) technology. Discovery of novel HPVs using NGS technology in oral rinse samples collected from oral cavity cancer (OCC) and oropharyngeal cancer (OPC) patients. Determine prevalence of novel HPVs in archived OCC/OPC tissue samples. Determine frequency of novel oncogenic HPVs in cancer and non-cancer oral lavage samples.

**Results:** We discovered three potential novel HPVs: NV14.4, NV69.1, and NV95. NV14.4 has 89% homology to HPV76; NV69.1 has 85% homology to HPV152; and NV95 has 77% homology to HPV147. From the archived tissue biopsy samples, only 1 patient who had OCC was positive for NV14.4. Of the OPC oral rinse samples: 1% was positive for NV14.4; 13% was positive for NV69.1; and 1% was positive for NV95. Of the OCC oral rinse samples: 6% was positive for NV14.4; 12.5% was positive for NV69.1; and 6% was positive for NV95. Of the other head and neck cancer oral rinse samples 12.5% was positive for NV69.1. None of the non-cancer samples in the tissue biopsies nor the oral rinse samples had any of the three novel HPVs detected.

**Conclusions:** Novel, potentially oncogenic, HPVs can be detected in oral rinse samples using NGS technology in conjunction with regular sequencing and cloning.

Supported by: UW Royalty Research Fund, Warren G. Magnuson Scholarship, ITHS TL1 Training Program



#### 4. Yen-Wei Chen Restorative Dentistry **Cytotoxicity of Titanate-Calcium Complexes with MC3T3 Cells**

Chen Y, Drury J, Taylor-Pashow K, Hobbs D,  
Wataha J

**Objectives:** Insoluble monosodium titanate (MST) particles bind multivalent ions and are promising for the delivery or sequestration of calcium (Ca(II)) in clinical dental contexts involving hard tissues. Therefore, the toxicological properties of MST are crucial. The **aim** of this study was to determine the cytotoxicity of MST and MST-calcium complexes with MC3T3 osteoblast-like cells.

**Methods:** MC3T3 cells were plated (5000 - 30,000 cells/cm<sup>2</sup>) and allowed to attach for 24 h. Following attachment, native MST (no ions) and MST-Ca(II) complexes were added (0 - 200 mg/L) and incubated for 24-72 h. The fluorescent CellTiter-Blue® assay was employed to assess the metabolic activity of the cells (fluorescence, 560 nm EX/590 nm EM, SpectraMax M2). Differences in metabolic activity between MST and MST-Ca(II) were identified using one-way ANOVA and Tukey post-hoc analysis ( $\alpha=0.05$ ).

**Results:** MST and MST-Ca(II) suppressed MC3T3 metabolic activity in a dose, time, and cell-density dependent fashion. After 24 h with 30,000 cells/cm<sup>2</sup>, MST and MST-Ca(II) suppressed MC3T3 metabolism 58% and 52%, respectively at  $\geq 50$  mg/L ( $p < 0.05$  vs. native MST); suppression increased to 88% (MST) and 90% (MST-Ca(II)) by 72 h ( $p < 0.05$ ). MST-Ca(II) suppressed MC3T3 metabolism in a statistically identical manner as native MST at all concentrations. After 24 h at 5000 cells/cm<sup>2</sup>, MST metabolic suppression was greater than at 30,000 cells/cm<sup>2</sup> (78%,  $p < 0.05$ ); Ca(II) mitigated the suppression of the native particles (52%, no difference from higher density). However, by 72 h, suppression was nearly 100% for both MST and MST-Ca(II).

**Conclusions:** MST and MST-Ca(II) are significantly cytotoxic to MC3T3 cells through a mechanism yet unknown.

Supported by: Dean and Margaret Spencer Endowed  
Clinical Research Fund

#### 5. Bryce Jeffrey Planchich Restorative Dentistry **Release of Calcium Ions from Monosodium Titanates**

Planchich B, Drury J, Chen Y, Taylor-Pashow K,  
Hobbs D, Wataha J

**Objectives:** The aim of this study was to examine calcium ion (Ca(II)) release from monosodium titanate (MST) calcium complexes. Ca(II) release is central to possible therapeutic dental applications of these complexes.

**Methods:** Stock solutions, 8000 mg/L, of native MST(control) and MST complexed with calcium ions (MST-Ca(II)) were prepared using sterile water (pH 7 or pH 5). Samples were incubated at 37°C, 5% CO<sub>2</sub>, 100% humidity for 0 h to 8 wk. At specified times, 3 aliquots were collected for each sample, vortexed, and centrifuged. The top 50  $\mu$ L of supernatant were then removed. Both the supernatant and the remaining particulates were analyzed for Ca(II) using the QuantiChrom™ Calcium Assay Kit (612 nm optical density, SpectraMax M2 Plate Reader). Differences in Ca(II) release between controls and experimental samples were identified with two-sided Student's t-tests, with a p-value  $< 0.05$  considered significant.

**Results:** Ca(II) was not detected in native MST (control) supernatant samples. Ca(II) release was detected from MST- Ca(II) into supernatants. At pH 7, the supernatant Ca(II) concentration increased over 3 d, from 0 to 2.75 mg/dL ( $p < 0.05$  compared to MST control) after which it remained constant to 8 weeks. A large reservoir of Ca(II), 45 mg/dL, remained on the MST-Ca(II) particles (compared to 0 mg/dL measured on particulate native MST (control);  $p < 0.05$ ). At pH 5, 15 mg/dL of Ca(II) was immediately released into the supernatant with no further release over 7 d, and 35 mg/dL Ca(II) remained on the particles. Finally, when the supernatant was partially replenished every 24 h with sterile water (pH 7), Ca(II) release from MST-Ca(II) was ongoing, reaching a cumulative total of 4.7 mg/dL over 4 d.

**Conclusions:** Calcium was released from MST-Ca(II) into water; release was affected by pH and Ca(II) concentration in the solute.

Supported by: Dean and Margaret Spencer Endowed  
Clinical Research Fund

## 6. Jeanie L. Drury Restorative Dentistry **Calcium-Titanates Increase *in vitro* Dental Pulp Cell Viability**

Drury J, Chen Y-W, Plancich B,  
Taylor-Pashow K, Hobbs D, Wataha J

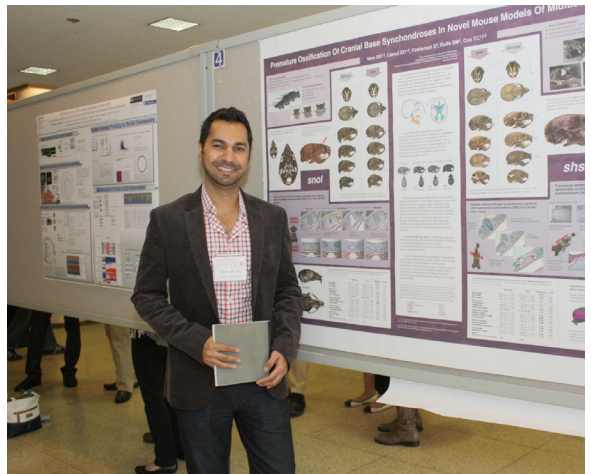
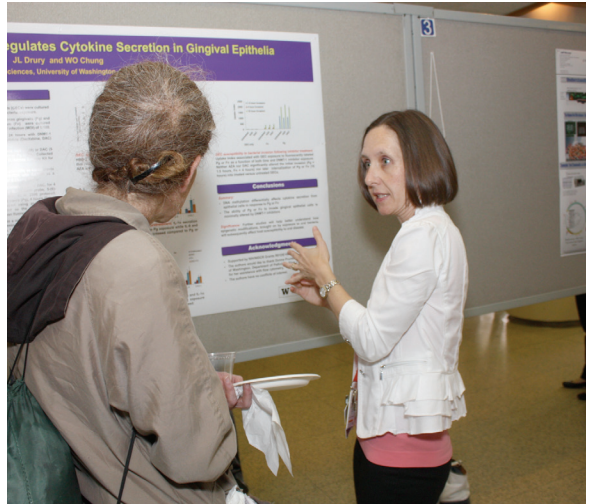
**Objectives:** Titanates are water insoluble ceramic particles (1-20  $\mu\text{m}$ ) of titanium oxide that bind multivalent cations. *In vitro* biocompatibility studies have reported varying degrees of cellular toxicity to titanates depending on the cell type. In addition, toxicity has been augmented by titanate-complexed cations. The aim of this study was to measure the toxicity of titanate-calcium complexes to dental pulp cells (DPCs).

**Methods:** DPCs were plated in 96-well format (n=8) at cell densities of 5,000 (low) or 30,000 (high) cells/cm<sup>2</sup> for 24 h prior to treatment with monosodium titanates (MST, 0-200 mg/L) without ('native', control) or complexed with calcium (MST-Ca(II)). Cellular metabolic activity was used to estimate cellular viability with the commercially available CellTiter-Blue® assay (resorufin fluorescence, 560nm excitation/590nm emission). Differences in metabolic activity were identified using two-sided Student's t-tests with a p-value < 0.05 considered significant.

**Results:** At a low initial cell density, native MST treatment resulted in 67% viability compared to untreated controls (100%, p < 0.05). The decrease in viability was significant at an MST concentration of 25 mg/L and reached a plateau at 50 mg/L, congruent with previously reported studies using other cell types. The addition of calcium complexed with MST increased cell viability such that there was no statistical significance between untreated cells and cultures treated with 200 mg/L MST-Ca(II). At high initial cell density, cell viability decreased to 76% compared to controls (p < 0.05) and was not significant until 100 mg/L MST. The addition of Ca(II) complexed with the MST increased cell viability and stimulated cell proliferation, with a statistically significant increase in viability (116%, p < 0.05) at an MST-Ca(II) concentration of 25 mg/L; viability returned to control levels at 200 mg/L.

**Conclusions:** Overall, MST is slightly toxic to DPCs but can be used to deliver Ca(II) to cultures, increasing cell viability.

Supported by: Dean and Margaret Spencer Endowed  
Clinical Research Fund



## 7. Hanson Fong Materials Science and Engineering **Dentomimetics-Constructing an Enamel-like Biomineralized Microlayer via Amelogenin-Derived Peptides in Rat, Pig and Human Teeth *in vitro***

Fong H<sup>1</sup>, Yucesoy D<sup>1</sup>, Gungormus M<sup>1</sup>,  
Cousins T<sup>2</sup>, Oren E<sup>1</sup>, Tamerler C<sup>1</sup>, Hnilova M<sup>1</sup>,  
Huang G<sup>2</sup>, Dogan S<sup>3</sup>, Herring S<sup>2,4</sup>, Sarikaya M<sup>1,4</sup>

**Objectives:** Enamel and cementum are the outer-, mineralized tissue covering the tooth and the root, respectively, and essential parts of the tooth system and the periodontal tissue that anchors the tooth to the bone. While a variety of dental caries formation start from the chemical and mechanical deterioration of enamel and the periodontal disease results from the destructive behavior of the host elicited by an infectious biofilm adhering to the tooth root, if left untreated, these may eventually lead to tooth loss. We describe a novel protocol for identifying peptide sequences from native proteins with the potential to repair damaged dental tissues by controlling hydroxyapatite biomineralization.

**Methods:** Using amelogenin as a case study and a bioinformatics scoring matrix, we identified regions within amelogenin that are shared with a set of hydroxyapatite-binding peptides (HABPs) previously selected by combinatorial mutagenesis. One 18-amino acid long peptide regions referred to as amelogenin-derived peptide 5 (ADP5) was shown to facilitate cell-free formation of a cementum-like hydroxyapatite mineral layer on demineralized human root dentin that, in turn, supported attachment of periodontal ligament cells *in vitro*.

**Results:** The remineralization studies have also been further extended to enamel surface of extracted human, rat and pig molars. Our findings have several implications in peptide-assisted mineral formation that mimic biomineralization. By further elaborating the mechanism for protein control over the biomineral formed, we afford new insights into the evolution of protein–mineral interactions. By exploiting small peptide domains of native proteins, our understanding of structure–function relationships of biomineralizing proteins can be extended and these peptides can be utilized to engineer mineral formation.

**Conclusions:** The dentomimetic layer formed by ADP5 has the potential clinical application to repair diseased teeth prevent and root surfaces so as to prevent caries formation and to promote the regeneration of periodontal tissues and thereby reduce the morbidity associated with tooth loss.

Supported by:

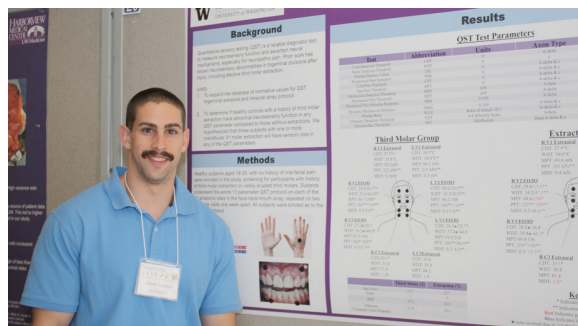
NSF-DMR/MRSEC, ARO-DURINT, NIDCR, WA-LSDF, SURF, Spencer

<sup>1</sup>GEMSEC, Genetically Engineered Materials Science and Engineering Center, Department of Materials Science and Engineering, University of Washington, Seattle, WA 98195, USA

<sup>2</sup>Department of Orthodontics, University of Washington, Seattle, WA 98195, USA

<sup>3</sup>Department of Restorative Dentistry, University of Washington, Seattle, WA 98195, USA

<sup>4</sup>Department of Oral Health Sciences, University of Washington, Seattle, WA 98195, USA



8. Mehmet Sarikaya  
Materials Science and Engineering,  
Chemical Engineering,  
Oral Health Sciences  
**Towards Novel Dental Health Care:  
Biogenic Peptides Derive Dental  
Tissue Remineralization *in vivo* in Rat  
Model**

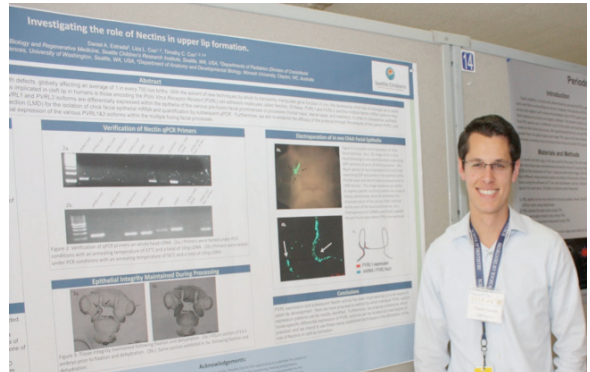
Fong H<sup>1,2</sup>, Yucesoy D<sup>1,2</sup>, Gresswell C<sup>1,2</sup>,  
Chung W<sup>3</sup>, Huang G<sup>4</sup>, Dogan S<sup>5</sup>, Sarikaya M<sup>1,2,3,6</sup>

**Objectives:** A long-standing practical challenge associated with hypersensitivity, caries and other demineralization related dental diseases is incorporating a functional mineral microlayer fully integrated into the molecular structure of the tooth for use in repairing damaged enamel or dentin surfaces. Here we address, using recent advances in peptide-enabled mineralization, one of the key problems in dental tissue restoration through achieving remineralization on the surface of demineralized tooth in a rat model. Establishing the scientific foundations for remineralization on tooth has a high potential to empower practicing dentists to address other related dental problems.

**Methods:** Two peptides, namely ADP5 and ADP7, to be used in this project, have been derived from recombinant mouse amelogenin sequence using a combination of biocombinatorial experimental selection and bioinformatics-based design approaches. Amelogenin is the major biomineralization protein in enamel with potential role in dentin and cementum formation. We hypothesize that the newly formed mineral will be functional in treating incipient caries, when they are applied to damaged root of tooth by forming a durable biogenic mineral layer.

**Results:** The project demonstrated that we lay down a newly formed mineral atop demineralized tooth surface *in vivo* in a rat model within a clinically desirable time frame. The new mineral has clinically stable mechanical properties and adhere biochemically well onto the underlying, exposed, dentin tissue material.

**Conclusions:** The demonstration of peptide mediated mineralization of dental tissues brings us one step closer to providing a general clinical platform in restorative dentistry including treating hypersensitivity, and periodontitis, major ailments significantly impacting quality of life.



Supported by:

WA State LSDF, NIH-NIDCR, NSF-MRSEC

<sup>1</sup>GEMSEC, Genetically Engineered Materials Science and Engineering Center, Departments of <sup>2</sup>Materials Science and Engineering, <sup>3</sup>Oral Health Sciences, <sup>4</sup>Orthodontics, <sup>5</sup>Restorative Dentistry, and <sup>6</sup>Chemical Engineering, University of Washington, Seattle, WA 98195, USA

9. Alireza Sadr  
Restorative Dentistry  
**In-depth Imaging of Tooth Structure  
without X-rays: Optical Coherence  
Tomography**

Sadr A

Recent research findings show that optical systems have the potential to substitute X-ray imaging that is commonly used to characterize tooth decay. The light at near-infrared region around 1300 nm has the best penetration through sound enamel structure, which is a highly mineralized tissue; therefore, this wavelength has been explored for tooth imaging based on transmission or reflection. Optical coherence tomography (OCT) is a non-destructive in-depth imaging system for tissues and biomaterials. In simple words, OCT uses an optical fiber to project a band of light such as laser on the structure and then reconstructs micron-resolution cross-sectional images based on photons backscattered from inside the structures, within several millimeters of the surface. Dental hard tissues and biomaterials are light-scattering media suitable for OCT imaging. Tissue optical properties are affected by caries; e.g., demineralized enamel depolarizes light and results in multiple scattering of light that can be detected by OCT. This work presents diagnostic OCT images obtained in vitro and in vivo from teeth structure and discusses the applications of this technology not only for basic research on tissue optical properties, but also as a clinical tool.

Supported by: Japan Society for Promotion of Science,  
Optical Society of America

10. Gurveen Khathar  
Oral Medicine  
(Oral and Maxillofacial Radiology)  
**Dental Bitewing Radiography  
Absorbed Radiation Doses:  
Preliminary Results**

Christensen K, Khathar G, Aps J

**Objectives:** The aim of the pilot study was to assess the effect of different X-ray beam collimators on the absorbed radiation dose of the contralateral parotid gland, the lens of the eye and the thyroid gland on an DXTR® phantom with and without a lead apron.

**Methods:** A DXTR® phantom, an XCP®Rinn positioning device, a phosphor storage plate and 4 different collimators (standard circular, rectangular XDR® green, rectangular XDR® white, rectangular Sirona®) with and without a lead apron were used. Sixty left BW were taken (Sirona® Heliodent DS, 65 kV, 7mA, 25 ms). The Unfors® Patient Skin Dosimeter was used to measure the skin surface absorbed doses (AD) on the contralateral parotid gland, lens of the eye and at the thyroid gland.

**Results:** BW taken without a lead apron, irrespective of collimation, result in a significant ( $P=0.004$ ) lower AD to the contralateral lens of the eye. BW taken without a lead apron and with a circular collimator result in significant lower AD in the contralateral parotid gland ( $P=0.0197$ ). BW taken without lead apron, but with the green XDR® rectangular collimator result in significant higher AD in the contralateral parotid gland ( $P<0.0001$ ) and in a lower AD to the contralateral lens of the eye ( $P=0.04$ ). BW taken without lead apron and the white XDR® rectangular collimator, result in significant lower AD to the contralateral parotid gland ( $P=0.002$ ) and to the thyroid gland ( $P=0.003$ ). BW taken without lead apron but with the Sirona® rectangular collimator, result in significant lower AD to the contralateral parotid gland ( $P=0.0007$ ).

**Conclusions:** A lead apron in combination with rectangular collimation in an attempt to keep the radiation dose as low as possible does not work. Further study will be beneficial in establishing a school wide consensus on the use of lead aprons and rectangular collimators.

11. Susan Lee  
Oral Medicine  
(Oral and Maxillofacial Radiology)  
**Dental Panoramic Radiography  
Tutorial**

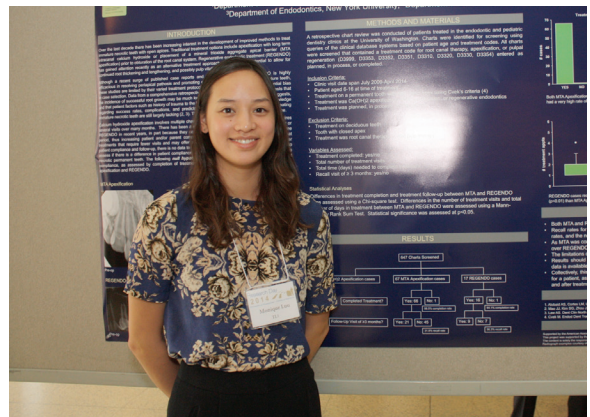
Lee S, Madhavan D, Aps J

**Objectives:** The aim of this project was to create a tutorial for dental school students to better understand the results of different positions of the patient's head in the panoramic machine.

**Methods:** A dry skull with cervical spine and thorax was borrowed from the UW anatomy lab. Three different sized hyoid bones were sculpted (SL) and positioned at different levels in the neck. Subsequently panoramic radiographs were taken with the 3 hyoid bones at different levels. In a next step the skull was intentionally ill-positioned (midsagittal plane off, tilting of the Frankforter plane and combinations of mistakes). Tilting was measured using a Black and Decker® laser leveler.

**Results:** A total of 52 panoramic radiographic images were taken. The latter are helpful to teach dental students the effects of ill-positioning on the image quality: magnification of teeth and bony structures and distortion in the shape of the mandible and / or maxilla.

**Conclusions:** A human cadaver would have been better, as also soft tissues would be involved then. However, due to financial restrictions, a dry skull and thorax had to be used. Nevertheless the aim of the project was achieved and a tutorial for dental students and dental assistants can now be established. This project was the start of future online tutorials, which are the future of modern academic education, allowing distant learning and allowing students to study at their own tempo. A video, instead of an online power point animated tutorial, showing the effects of ill positioning in panoramic imaging is the ultimate goal of this project.



# GRADUATE STUDENT POSTER PRESENTATIONS

## 12. Michael C. Baldwin

Oral Health Sciences and Orthodontics

### **Effects of Multiple Botox Injections on the Rabbit Masseter**

Baldwin M, Rafferty K, Herring S

**Objectives:** Paralysis of the masseters using botulinum toxin (BTX) is a common treatment for cosmetic reduction of the masseters, muscle spasm, and pain. Clinical BTX treatment generally requires repeated injections every 3 months to maintain its effects. Previous work has demonstrated that a single injection of BTX causes muscle atrophy and fibrosis, even after activity is recovered. The purpose of this study is to determine whether multiple BTX injections increases muscle damage.

**Methods:** Rabbit masseters were injected unilaterally every 3 months with BTX (n=13) or saline (n=5) and euthanized after 3 injections and a final recovery period. Muscles were paraffin-embedded, cross-sectioned, and stained with trichrome. The least diameters of 120 muscle fibers per section were averaged. Percent tissue composition was determined by superimposing a grid over the entire section, identifying the tissue type at each intersection, and dividing the frequency of each tissue by the total number of intersections. The observer was blinded to treatment and side of treatment.

**Results:** BTX-injected muscle fiber diameter was reduced by 24% and the proportion of collagenous tissue increased by 46%. Saline controls were similar to the uninjected contralateral muscles.

**Conclusions:** Compared to the rabbit masseters that received only one injection, these masseters showed similar fiber dimensions; however, fibrous content was more marked (46% vs. 35%). Although damage to muscle fibers is not notably increased by multiple injections, fibrosis may be more severe than after receiving a single injection of BTX.

Supported by: PHS DE018142, T90DE021984

## 13. Atriya Salamati

Oral Health Sciences and Orthodontics

### **Tooth Mobility and PDL Space Width in Pigs**

Salamati A, Liu Z, Herring S

**Objectives:** Teeth move within their sockets in response to environmental stressors and loads. Clinically, the extent of tooth mobility is used to determine the prognosis for teeth and to establish treatment plans. However, the direction and extent of tooth movement under functional loads is unknown for either periodontal health or disease. The objective of this study was to investigate the in vivo tooth displacement during mastication and masticatory muscle stimulation in healthy pigs and its relationship to the periodontal ligament (PDL) space width. Pigs were chosen as the animal model because of their masticatory similarity to humans.

**Methods:** Sonomicrometry was used to measure tooth mobility in two-month-old farm pigs (n=6). Arrays of 2mm ultrasound crystals were implanted in the pulp chamber (mesial side) of the last deciduous maxillary molar and in the surrounding buccal and palatal alveolar bone. After restoration of the molar crown, pigs were allowed to chew, and then re-anesthetized while stimulating electrodes were placed in the jaw muscles. The masseter muscles were stimulated with voltage that was gradually increased to supramaximal. Micro CT ( $\mu$ CT) images were analyzed to measure PDL space width for the mesial roots in the buccal, palatal, mesial, distal and apical directions.

**Results:** Tooth displacements ranged from 20-800 $\mu$ m, averaging about 300 $\mu$ m for both mastication and masseter stimulation. PDL space width measurements for the mesial roots were similar averaging 350-400 $\mu$ m in all directions except for width at the root's apex, which at about 600 $\mu$ m was significantly larger ( $p < 0.001$ ) than the other directions, closest in measurement to the maximal displacements observed.

**Conclusions:** Functional tooth mobility caused by muscle contraction is extensive, approximating the entire width of the periodontal space. The deciduous molar typically moved away from both the buccal and palatal alveolar bone, which suggests an intrusive movement during the power stroke of mastication.

Supported by: PHS award R21DE023127, T90DE021984 from NIDCR, and UWSod SunStar Preventative Dentistry Award (2014-2015)

## 14. Mikhail Garibov

Graduate Periodontics

### **Post-translational Collagen Synthesis in Human and Murine Periodontal Ligament Tissue**

Garibov M, Hudson D, Weis M, Dixon D, Eyre D, Popowics T

**Objectives:** Regeneration of periodontal ligament attachment after alveolar bone loss is highly dependent on collagen I formation. Collagen synthesis is a complex process with multiple steps and numerous post-translational modifications (PTMs) including hydroxylation, glycosylation, and cross-linking. As a result, collagen fibrils can be distinct due to tissue-dependent differences in these PTMs. Little is known regarding collagen formation in periodontal tissue as previous research has focused primarily on collagen fibrillogenesis in skin, bone, and tendon. The purpose of this study was to identify evolutionarily conserved post-translational variances between murine and human type I collagen  $\alpha$ -chains from PDL and tendon.

**Methods:** PDL tissue was harvested surgically from extracted healthy human teeth of de-identified donors (N=5). PDL tissue dissected from extracted murine molars was pooled for collagen analysis (2 groups, 8 mice each). Tandem mass spectrometry was used to evaluate several known sites of prolyl-3-hydroxylation, lysine hydroxylation, and subsequent glycosylation in type I collagen. These sites were compared between species and tissue type.

**Results:** Our results indicate that, compared to other tissue sources, type I collagen from PDL has a unique post-translational phenotype. For example, at the  $\alpha 1(I)$  sites, Pro707 and (GPP)<sub>n</sub>, which are highly modified in mouse and human tendon, are completely lacking in PDL tissue from both species. At the same time, mouse and human PDL type I collagen show cross-species similarities as evidenced by glycosylation patterns at  $\alpha 1(I)$  K87.

**Conclusions:** PDL type I collagen shows a unique PTM phenotype, and these observations confirm that the mouse is an appropriate model to study human PDL due to evolutionarily conserved features. Further developing a murine model and using it for future PDL collagen research would allow us to identify novel and/or improve existing clinical strategies for PDL wound healing and regeneration.

Supported by: Elam M. and Georgina E. Hack Memorial Research Fund

## 15. Wenjie Li

Oral Health Sciences

### **Hmx1- A Regulator of Lateral Facial Development**

Li W, Rosin J, Rolfe S, Cox L, Visel A, Turner E, Cox T

**Objectives:** The oculoauricular syndrome (OAS) in humans, the “dumbo” and “misplaced ears” strains in mice, the “dumbo” strain in rats, and “crop ear” phenotype in cattle all converge on a single gene, Hmx1. Hmx1 encodes a homeodomain transcription factor expressed in the developing peripheral nervous system and branchial arches (BA), the latter giving rise to lateral craniofacial structures including the external ear. In mice and humans, the phenotypes of dumbbo and OAS, respectively, are due to loss of function coding region mutations. In contrast, our group showed that deletion of a non-coding region downstream of the Hmx1 locus is responsible for the phenotype in dumbbo rats. This downstream deletion contains an ~600bp evolutionarily conserved region (ECR). In this study, we characterized in detail the craniofacial presentation in Hmx1 mutant mice to better understand Hmx1’s role in craniofacial development and its functional role.

**Methods:** 3D morphological studies were performed on mouse embryos at different developmental stages and also on postnatal day 28 mature mice. Air blowing test was used to explore the craniofacial neuro-muscular function defect in the mutant mice.

**Results:** In addition to the rotated low-set position of the dumbbo ear, extra fold of the pinna was also noted that could be traced back to embryonic day (E)12. Various subtle bony defects and a likely neuromuscular defect were also uncovered in dumbbo mutant mice. Transient transgenesis revealed the ECR to be sufficient to direct Hmx1 expression within specific lateral and frontonasal tissue.

**Conclusions:** Hmx1 plays an important regulatory role, downstream of key patterning genes, in the development of lateral facial structures, especially the ear. Future studies are will involve fate-mapping Hmx1 expressing cells to ultimately determine what specific craniofacial tissues are derived from the embryonic Hmx1 expressing cell populations.

Supported by: R90DE023059, Laurel Foundation Chair in Pediatric Craniofacial Research, Seattle Children’s Research Institution Inner-center grant



16. Basma Ibrahim Tamasas  
Oral Health Sciences  
**Significantly Increased Susceptibility to, and Severity of, Dental Caries in a Mouse Model of Cleft Lip/Palate**

Tamasas B, Li L, Cox T

**Objectives:** Individuals with cleft lip/palate (CLP) exhibit an increased incidence of dental abnormalities, including enamel defects. Changes in salivary function, such as prolonged clearance times, have also been described in cleft children. Anecdotally, an increase in caries incidence and severity has been reported as a major problem in the CLP population. IRF6 is the most prominent CLP gene and is expressed in all epithelia. To avoid the embryonic lethality associated with ablation of *Irf6* in all epithelia, we developed a mouse model in which *Irf6* was conditionally ablated only in the late embryonic oral epithelium (*Irf6* Null-E). Previously, we found these *Irf6* Null-E mice exhibited enamel mineralization and tooth morphology defects that were associated with delayed polarization of ameloblasts. We also noted grossly abnormal salivary gland morphology. The goal of this study was to determine whether *Irf6* Null mice exhibit a higher caries outcome compared to background matched controls.

**Methods:** *Irf6* Null-E and control mice were inoculated with *S. mutans* cariogenic bacteria using oral swabs, and fed 56% sucrose diet (5BCB) with 5% sucrose water. Mice were euthanized after 8 weeks and scored for caries under a dissecting microscope and following microCT imaging. Bacterial quantities were assessed to investigate the extent of oral cavity colonization. Salivary glands were assessed functionally using pilocarpine and histologically postmortem.

**Results:** A striking increase in caries was observed in *Irf6* Null mice compared to controls ( $P < 0.0001$ ), this was associated with a significant increase in total and *S. mutans* bacterial populations. Both saliva flow rate and buffering capacity were severely decreased in the Null mice.

**Conclusions:** In addition to altered tooth morphology and decreased enamel mineralization, abnormal salivary gland function may be significantly increasing caries susceptibility and severity in the CLP population. For children with IRF6 mutations, implementation of early oral health strategies may be warranted.

Supported by: Laurel Foundation Endowed Chair in Pediatric Craniofacial Research

17. Deniz T. Yucesoy  
Materials Science and Engineering  
**Structural and Functional Characterization of Caries Formation in a Rat Model – A Systematic Study**

Yucesoy D<sup>1,2</sup>, Fong H<sup>1,2</sup>, Gresswell C<sup>1,2</sup>, Gil S<sup>3</sup>, Chung W<sup>3</sup>, Dogan S<sup>4</sup>, Sarikaya M<sup>1,2,3</sup>

**Objectives:** The utilization of rat models in cariology research has made a substantial contribution in understanding the mechanism of caries formation and development of preventative technologies. There are, however, still challenges in the currently accepted rat caries formation models carried out for the purpose of fundamental and clinical studies. These challenges include lack of consistency among reported studies which are often based on the prerequisite to promote highly advanced lesions due to limited sensitivity of caries detection and scoring methods, and the paucity of more detailed structural or mechanical properties information when characterizing carious in different regions of a given tooth as well as in a variety of different teeth.

**Methods:** To address the problem of poor caries detection, scanning electron microscopy (SEM) offers an opportunity for high resolution detection with pseudo-3D topographic view and quantification of subtle changes in the morphology and demineralization state of the hard tissues and, thereby, to reveal valuable structural information about caries lesions. The purpose of this study was to develop an *in vivo* caries formation model in rats that comprises creating mild caries followed by detailed structural and mechanical characterization at high spatial resolution.

**Results:** For this, first, we developed a new rat caries model that promotes a slow progression of mild dental caries with a *S. mutans* infection control by using real-time PCR assay. High resolution characterization was achieved using SEM imaging and EDXS elemental compositional analyses techniques that provided morphological and mineral contents of these lesions, respectively, and the local properties, acquired from micro- and nano-meter regions using nanoindentation method, provided force-deflection data for determining hardness and elastic modulus.

**Conclusions:** The principles laid out in this work with rats have a high potential to be adapted to *in vivo* cariology studies with other species, such as pigs, towards developing standard protocols, for example, in next-generation remineralization studies.

Supported by:

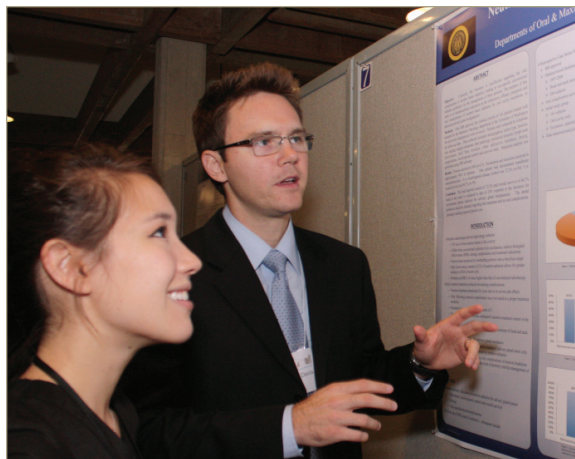
NSF-DMR/MRSEC, ARO-DURINT, NIDCR, WA-LSDF, Spencer

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<sup>2</sup>Department of Materials Science and Engineering, University of Washington, Seattle, WA 98195, USA

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## 18. Nicole Chin Materials Science and Engineering Peptide-Enabled Aqueous Tooth Whitening

Yucesoy D<sup>1</sup>, Chin N<sup>1</sup>, Fong H<sup>1</sup>, Dogan S<sup>2</sup>,  
Sarikaya M<sup>1,3</sup>

**Objectives:** Tooth discoloration as a result of a various and multifaceted causes including food, aging, tobacco, disease, physical trauma, and individual susceptibility creates a wide range of cosmetic problems. Because stained teeth are a common aesthetic concern for many individuals, the dental profession and the public expend considerable amounts of time and money in attempts to improve the appearance of discolored teeth. Although different in-clinic and at-home whitening treatments are currently available to manage discolored teeth, these methods are typically either expensive or cause more harm to the oral health of the individual, such as an increase in tooth sensitivity.

**Methods:** Our group's approach has been to address tooth whitening treatments by developing a new tooth whitener using biomineralizing peptides. These short peptides have either been selected using combinatorial mutagenesis, bioinformatically designed de novo, or derived from well-known biomineralizing proteins. By acting as tiny enzymes, these peptides direct Ca<sup>2+</sup> and PO<sub>4</sub><sup>3-</sup> ions to re-mineralize tooth enamel (or dentin) surfaces and restores the color of teeth by masking the underlying stain. We are currently working on a liquid whitening solution that can act as a mouthwash analog using a peptide solution of human ADP5 (hADP5) to bind to tooth enamel surfaces and facilitate mineral formation

in a CaCl<sub>2</sub> and KH<sub>2</sub>PO<sub>4</sub> solution. The extracted human teeth samples obtained from the UW's Dental Clinics are stained artificially using tea solutions followed by the novel remineralization based whitening procedure. Comparative analysis for brightness and whiteness of the teeth samples after whitening are done by recording the images of side-by-side unstained, stained and whitened samples under an optical microscope.

**Results:** Our data show significant differences in enamel coloration among the non-treated, stained, and peptide-treated tooth samples. Extensive structural, chemical and mechanical analyses of the samples have been carried out using optical and electron microscopy imaging and chemical analysis as well as nanomechanical tests, respectively, for comprehensive characterization of the whitening effect resulted from peptide-enabled whitening versus control samples.

**Conclusions:** The team has developed peptide-enabled whitening solution, which, as opposed to current commercial products as scale and polish, is a simple oral hygiene that acts in water, biogenic, constructive and additive, and therefore is expected to greatly impact the dental health care as well as cosmetics.

Supported by:

NSF-DMR/MRSEC, ARO-DURINT, NSF-Biomat, WA-LSDF, Spencer

<sup>1</sup>GEMSEC, Genetically Engineered Materials Science and Engineering Center, Departments of <sup>1</sup>Materials Science & Engineering, <sup>2</sup>Restorative Dentistry, and <sup>3</sup>Oral Health Sciences, University of Washington

19. Erin E. Masterson  
Epidemiology and Oral Health Sciences  
**Enamel Hypoplasia and Chronic  
Disease Risk in Adolescence**

Masterson E, Hujuel P, Eisenberg D, Enquobahrie D, Mancl L, Nurius P, Fitzpatrick A

**Objectives:** We aim to evaluate whether enamel hypoplasia (EH) in the permanent maxillary incisors, presumably influenced by malnutrition during early childhood, is associated with adolescent health indicators.

**Methods:** This study is a work-in-progress that extends a prospective cohort from the Bolivian Amazon. The study sample was comprised of 349 adolescents, aged 10-17 years, who were included in a 9-year longitudinal study as young children. The presence of any EH in the permanent dentition was quantified using digital photography. Health outcomes, including blood pressure, HbA1c, hemoglobin, and white blood cell count, were measured in the field using point-of-care devices. The presence of any EH was then evaluated in relation to adolescent health.

**Results:** The dual burden of under-nutrition in childhood (45%) and overweight in adulthood (23%) afflict the study population. Preliminary analyses of the digital photographs indicate that approximately 84% of the study participants have EH (pitting) on the permanent maxillary incisors. On average, the study sample had a healthy blood pressure (mean  $\pm$  SD: 112  $\pm$  10/63  $\pm$  8 mmHg) and HbA1c level (mean  $\pm$  SD: 5.3%  $\pm$  0.3), but slightly elevated average white blood cell count (mean  $\pm$  SD: 10.9  $\times$  10<sup>9</sup>/L  $\pm$  2.9). Sixty five percent of the study sample had anemia based on a 12.0 g/dL hemoglobin threshold for diagnosis (mean  $\pm$  SD: 11.4 g/dL  $\pm$  7.0). Our next steps will be to conduct regression analyses, adjusted for age and gender, to determine the extent to which the presence of EH is associated with adolescent health measures.

**Conclusions:** This study examines the relationship between adolescent health and a permanent dental marker that presumably reflects early childhood exposures. This measure has the potential for use as a biomarker for evaluating the influence of early childhood experience on chronic disease risk later in life in low-resource settings.

Supported by: The Wenner-Gren Foundation Dissertation Fieldwork Grant, UW Royalty Research Fund, National Institute of Dental and Craniofacial Research (NIDCR) T90DE021984, Eunice Kennedy

Shriver National Institute of Child Health and Human Development (NICHD) research infrastructure grant R24HD042828 to the UW Center for Studies in Demography & Ecology (CSDE)

20. Stephanie Cruz  
Oral Health Sciences  
**Oral Health Services within  
Community Organizations for Young  
Children with Special Needs**

Cruz S, Chi D, Huebner C

**Objectives:** This exploratory study sought to identify the types of oral health services offered by community-based organizations to young children with special health care needs (CSHCN) and the barriers and facilitators to the provision of oral health services.

**Methods:** Thirteen key informant interviews were conducted with representatives from early intervention agencies, advocacy groups, and oral health programs who provide services to CSHCN in Spokane County, Washington. We used a content analysis to thematically identify and group barriers and facilitators associated with the provision of oral health services within these community-based organizations.

**Results:** We identified four types of oral health services provided to CSHCN: screenings; education; preventive dental care; and referrals to dentists. Barriers to the provision of oral health services included limited agency resources; restrictive administrative and system-level policies; and low demand from families. A barrier to the provision of oral health education and preventive dental care was the disagreement in the community regarding use of fluoride. A barrier to providing dental referrals was the perceived lack of dentists with the skills needed to treat CSHCN. Facilitators to the delivery of oral health services were established community partnerships among the organizations and utilization of the ABCD program.

**Conclusions:** Oral health services for young CSHCN are limited and often delivered in response to oral problems. More coordinated efforts between community-based organizations are necessary to ensure proactive delivery of oral health services to young CSHCN.

Supported by:

Award Number U54DE019346 from the National Institute of Dental and Craniofacial Research, National Institutes of Health, Bethesda, MD USA

21. Rania Abasaheed  
 Oral Medicine  
**Chemosensory Alterations in Patients undergoing Hematopoietic Stem Cell Transplantations**

Abasaheed R, Coldwell S, Soliman S, Lloid M, Dakhil S, Macris P, Schubert M

**Objectives:** to assess the magnitude and characteristics of gustatory and olfactory (chemosensory) functions in patients receiving hematopoietic stem cell transplantation (HSCT) at the Seattle Cancer Care Alliance (SCCA).

**Methods:** Patients aged 18+; scheduled to undergo HSCT were tested for chemosensory functions at three time points: pre-transplant and then on day 30 and day 80 post HSCT. Gustatory function was assessed following the procedures of the Rapid Screening test used by the Monell-Jefferson Taste and Smell Clinic. Olfactory testing was conducted using the National Institute of Health (NIH) Toolbox Odor Identification Test. Quality of life (QOL) was also assessed using the European Organization for Research and Treatment of Cancer (EORTC) survey instruments [EORTC QLQ-C30 & EORTC QLQ – Head & Neck (H&N) 35].

**Results:** Twenty-nine patients were enrolled in the study between August 2014 and March 2015. Twenty-three patients were included in the analysis with sixteen tested at baseline, day 30 and day 80. The primary finding is decreased sensitivity (hypoguesia) for 0.018 M citric acid ( $p < 0.001$ ) and 0.0056 M citric acid ( $p < 0.01$ ) on day 30 following HSCT (Newman-Keuls post hoc tests). Citric acid intensity was partially recovered by day 80.

Increased sensitivity (hyperguesia) to 0.1 M sucrose at day 30 ( $p < 0.01$ ) and 1 M NaCl at day 80 was also observed.

Olfactory identification scores were unchanged from baseline to day 30. Quality of life was reduced at day 30 post-transplant and was restored to an acceptable level of functioning and symptoms by day 80. However, some areas remain impaired, such as social functioning and dry mouth.

**Conclusions:** There is some concern with taste perceptions for selected taste intensities and modalities in the early post-transplant period. This was largely resolved within 2.5 months. No obvious issues were found with olfactory function.

Supported by: University of Washington Department of Oral Medicine, Washington Dental Service Professorship and ITHS TL1 Grant (TL1TR000422)



22. Alex Ko  
Department of Periodontics  
**Characterization of Mucosal  
Associated Invariant T (MAIT) Cells in  
the Oral Mucosa**

Slichter C, Davis A, Ko A, Lwo Y, McLean J,  
Yajima M, Deng J, Gottardo R, Prlic M, Dixon D

**Objectives:** Mucosal associated invariant T (MAIT) cells are a recently discovered lymphocyte population which comprise 1-8% of the lymphocyte population in the peripheral blood and digestive tract. MAIT cells are either CD8+ or CD4-CD8- (DN) and are characterized by expression of an invariant T cell receptor (TCR), (V $\alpha$ 7.2), and high expression of the cell surface marker CD161. Previous work has shown that upon stimulation with inflammatory cytokines or through their TCR, MAIT cells secrete pro-inflammatory cytokines. The purpose of this study was to quantify and characterize the frequency and phenotype of MAIT cells in human oral mucosa compared to MAIT cells found in peripheral blood. We hypothesized that MAIT cells are activated in oral mucosa and strongly associated with inflammatory regulation of bone metabolism.

**Methods:** To test this hypothesis, we used flow cytometry to isolate and quantify CD8+/- MAIT cells from discarded oral mucosal tissues and peripheral blood from one donor with periodontal disease and RNA sequencing to compare the overall gene expressions profile of the two cell populations within the mucosa.

**Results:** MAIT cells in the oral mucosa at a frequency similar to that of other mucosal tissues, which counted higher proportion in mucosal tissue compared to peripheral blood. RNA sequencing analysis revealed an upregulation of IL-17F, and IFN- $\gamma$  in CD8+ population and IL-6 in DN population.

**Conclusions:** These pro-inflammatory cytokines bind to bone marrow stromal cells and increase the expression of RANKL and M-CSF, which regulate osteoclastogenesis and osteoclast activity, and decrease the production of osteoprotegerin, thereby promoting increased osteoclast activity and bone resorption leading to bone loss. The evidence of association between these up-regulated pro-inflammatory cytokines and bone metabolism may imply that MAIT cells could be involved in the process of bone metabolism. Further studies are necessary to confirm these preliminary results.

Supported by: Project was funded in part by NIH grant DP2DE023321

23. Nutthapong Kantrong  
Oral Health Sciences  
**IL-1  $\beta$  – Induced CXCL Expression in  
Response to Oral Pathogen : Its Indirect  
Potential Roles for Periodontal Health  
Homeostasis**

Kantrong N, Darveau R

**Objectives:** Homing of neutrophils to junctional epithelium is an essential regulatory mechanism for maintaining periodontal health. Recent in vivo study reported that chemokine ligands CXCL1 and CXCL2 act as neutrophil chemoattractants and that CXCL2, but not CXCL1, is induced by oral commensal microbiome. However, aside from Toll-like receptors (TLR) -2 and -4, little is known about the contribution of IL-1 receptor (IL-1R) signaling to the induction of CXCLs in oral epithelium. We speculated that IL-1R pathway provides a NF- $\kappa$ B auto-regulatory loop for CXCL production; thereby leading to increased numbers of neutrophil to the site of oral commensal infection.

**Methods:** To elucidate potential roles of IL-1R for gingival health homeostasis, we utilized immortalized human normal oral mucosal keratinocyte cell line (OKF6/TERT-2) and human embryonic kidney (HEK293) cell lines as in vitro models for investigating the activity of IL-1 $\beta$  – Nf- $\kappa$ B – CXCL axis in response to *Fusobacterium nucleatum* infection.

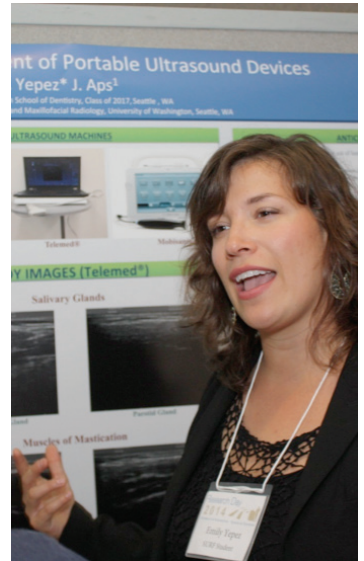
**Results:** We found that CXCL1 and CXCL2 are transcriptionally down-regulated when NLRP3, major canonical-inflammasome component required for IL-1 $\beta$  processing, is silenced, indicating the requirement for mature form of IL-1 $\beta$  in maintaining physiological level of CXCL expression. Furthermore, increased E-selectin expression by human umbilical vein endothelial cells in response to IL-1 $\beta$  – containing conditioned medium is observed, suggesting a paracrine activity of IL-1 $\beta$  for recruiting neutrophils in response to oral pathogen.

**Conclusions:** This study highlights the impact of IL-1R signaling pathway on homeostasis of oral tissues, and that functional impairment of inflammasome ultimately leads to the loss of an ability to mount a proper host cell response against invading pathogens.

Supported by: NIH R01DE023453



24. **Withdrawn**



## 25. Carolyn Gresswell Materials Science and Engineering **Engineered Chimeric Peptides as Antibacterial Surface Coating Agents towards Infection-Free Implants**

Gresswell C<sup>1,2</sup>, Yucesoy D<sup>1,2</sup>, Yazici H<sup>1,2</sup>,  
O'Neill M<sup>1</sup>, Kacar T<sup>1,2</sup>, Wilson B<sup>1</sup>, Oren E<sup>1,3</sup>,  
Tamerler C<sup>1,4</sup>, Fong H<sup>1</sup>, Dogan S<sup>5</sup>, Sarikaya M<sup>1,2,6</sup>

**Objectives:** Prevention of bacterial colonization and consequent biofilm formation remains a major challenge in the implantable medical devices. Implant-associated infection are not only a major cause of implant failures but their conventional treatment with antibiotics also brings further complications due to the escalation in the multi-drug resistance in variety of bacterial species. Owing to their unique properties, antimicrobial peptides (AMPs) have gained significant attention as effective agents to combat colonization of microorganism. These peptides have shown to include a wide spectrum of activities with the specificity to a target cell while having low tendency for developing bacterial resistance. Engineering biomaterial surfaces that feature AMP properties, therefore, offer a promising approach to prevent implant infections.

**Methods:** Here, we engineered a chimeric peptide with bi-functionality that both forms a robust solid-surface coating while presenting antimicrobial property. The individual domains of chimeric peptides were evaluated for their solid-binding kinetics to titanium substrate as well as for their antimicrobial properties in solution. The antimicrobial efficacy of the chimeric peptide on the implant material (Titanium alloys and Zirconia) was evaluated in vitro against infection by a variety of bacteria, including *S. mutans*, *S. epidermidis*, and *E. coli*, which are commonly found in oral and on orthopedic implants.

**Results:** Our results demonstrate significant improvement in reducing bacterial colonization by bacterial adherence below to detectable limit.

**Conclusions:** Engineered chimeric peptides with modular implant binding and freely displayed antimicrobial domains could be a potential solution for developing infection-free surfaces by targeting implant interfaces by combining durable surface coverage with highly reduced bacterial colonization property.

Supported by:

NSF-DMR/MRSEC, NSF-BioMat, WA-LSDF, NIH

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# DENTAL STUDENT SUMMER RESEARCH PROGRAM

## POSTER PRESENTATIONS

### 26. Abigail Anne Tangalan Mazon Dental Treatment Under General Anesthesia: A Three-Year Retrospective Cohort Study

Mazon A, Cunha-Cruz J, McKinney C, Nelson T

**Objectives:** Pediatric patients with tooth decay are often treated under general anesthesia (GA). Previous studies show poor outcomes after surgery but have not compared these results to a non-GA population. To assess dental outcomes following GA, a retrospective cohort study was conducted examining differences between GA and non-GA patients and investigating the effects of other factors such as gender, insurance, age, presence of medical alerts, and geographic location.

**Methods:** Electronic charts of children 0-10 years old at the University of Washington's Center for Pediatric Dentistry from January 2012 through April 2015 were reviewed. Patients were categorized as receiving dental treatment under GA (n=1,542) or not (n=8,365). Information from subsequent visits was analyzed to determine dental treatment outcomes after the initial baseline period of GA treatment within 6 months from first treatment (GA group) or any treatment within 6 months from first exam (non-GA group). The follow-up period for both groups extended from immediately after the baseline period to all visits through April 2015. Relapse was any extraction, restoration or endodontic treatment after baseline.

**Results:** The relapse rate was higher for non-GA patients (18%) than for GA patients (7%), but relapse occurred earlier for GA patients (M=0.90 ± 0.64 years) than non-GA patients (M=1.32 ± 0.68 years), p<0.001. GA patients also had fewer follow-up visits (non-GA: 6.38 ± 8.78 versus GA: 3.06 ± 5.26, p<0.001) and lower maximum follow-up times (non-GA: 0.96 ± 1.06 versus GA: 0.36 ± 0.58, p<0.001). These differences were consistent across different demographic and patient characteristics.

**Conclusions:** GA patients and non-GA patients exhibited different dental outcomes. Despite lower rates of relapse, shorter follow-up times from GA patients and earlier relapse rates demonstrated the continued high risk of this population. The true relapse rates of GA patients remain uncertain with possible relapses occurring without follow-up.

Supported by: National Center for Advancing Translational Sciences, National Institutes of Health, through Grant TL1TR000422

### 27. Karen Wang Restorative Dentistry Longevity of Ceramic Veneers: A Retrospective Cohort Study

Wang K, Chen Y, Cunha-Cruz J

**Objectives:** Ceramic veneer is one of the relatively conservative treatment modalities used in esthetic restorations. Three types of ceramic materials are majorly used for veneers: feldspathic porcelain, leucite-reinforced glass (Empress) and lithium-disilicate glass (Emax). The objective this retrospective cohort study is to investigate the longevity of ceramic veneers.

**Methods:** An electronic chart review of all 38 patients who received at least one ceramic veneer made of different types of materials placed on anterior and premolar teeth by pre-doctoral, graduate students and faculty at the University of Washington School of Dentistry between June 2009 to May 2015 was conducted to evaluate the longevity of ceramic veneers. We classified any failures as veneer repairs and/or replacements. If the patient presented with none of the aforementioned problems, then the veneer was defined as successful.

**Results:** The patient sample included 38 patients (14 male, 24 female) with 135 veneers placed between the ages of 19 and 80, with the average age of 52.16. Length of mean follow-up time of veneers was 47.7 months. Overall success rate was 91.9% (124/135). Of the 135 veneers, 55 were at maxillary sites and 76 were mandibular sites.

Survival rate of mandibular veneers 98.7% was significantly higher than maxillary veneers 83.1% (p<0.05). Reasons for failure of these 11 veneers were debonding 27.3% (3/11), fracture 9.1% (1/11), color mismatch 36.4% (4/11), and unsatisfied contour 27.3% (3/11).

**Conclusions:** Ceramic veneers offer a predictable procedure for the conservative treatment in the esthetic zone, within the limitation of a small sample size and short follow-up period. Mandibular veneers have a significantly higher success rate than maxillary veneers. The reasons causing veneer failure, listed in descending order were esthetic dissatisfaction, debonding, and fracture.

Supported by: University of Washington  
Dr. Douglass L. Morell Dentistry Research Fund



28. Nataliia Garibov  
Oral Medicine  
**Quantitative Sensory Testing  
Reliability & Sensory Loss After Third  
Molar Surgery**

Garibov N, Angkanawaraphan L, Szajman A  
Spiekerman C, Drangsholt M

**Objectives:** 1) measure the test-retest reliability of the Trigemino-cervical Quantitative Sensory Testing (QST) array of the hand-neck-face-mouth; 2) collect QST array normative values for healthy persons aged 18-30; and 3) determine if healthy controls with history of third molar extraction have sensory loss in QST parameters compared to those without extractions.

**Methods:** QST was performed on 7 different body sites bilaterally (hand, forehead, midface, chin, neck, maxillary and mandibular gingiva). QST at each anatomic site included: cold & warmth detection thresholds (CDT, WDT), thermal sensory limen (TSL), paradoxical heat sensations (PHS), cold and heat pain thresholds (CPT, HPT), mechanical detection threshold (MDT), mechanical pain threshold (MPT), mechanical pain sensitivity (MPS), dynamic mechanical allodynia (DMA), vibration detection threshold (VDT) and pressure pain threshold (PPT). Means, medians and standard deviations were calculated. Intraclass correlation coefficient (ICC) was used to calculate test-retest reliability. Two-tailed T-tests were used to assess statistical significance between the groups for those with and without third molars.

**Results:** Reliability – ICC's calculated for 18 subjects, comparing the first to the second visit revealed excellent reliability of MDT; good reliability of thermal testing in maxillary region and good-fair reliability of PPT when tested intraorally. Extraorally, most thermal tests, VDT and PPT showed excellent to fair reliability, with extraoral MDT and MPT showing the most variability between visits. Comparison of Third vs. No Third Molars: Extraction group (n=14) showed significant losses of sensation of MDT & VDT parameters (a-beta fibers) for intraoral maxillary (40 vs. 8.0 mN,  $p=0.03$ , 6.8 vs. 6.45,  $p=0.03$ ); and intraoral mandibular regions (18.5 vs. 5.4 mN,  $p=0.01$ ; 6.8 vs. 6.2,  $p=0.01$ ) when compared to non-extraction group (n=7).

**Conclusions:** Key QST Array parameters show good to excellent reliability. Third molar extraction appears to significantly reduce a-beta fiber neurosensation in healthy asymptomatic third molar extraction recipients years after their surgery.

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29. Alexander Stanton  
Oral Radiology  
**TMJ Condyle Angle Change as  
Osteoarthritis Progresses**

Stanton A, Hollender L, Lee P

**Objectives:** Temporomandibular joint disorders are the second most common musculoskeletal condition that leads to both pain and disability. Research has shown that the horizontal condyle angle is associated with internal derangement. In a previous cross sectional SURF study, unilateral osteoarthritis (OA) affected horizontal condyle angles were statistically significantly larger than the control and unilateral OA unaffected joints. However, it is not clear whether an increasing condyle angle is correlated with OA progression. The aims of this study were to investigate whether mandibular condylar OA is a progressive condition without intervention and to examine whether OA progression is correlated with increasing horizontal condyle angle.

**Methods:** This is a retrospective longitudinal study including a total of 132 subjects with and without TMJ disorders who had participated in the multicenter validation project and who returned for a follow up examination 8 years later. No treatment intervention was rendered to any participating subject. The angles of the condyles in the axial plane were measured without the knowledge of the TMJ diagnosis.

**Results:** (1) Out of 254 joints, majority showed no changes in OA severity over time (86%), 16 got worse (6.3%) and 20 got better (7.9%). (2) The severe degenerative OA joints average horizontal condyle angle (24.8, 95%CI[22.0,27.7]) was statistically significantly larger (Wald test  $p=0.04$ ) than mild degenerative OA joints (23.3, 95%CI[20.852,25.8]) and the normal group joints (23.15, 95%CI[21.7,24.6]). (3) A Wald test p value of 0.01 was calculated comparing the change in condyle angle and specific changes in degenerative diagnosis from baseline to follow up.

**Conclusions:** Condyle angle is statistically higher in patients with more severe OA. There exists an association between changes in condyle angle and specific changes in diagnosis from baseline to follow up. That being said, majority of subjects showed neither changes in joint severity nor changes in condylar angle during the intervening 8 years.

Supported by:  
University of Washington Dental Alumni Association

30. Meghan Spain  
Periodontics  
**Optimizing Growth of  
Subgingival Plaque Bacteria in  
*in vitro* Microbiome Model**

Spain M, To T, McLean J

**Objectives:** The objective of this project is to develop novel cultivation methods for subgingival periodontal microbiota that will maintain a high diversity biofilm representative of a typical subgingival microbial community. Our study hypothesis, based on preliminary data, is that subgingival Gram-negative, periodontal species are enriched and selected for when grown in spent supragingival plaque community media (spent SHI media) which has a lower pH, reduced REDOX potential and potential signaling molecules stimulating growth.

**Methods:** 5 mL of saliva from 4 healthy subjects was collected and centrifuged. The supernatant was removed, pooled and inoculated in SHI media for growth at 37°C in anaerobic conditions for 20 hours. This saliva-spent SHI media was filter-sterilized (0.4 µm), inoculated with isolated subgingival plaque bacteria and placed in a 96-well plate with unspent SHI media and water as controls. The 96-well plate was incubated at 37°C in anaerobic conditions for 20 hours. The plate was then read for OD600 and the drop plate method was used to determine CFU.

**Results:** Despite nutrient depletion by supragingival bacterial growth from a saliva inoculum, this saliva-spent SHI media did not inhibit growth of Gram-negative subgingival species, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Aggregatibacter actinomycetemcomitans*, and *Fusobacterium nucleatum*. Moreover, spent SHI medium strongly supported growth of “bridging” species, *F. nucleatum*.

**Conclusions:** While more work is needed to further standardize and fine-tune the protocol, we cultivated difficult to grow periodontal bacteria in both spent and unspent SHI media. We also successfully developed a protocol for the cultivation and collection of spent SHI media and will now be able to proceed using this model to explore the complex interaction between subgingival and supragingival periodontal bacteria.

Supported by: University of Washington  
Dr. Douglass L. Morell Dentistry Research Fund

31. Hakan Gem  
Oral and Maxillofacial Surgery  
**Differential Expression of  
Cellular Proteins in Malignant versus  
Benign Tumors**

Gem H, Chandra S, Dodson T

**Objectives:** While expression of metabolic proteins have been studied extensively in malignant neoplasms, few studies have investigated metabolic protein expression in benign odontogenic tumors. Hypoxic environments in tumor cores lead to a shift from aerobic to anaerobic cellular metabolism spurring the upregulation of specific metabolic proteins. We examined the expression of three such proteins (GLUT1, LDHA, and MCT4) in various benign tumor samples including myxomas, ameloblastomas, and keratocysts and compared their levels against those in malignant squamous cell carcinomas.

**Methods:** Tumor samples were collected from the NW-BioTrust specimen bank using the criteria that they had grown over 2 centimeters in vivo and no previous treatment such as chemotherapy or radiation therapy had been performed. All tumor specimens had been resected within the last year. Immunohistochemical staining was performed on the specimens specific to intracellular proteins GLUT1, LDHA, and MCT4. Protein expressions were then visualized microscopically for each tumor type and uniquely scored based on the protein being examined. A Fisher exact test was then used to determine if significant differences in protein expression were observed between benign versus malignant tumors.

**Results:** The GLUT1 stains have been processed and are ready with Dr. Oda’s lab to begin analysis. Antibody optimization for LDHA staining has been outsourced to a lab at the Fred Hutchinson Cancer Research Center as is currently underway. Obtaining antibodies for MCT4 has been challenging in terms of whether mouse or rabbit antibodies will be most effective and thus optimization is still pending for this protein.

**Conclusions:** TBD when samples have been optimized and stained fully.

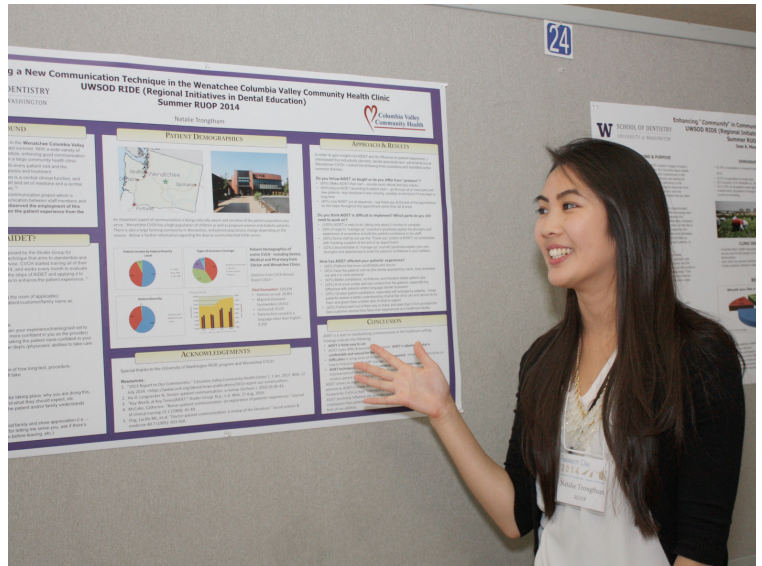
Supported by:

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TL1TR000422

# RURAL/UNDERSERVED OPPORTUNITIES DENTAL PROGRAM (R/UOP) AND COMMUNITY OUTREACH POSTER PRESENTATIONS

The Office of Regional Initiatives in Dental Education (RIDE) University of Washington School of Dentistry, offers first year dental students a 4-week clinical experience in community health care settings in Eastern and Central Washington. The Summer RUOP program is designed to expose dental students to the challenges and rewards of delivering oral health care to rural and underserved populations. Students learn the dynamics of care for the underserved by greeting and seating patients, taking health histories, learning sterilization techniques, taking radiographs, assisting the dentists, placing local anesthesia and rubber dams, and through a host of other duties and responsibilities. Students are encouraged to take part in community-wide dental education events and to learn more about the culture of their Summer RUOP area.

Support for first year dental student RUOPs is provided by the University of Washington School of Dentistry RIDE program. Success of the program is also dependent upon the support of many of our community partners who generously help by providing assistance with housing expenses.



### 32. Arley Medrano **Emergency Room Visits for Dental-Related Problems in Okanogan County**

Medrano A

RIDE (Regional Initiatives in Dental Education)

My project is a comparison of the occurrence of dental-related ER visits in Okanogan County pre and post the expansion of Medicaid to adults. Many individuals turn to the ER for a variety of health care needs, including dental care, when their access to professional dental care is limited. This limitation can be due to many factors including location, hours of operation, or insurance coverage. In an 18-month period in 2008-09, a survey of 53 hospitals within Washington found that residents made more than 23,000 visits to emergency rooms for dental related problems. I was given the opportunity to collect this information while on clinical rotation at Okanogan and Oroville Family Health Dental Clinics, as part of the Rural Underserved Opportunities Program (RUOP). As a part of the Regional Initiatives in Dental Education (RIDE), which exposes dental students to hands-on clinical experiences that included dental assisting and administration of local anesthetic, as well as encourage future practice in Eastern Washington. Working with one of my preceptors I collected medical records/reports from local hospitals within the County to observe incidence of ER visits for various dental care. Subsequently, I compared each year's results at corresponding hospitals and observed any changes after Medicaid expansion (Jan. 1, 2014). Results showed that in a 5-month period between Aug. 2013 and Dec. 2013 forty-three individuals (8.6/month) visited the Mid-Valley ER for dental-related emergencies. After Medicaid expansion only twenty (2.5/month) individuals visited the same ER for dental emergencies in a 7-month period between Jan. 2014 and Aug. 2014. This indicates that the occurrence of dental-related emergencies decreased by over half after the Medicaid expansion at Mid-Valley hospital. The results showed a trend that suggests the Medicaid expansion had direct effect on the decrease in ER visits due to dental problems. Therefore, the expansion was crucial in decreasing dental-emergency visits in the ER.

Supported by: UWSOD RIDE

### 33. Hayley N. Denison **Migrant Farmworker Outreach and Community Health Clinic Partnerships**

Denison H

RIDE (Regional Initiatives in Dental Education)

Migrant farm workers are an essential, but most of the time an unnoticed population. Yet, they are a vital part of Washington State's economy.

The purpose of this project was to find out why there is a disparity of access to care for the migrant farm workers in areas with the presence of a community health clinic. I was given an opportunity this summer through the RIDE program to spend a month at the Columbia Valley Community Health clinic in Wenatchee. During my time I observed a relatively low proportion of migrant farm workers in Wenatchee seek care. Only 30 people out of 150 residing at the Monitor Camp sought and received care. I collaborated with CVCH staff, inquiring patients about individual access to care at multiple locations.

Results show lack of transportation, no insurance, and living out of state as leading hindrances in their access to care. At Sage Bluff only 1 individual from the 22 surveyed had dental insurance and only 1 individual had personal transportation. Another integral component to this project was education. We presented basic oral hygiene to many of the migrant farmer workers.

The results of my project suggest that altering the way care is given and adapting to this specific population would be successful due to their many obstacles. Bringing care to the migrant farmer workers seems ideal. Changing the way care is delivered to this population takes time and effort from the providers. The CVCH is already doing a great service with their continued outreach to educate the migrant farm workers. The community and the economy would not survive without this often overlooked population.

Supported by: UWSOD RIDE

### 34. Shawn Griffith **Utilization of EFDAs and RDHs in Restorations**

Griffith S

RIDE (Regional Initiatives in Dental Education)

In Washington, Expanded Function Dental Auxiliaries (EFDAs) and Dental Hygienists (RDHs) are allowed to restore tooth anatomy/occlusion after the dentist has cleaned the preparation of caries and evaluated the area. These individuals can be established into an expanded function (being utilized solely to restore preparations for the dentist so that the dentist can be available for other procedures that other professions are not legally allowed to perform). The purpose of this experiment was to determine if this practice is truly effective and, if so, how efficient it is at saving time and utilizing available resources.

Dentists, dental hygienists, and EFDAs were individually timed to determine how long it took for a restoration to be completed. In addition, the number of patients seen by a particular dentist based on whether they were utilizing expanded function or not was determined. The number of different procedures performed by the dentist was also recorded to determine exactly what procedures were increasing/decreasing in volume.

Results showed that although dentists took less time on restorations than both EFDAs and dental hygienists, there was an increase in total number of patients seen when the dentist was utilizing an expanded function schedule. Expanded dentists saw an average of 24.14 patients in a day, while dentists that were not utilizing expanded schedules only saw an average of 20.11 patients a day. This increase in patients was seen mostly in operations, allowing more fillings/restorations to be treated in a single day than before EFDAs and RDHs were allowed to perform restorations.

Because of these results, it was determined that there is indeed a significant benefit to the utilization of Expanded function dental auxiliaries and Dental hygienists in expanded function for the effectiveness of a dental practice. Although more time was spent in completing the restoration by RHDs and EFDAs, the dentist was able to see roughly 4 more patients a day, resulting in greater amount of care for patients.

Supported by: UWSOD RIDE

### 35. Rachelle Pope **Amalgam versus Composite Resin Utilization**

Pope R

RIDE (Regional Initiatives in Dental Education)

Today there are many restorative materials available to fill carious lesions. Historically, the silver-mercury alloy amalgam has proven superior in posterior restorations given its strength and durability. Today, composite resin is a competitive alternative to amalgam in posterior restorations, despite its increased technique sensitivity and rate of failure. The general practice trend is to utilize more composite resins, however after participating in a RIDE rotation at the Moses Lake Community Health Center, their data suggested that they tend to utilize a high percentage of amalgams. The goal of this project was to better understand the reason providers were more inclined to utilize amalgam versus composite resin and take that into consideration with patient preferences. Because providers were allowed to choose between composite resin or amalgam, treatment plan information was collected from a select group of providers after completion of restorative procedures. Together, we examined the patient's radiographs and chart to determine their caries risk and data was collected about the size of the restoration, tooth number, family history (when applicable), ethnicity, and translator utilization. Semi-structured interviews were also conducted with providers to better understand decision-making. Results suggest that there are many factors involved in a providers' choice when choosing a posterior restorative material. Providers tended to utilize amalgam more based on longevity and history of prior decay, while composites were used based on size of lesion (small) and the more conservative nature, esthetics, and patient request. Another interesting factor involved may be a patient's preference, based on cultural or ethnic reasons.

Supported by: UWSOD RIDE



36. Kathie Wang, Daniel Estrada  
 Seattle Children's Odessa Brown  
 Children's Clinic  
**Childhood Caries:  
 Exploring Head Start's Role in  
 Risk Reduction**

Wang K, Estrada D, Keith A, Delecki C, Gandara B  
 Community Outreach - Pediatric Dentistry



Dental caries is currently the most common chronic childhood disease, affecting nearly half of all children between ages 2 and 11. The prevalence of childhood caries increases significantly among minority and low-income families, and is further exacerbated by insufficient oral hygiene education and diets high in sugar and refined carbohydrates. Additionally, untreated caries increases risks of systemic disease, preventable emergency room visits, and extensive future treatment, posing a great public health concern.

Seattle Children's Odessa Brown Children's Clinic (OBCC) is a community pediatric clinic in Seattle's Central District that provides needed care for many low-income, high caries risk children. As part of our summer externship at OBCC, we helped provide care to children through preventative and educational means. Focusing on oral hygiene techniques and the importance of nutrition in caries risk reduction, we encouraged proper oral health habits among children and caregivers.

In evaluating our patients' overall oral health, we recognized overlap between our goals to promote pediatric dental health and those of the federally funded Head Start (HS) program. The early education program maintains a critical presence among low-income populations, providing childcare resources that emphasize early learning, health, and family

well-being. HS requires a dental provider document a child's oral health prior to enrollment, and further mandates participants have an established dental home. These measures prompted us to explore HS policies dedicated to reducing caries risk. We found HS utilizes a multifaceted approach at both local and national levels to address crucial factors contributing to oral health disparities. Ranging from active prevention and education, to proper staff training, these strategies may ultimately be highly influential in reducing childhood caries risks among vulnerable populations. This presents the opportunity for future exploration into the outcomes of HS efforts and opens discussion on moving forward with further initiatives to combat childhood caries.

Supported by: Seattle Children's Odessa Brown Children's Clinic

### 37. Lance R. Rhoten **Dietary Habits and Oral Health of Children in Othello, WA**

Rhoten L

RIDE (Regional Initiatives in Dental Education)

Dietary habits such as between meal snack choices of pediatric patients have a significant impact on overall oral health. Among all pediatric patients, it has been observed that ethnic minority groups such as Mexican-American children have a higher prevalence of dental caries when compared to other ethnic groups. The purpose of this project was to investigate dietary habits of Mexican-American children and propose possible contributions that diet may have on the observed elevated caries rate. This project was carried out at a Federally Qualified Health Center (FQHC), the Columbia Basin Health Association (CBHA) dental clinics in Othello, WA, as part of the Rural Initiatives in Dental Education (RIDE) program's Rural Underserved Opportunities Program (RUOP). A survey was administered and data was gathered regarding snack frequency and snack choices. Results of the project made evident that cariogenic items such as juice, candy, cookies, and sweets were most commonly consumed and preferred throughout the day as snacks, and that items like cheese and vegetables were least commonly consumed as snacks of the surveyed population. Given that the commonly consumed foods are cariogenic, this finding supports the notion that diet plays a significant role in the high caries rate of these children. This data implies the importance for providers and healthcare workers to emphasize patient and parent education regarding healthy snack habits and the associated oral health consequences.

Supported by: UWSOD RIDE

### 38. Zach Meyers **Link Between Oral and Systemic Health**

Meyers Z

RIDE (Regional Initiatives in Dental Education)

The link between oral and systemic health is more apparent and extensive than ever was thought in previous decades. It is important that patients understand this link so they can make informed decisions on their oral health and oral hygiene behaviors. Doctor patient communication is key in providing this understanding. The purpose of this project was to evaluate the level of understanding of the Lake Spokane community clinic patients on the link between oral and systemic health. This is important in the Lake Spokane community as it was suspected that the population served by the community clinic I observed at was largely uneducated in the dental health field. This project was part of my summer RUOP. I underwent this RUOP as part of the RIDE program out of Spokane Washington. The RIDE program aims to give students experience in rural and underserved populations in hopes that they will choose to live and work in underserved areas. The project involved verbally asking the patients a few questions to assess their knowledge of the oral systemic health link. The questions were asked in between assistant and doctor time so as not to interfere with normal function of the office. I found patients claimed to believe a link between oral and systemic health existed. However when I asked about a specific disease and oral health in which we know there is a link most patients answered that they didn't believe there was a link. These results suggest that patients at the Lake Spokane Cummings clinic could benefit from education about the link between oral health and systemic health. Particularly specific diseases and how they are connected to oral health.

Supported by: UWSOD RIDE

### 39. Kyle Rowley The Young Edentulous, A Growing Population?

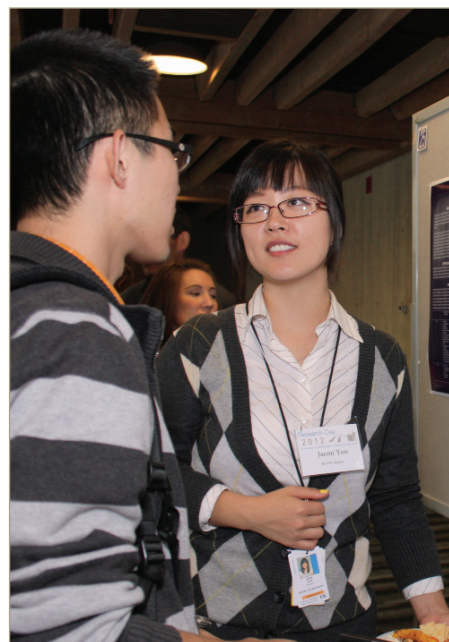
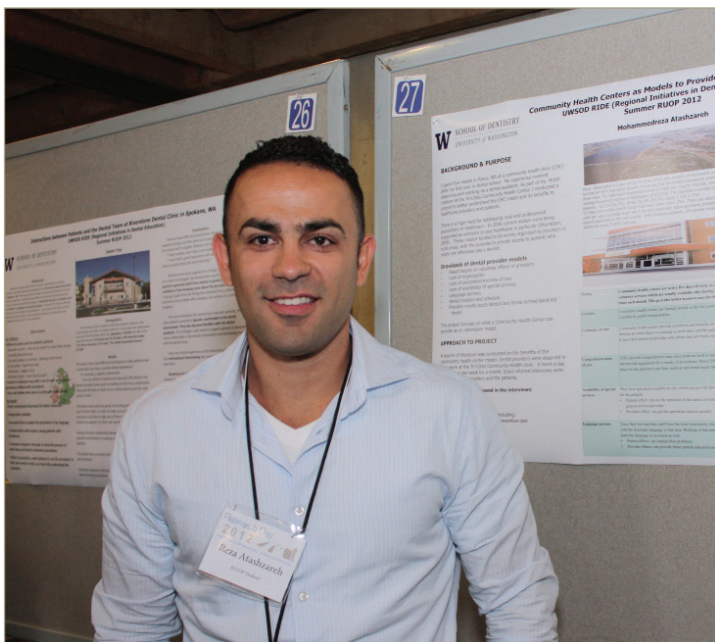
Rowley K

RIDE (Regional Initiatives in Dental Education)

Losing teeth early in life causes many long-term health problems for patients. These problems include bone loss, permanent denture use, discomfort from dentures, fungal diseases caused by unclean dentures, and an overall inability to chew comfortably. Many young patients don't calculate these consequences into their daily oral hygiene decisions. The purpose of this project was to learn more about this demographic of young patients, see how large it is, determine why they exist, and discover preventative solutions. Within the first couple days of my rotation at the NE Unify Dental Clinic in Spokane, WA, I noticed a lot of extractions (not wisdom teeth) on young patients. Volunteering as a dental assistant gave me the opportunity to survey the doctors, patients, and dental team and learn more about these extractions.

Results showed that the community dental clinic in Spokane was performing more than 24% of its extractions on patients under the age of 30. Communication with patients and the dental team showed that the main reasons for this include: lack of oral hygiene and parental education; patients' views on the value of oral health; and misunderstanding of alternative treatments. Data suggests that there is a lack of education of the consequences of being young and edentulous. Parents, school education, and the dental team should all be constant sources of oral hygiene education. With this education, there needs to be a focus on the long term benefits and consequences of proper oral hygiene.

Supported by: UWSOD RIDE





## 40. Alexa Ellingsen Dental Anxiety: Causes & Relievers from A Patient and Provider Perspective

Ellingsen A

RIDE (Regional Initiatives in Dental Education)

In dentistry, it is critical that providers fully understand their patients' concerns and anxiety levels in order to establish a comfortable, trustworthy relationship. By establishing a level of comfort and trust through understanding patients, the best possible patient care can be provided. This project aimed to identify and compare what patients believe to be the most common triggers of dental anxiety, as well as their preferred method of relief with that of what providers believe regarding their patients. At the NEWHP Colville Clinic, a majority of the patient base consists of younger individuals from low income families, making it an ideal location to address dental anxiety. This project was the product of a month long rotation at the NEWHP Colville Clinic. The project involved creating an anonymous survey regarding dental anxiety causes and reliefs for both patients and providers. Results showed that fear relating to getting injections, embarrassment about the condition of their mouth and the sound or feel of the drill are all common top causes amongst both males and females of dental anxiety. To relieve anxiety, the majority of males felt comfortable being talked through the procedure, whereas the majority of females wanted the procedure over with quickly. In comparison, providers ranked the top causes of dental anxiety in their patients as having had a previous bad experience, fear of getting injections and fear of experiencing pain during their visit. In an attempt to relieve anxiety, a majority of providers like to talk the patient through the procedure. My study shows that dental anxiety is a complicated topic and often has multiple causes. It is important to remember that not all patients are the same. As a provider, it is important to identify with your patients in order to provide them with the best dental care possible.

Supported by: UWSOD RIDE

