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RESEARCH REVIEW: HIGHLIGHTS FROM PENN DENTAL MEDICINE 2015 RESEARCH CONFERENCES

ONCE AGAIN, we are pleased to present this special supplement to the *Penn Dental Medicine Journal*. In it are highlights from four research meetings held by Penn Dental Medicine over the last year. In June of this year, Penn Dental Medicine hosted two conferences that brought together leading researchers and clinicians from across the country and around the world — the Penn Periodontal Conference 2015 and the Penn Esthetics Symposium, which also celebrated the 60th Anniversary of our Department of Periodontics. And this May, our faculty and students gathered to share their recent research through the School's annual Faculty Research Retreat and Student Research Day — programs that demonstrated the great depth of research activities by our students and faculty. You will get a sense of the wide range of work presented through a selection of abstracts from each meeting on the pages that follow.

Creating such forums facilitates the exchange of ideas among investigators and helps build new collaborations — a vital part of the School's mission and important to our ongoing research growth and in Penn Dental Medicine's leadership in oral health research. Multidisciplinary research that reaches across schools, across fields of study, and across the globe is the hallmark of Penn as a world-class research institution, and it is our focus as well within Penn Dental Medicine's research enterprise. Whether building collaborations between our own basic and clinical science departments, among colleagues from the other Penn schools, or with other universities throughout the country and around the world, it is this integration of knowledge that advances the science and practice of dental medicine and other fields as well.

The impact of the School's research and scholarship is far reaching and at a level that generates diverse applications. Within 2014, 164 research articles were published by Penn Dental Medicine's 44 standing faculty members. Over the past five years, the number of publications, and most importantly, the number of high-impact publications has more than doubled as we have enhanced the quality of the School's research through faculty recruitment, and will continue to do so. We are also building upon the academic programs that promote research — from the growing interest of our DScD degree, which now has 13 students from the Departments of Periodontics, Endodontics, Orthodontics, and Oral Medicine and our Master's in Oral Biology to our dual-degree options for DMD students (see related story, page 8). And this year, the first student and young investigator recipients of the School's AADR/IADR Travel Awards program presented at the 2015 IADR/AADR/CADR meeting (see page, 49).

Indeed, Penn Dental Medicine is continuing to build on its position as an international leader in the generation of new knowledge and treatment modalities in oral health and beyond.

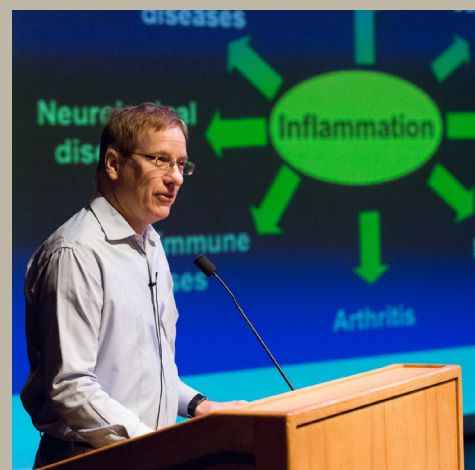


Dana Graves, DDS, DMSc

Vice Dean for Research and Scholarship

Professor and Interim Chair, Department of Periodontics

Director, DScD Program



“Creating such forums [research conferences] facilitates the exchange of ideas among investigators and helps build new collaborations.”



Penn Periodontal Conference 2015: A Forum of Exchange

BRINGING TOGETHER researchers from universities across the country and around the world, the Penn Periodontal Conference 2015 provided a forum to exchange the latest research from the clinical, translational, and basic sciences within periodontology. This international conference, presented by Penn Dental Medicine, is held biennially on the University of Pennsylvania campus and this year was held June 28 through July 2 at the Annenberg Center for the Performing Arts. The inaugural Penn Periodontal Conference, held in 2013, was moved from the Dental School to this same venue because it was over-subscribed, and once again, the Conference drew strong participation.

"We launched this conference two years ago to help fill the void left when the Gordon Conference on Periodontal Diseases was discontinued," says Dr. Dana Graves, Penn Dental Medicine's Vice Dean for Research and Scholarship and Interim Chair of the Dept. of Periodontics, who organized and hosted the event with Dr. Denis Kinane, Morton Amsterdam Dean. "To continue to advance our research and clinical care in periodontics, it is vital to bring together the various

basic and clinical fields of periodontology. Our goal with the Conference is not only to invite highly respected researchers to speak, but also to encourage all attendees to share their work with each other and foster future collaborations. The conference also is important in establishing Penn Dental Medicine's prominence in periodontal research."

The program speakers represented 28 universities from within the United States, Europe, Asia, and South America, addressing topics within the areas of host-microbial interactions; inflammation, immunity, and epigenetics; epidemiology; clinical advances in periodontal disease; resolution of inflammation; and proteomics, biofilms, and novel treatments of periodontal disease (see page 43 for selected abstracts from the presenters). Highlights also included three keynote speakers — "T Cell Therapeutics in Human and Murine Models of Disease" presented by Robert H. Vonderheide, MD, DPhil, Vice Chief for Research, Hematology-Oncology Division, Penn's Perelman School of Medicine; "Anti-Inflammatory Treatment of Chronic Disease" by Ira Tabas, MD, PhD, Richard J. Stock Professor and Vice Chairman of Research,

Department of Medicine, Columbia University, and "The Infectious Etiology of Cancer" by Erle S. Robertson, PhD, Professor of Microbiology, Penn's Perelman School of Medicine, and Tumor Virology Program Leader, Abramson Cancer Center.

Structured to facilitate interaction, the scientific program featured morning and evening sessions, leaving the afternoons open for attendees to view and discuss the poster presentations and share their research with fellow attendees.

"A wealth of knowledge was shared, and the Conference offered many occasions to explore ideas and research collaborations," notes Dr. Graves. "We welcomed postdoctoral researchers and PhD students along with highly accomplished researchers; such a forum is of critical importance to advances in our discipline and to career development. Moreover, internationally renowned researchers from Penn Dental Medicine — Drs. George Hajishengallis, Henry Daniell, Michel Koo, and Songtao Shi — presented their latest findings." The Conference will be held again in the summer of 2017.

PENN PERIO CONFERENCE SELECTED ABSTRACTS

Following is a selection of abstract briefs from the presentations as part of the scientific program at the Penn Periodontal Conference 2015, held June 28 – July 2, 2015.

FGF-2 and Periodontal Regeneration

By Shinya Murakami, D.D.S., Ph.D., Professor and Chair, Dept. of Periodontology, Osaka University, Graduate School of Dentistry

Basic fibroblast growth factor (FGF-2) has received particular attention in the field of regenerative therapy, as it stimulates various stem cells to proliferate while maintaining their multipotency and is a strong inducer of angiogenesis. To assess the possibility of clinically applying FGF-2 for periodontal tissue regeneration, we conducted double-blinded clinical trials, in which the investigational drugs were topically applied to the periodontal tissue defects. As a result, standardized radiographs revealed significantly increased alveolar bone mass in the 0.3%-FGF-2 Group compared to the Placebo Group. Throughout the investigation period, no emergence of any serious adverse effects was identified. These results suggest that topical application of FGF-2 can induce significant regeneration of periodontal tissue in periodontitis patients.

Nano-delivery of Inflammatory Therapeutics

By Steven Little, PhD, Chair, Dept. of Chemical and Petroleum Engineering, University of Pittsburgh

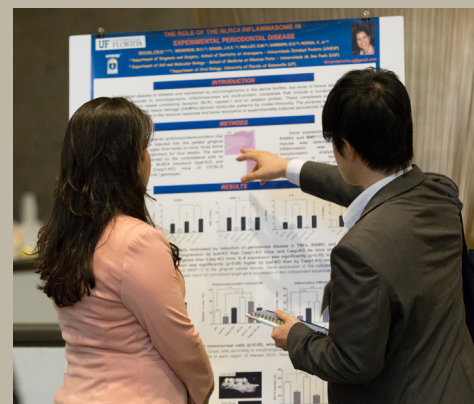
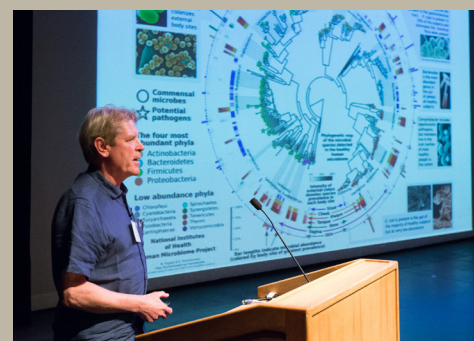
Periodontal disease is initiated by the host's damaging inflammatory response to invasive bacteria. In recent years it has become apparent that periodontal inflammation is reduced by recruitment of regulatory T-lymphocytes (Tregs). We developed a controlled release of a factor that recruits Tregs, CCL22. Following administration of this Treg-recruiting formulation, we observed increases in Tregs in the gingiva and a marked reduction in inflammation and bone resorption. Likewise, we applied the same system to a dog model of periodontitis and also obtained reduced clinical measures of inflammation and reduced bone loss. Thus, by applying slow release CCL22 we can effectively reduce destruction of periodontal tissue.



Introduction to Clinical Advances

By Anton Sculean, PhD, Dept. of Periodontology, University of Bern Switzerland

Recent findings suggest that the administration of short-term (up to 3 days), high dosage antibiotics (Amoxicillin + Metronidazol) in conjunction with nonsurgical therapy may lead to comparable outcomes to those obtained following the conventional one-week antibiotic administration and may minimize side effects that are often associated with one-or-two-week regimens. Furthermore, the combination of non-surgical mechanical therapy and Photodynamic Therapy (PDT), including a combination of Methylene or Toluidine Blue-based staining and low-level laser (670 nm), may result in substantially higher clinical improvements evidenced by probing depth (PD) and/or bleeding on probing (BOP) reductions compared to non-surgical therapy alone in patients with periodontitis. It may also represent a possible alternative treatment in patients with incipient peri-implantitis. Non-surgical mechanical therapy of peri-implantitis with adjunctive repeated application of a diode laser 3x for 30s (settings: 810 nm, 2.5 W and 50 Hz, 10 ms) yielded significant clinical improvements after an observation period of at least two years.



Penn Esthetics Symposium Marks 60th Anniversary of Penn Perio

PENN DENTAL MEDICINE marked the 60th Anniversary of its Department of Periodontics with the Penn Esthetics Symposium, held June 11 – 13, 2015 at Penn's Annenberg Center for the Performing Arts. The program brought together leading clinicians and researchers for discussion on both surgical interventions and restorative management techniques and topics within the field of periodontics.

"With esthetics and the related fields of implantology, tissue regeneration, and biological materials rapidly evolving, our goal was to present perspectives on the scientific basis and clinical decision-making necessary for optimal outcomes," says Dr. Ernesto Lee, Clinical Professor of Periodontics, who organized the symposium along with Dr. Joseph Fiorellini, Professor, Department of Periodontics; and Dr. Myron Nevins, Clinical Professor of Periodontics.

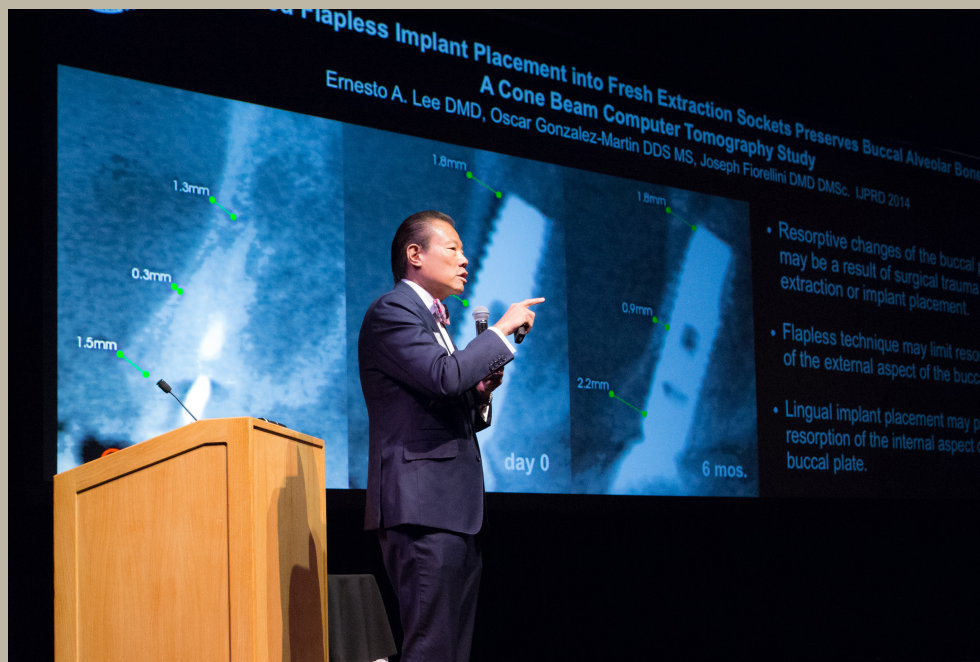
"We developed a program that reflected on the excellence in interdisciplinary therapy, which has remained a central theme in the rich heritage of the Penn periodontics and periodontal prosthesis graduate programs since their inception," states Dr. Lee.

Invited speakers in the area of surgical interventions spoke on mucogingival surgery, bone grafting, and peri-implantitis, while restorative management presentations addressed adhesion, porcelain laminates, single and adjacent implants, and the treatment of

compromised sites (see abstracts/briefs of selected presentations, page 45). The program also featured two corporate forums by Biomet 3i and Morita, highlighting some of the latest tools and technology in the field. Panel discussions were also part of the program, providing an opportunity for attendees to ask questions and contribute to the dialogue.

"The information shared by the speakers as well as through discussion among attendees was invaluable for all in attendance to gauge the current clinical and research trends impacting the practice of periodontics," notes Dr. Fiorellini.

The final day of the program was the Morton Amsterdam Program and Celebration of Life, paying tribute to the career and memory of Dr. Morton Amsterdam (C'43, D'45), recognized by many as the father of periodontal prosthesis and the founder of Penn Dental Medicine's postdoctoral periodontal prosthesis program. The program of speakers included both alumni of the School's periodontics programs and colleagues of Dr. Amsterdam on topics reflecting the influence of Dr. Amsterdam on the fields of periodontics and prosthodontics. The speakers included Drs. D. Walter Cohen (C'47, D'50), Arnold S. Weisgold (GD'65), David A. Garber



(GD'78, D'81), Robert L. Vanarsdall (GD'72), Jeffrey Ganeles (GD'87), Harold S. Baumgarten (D'77, GD'82), Howard P. Fraiman (D'77, GD'93, GD'94), and Ernesto A. Lee (GD'87).

A scholarship fund has been established at Penn Dental Medicine in memory of Dr. Amsterdam. Contributions to the Morton Amsterdam Scholarship Fund can be made payable to the Trustees of the University of Pennsylvania and addressed to Penn Dental Medicine, Office of Development & Alumni Relations, 240 S. 40th Street, Philadelphia, PA 19104.

PENN ESTHETICS PROGRAM HIGHLIGHTS

Following are selected abstract briefs by some of the speakers at the Penn Esthetics Symposium, held June 11 – 13, 2015.

Adjacent Implants

By Joseph Kahn, DDS, MS, Professor, Restorative Dentistry, Loma Linda University School of Dentistry

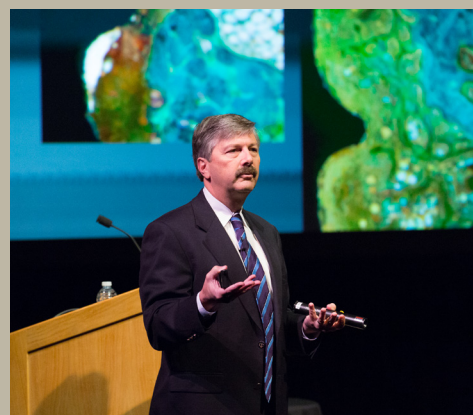
Papilla is dictated by the bone of adjacent teeth for an anterior single implant. This is because the implant platform is placed according to facial bone, making it inevitably more apical than proximal bone. Long-term maintenance of proximal bone coronal to the implant platform is not predictable, causing an infrabony defect development toward the implant and thinning of the adjacent teeth proximal bone over time. Once the adjacent tooth is extracted, proximal bone loss can be expected, followed by papilla loss. This is why papilla loss is common in inter-implant situations, especially when replacing a failing tooth adjacent to an existing restored implant which had been placed more than four to five years. The proximal socket shield procedure has been advocated with short-term success and can be considered as a cautious option.



Peri-Implantitis

By Michael R. Norton, BDS, FDS, RCSEd, Adjunct Professor, Penn Dental Medicine, Dept. of Periodontics

Defining, diagnosing, and managing dental implants with peri-implantitis is a difficult issue facing clinicians today. This presentation sought to define this disease entity and identify the etiology. The question was raised as to whether peri-implantitis is a condition of a primary infective origin or a secondary opportunistic infection subsequent to bone loss caused by other initiating processes, such as iatrogenic dehiscence of the cortical bone, inflammation induced by exogenous materials such as cement, occlusion, or as has recently been proposed, a foreign-body reaction. Risks and complications include wound breakdown and long-term tissue recession, exposing metal to the oral environment. In the alternative approaches of tissue regeneration versus pocket/defect elimination, the former is aimed at maintaining a good esthetic outcome, while the latter provides increased predictability for resolution of infection but results in compromised esthetics. Among the various therapies for peri-implantitis, the use of Erbium YAG laser has been shown to provide an additional tool in the effective decontamination and potential re-sterilization of the implant surface to aid disinfection of the peri-implant defect.



Standing on the Shoulders of Giants: Penn Perio Mentors and Their Influences on Contemporary Practice

By Jeffrey Ganeles, DMD, FACD, GD'87

Patients with severe bone loss, tooth loss, and tooth migration continue to present therapeutic challenges, particularly when fixed restorations are desired. Before implant dentistry was predictable, the principles of periodontal prosthesis were developed in the 1950s – 1970s by Drs. Morton Amsterdam, Leonard Abrams and Arnold Weisgold.

Current application of these principles can be combined with implant dentistry to facilitate treatment and optimize patient outcomes. These points were illustrated through a case presentation of a patient with multiple missing teeth, advanced periodontal bone loss, limited available bone support, severe bite collapse, and poor esthetics. A treatment plan was developed to restore the patient using implants in the maxillary arch, merging the analytic tools and skills of periodontal prosthesis with immediate loading implant dentistry. Critical aspects of care included disease control followed by precise implant placement in critical areas of strategic bone support. An immediate loading protocol was applied to the perio-prosthetic occlusal guidelines.

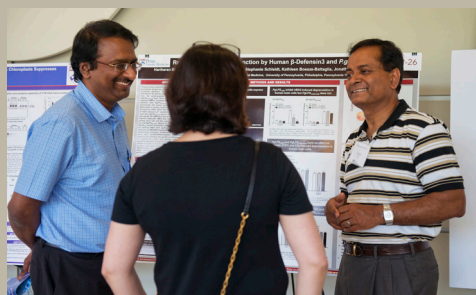
The results showed instant rehabilitation of the patient with minimal procedures, treatment time and an optimal, evidence-based result. The conclusion — combining the guidelines of periodontal prosthesis with state-of-the-art implant dentistry can lead to predictable, beneficial, and efficient treatment, even for the most difficult patients and circumstances.

Research Retreat 2015 Showcases Studies Across Disciplines

On May 29, Penn Dental Medicine held its Research Retreat 2015, bringing together the School's basic science and clinical departments for a day of exchange with colleagues across disciplines. This annual gathering, held once again at Penn Vet's Hill Pavilion, showcases the quality and depth of the School's research enterprise and provides opportunities for information sharing and discussions on future collaborations.

"The goal of our annual retreat is to create an opportunity for our basic science and clinical departments to take time out together — away from their labs, the clinic, and the classroom — to share their current research activities with one another," says Dr. Hyun (Michel) Koo, Professor, Dept. of Orthodontics, and Chair of the Research Retreat Organizing Committee.

The program included faculty presenters selected by the Research Retreat Organizing Committee for their high-impact research over the past year as well as faculty and non-faculty (postdoctoral fellows, graduate students, research investigators) selected by the School's Faculty Senate Research Committee from abstract submissions. This year, there were more than 33 abstracts submitted for consideration. The program featured eight faculty and five non-faculty presentations (see abstract briefs of the winning non-faculty presenters, page 48, who will receive Penn Dental Medicine AADR Travel Grant Awards to attend the AADR/CRD 2016 Annual Meeting in Los Angeles).



Those faculty projects presented included the following (see abstract briefs of three of the presentations, page 47):

Modulatory Roles of Hypoxia on Orofacial Mesenchymal Stem Cells, Dr. Sunday Akintoye, Associate Professor, Dept. of Oral Medicine

Expanding Public Health Experiential Learning in Predoctoral Education, Dr. Joan Gluch, Professor of Clinical Community Oral Health

Mechanisms of Anti-retroviral Drug-induced Changes in Amyloid, Dr. Kelly Jordan-Sciutto, Professor and Chair, Dept. of Pathology

Mesenchymal Stem Cells: From Clinics to Bench-Top and Back, Dr. Songtao Shi, Professor and Chair, Dept. of Anatomy & Cell Biology

Efficacy and Safety of Intranasal K305 in Anesthetizing Maxillary Teeth, Dr. Elliot Hersh, Professor, Dept. of Oral & Maxillofacial Surgery/Pharmacology

Persistent Infection of Oral Mesenchymal Stem Cells by KSHV and Its Implication in Kaposi's Sarcoma Development, Dr. Yan Yuan, Professor, Dept. of Microbiology

B-Cell Stimulatory Cytokines BLyS and APRIL Modulate Bone Loss in Murine Periodontitis, Dr. Jonathan Korostoff, Associate Professor of Periodontics

Shear Bond Strength of Dentin and Enamel of Amelogenesis Imperfecta Mouse Incisors, Dr. Rochelle Lindemeyer, Associate Professor of Pediatric Dentistry

The day's program also featured two guest speakers — Nicholas J.P. Ryba, PhD, who presented the keynote Joseph L. Rabinowitz Memorial Lecture, and Stefan Holst, DMD, PhD. Dr. Ryba is Senior Investigator and Chief of the Taste and Smell Section of NIH/NIDCR. Interested in the basic questions of sensory perception, his group has focused on the chemical senses, taste and smell, as powerful models to explore how sensory signals are detected and distinguished. Dr. Holst is Global Head of Research, Science and Regulatory Affairs for Nobel Biocare Services AG, responsible for developing and executing the research and science strategy to further develop and support the company's portfolio of implants, prosthetics, and regenerative products.

Time was also allotted in the program for attendees to view and discuss the poster presentations on display, which included projects from many of the faculty and non-faculty who submitted abstracts as well as those DMD Penn Dental Medicine students who were the recipients of the 2014 and 2015 Penn Dental Medicine AADR Travel Grant Awards.

"The work represented through all aspects of the retreat was inspiring," says Dr. Koo

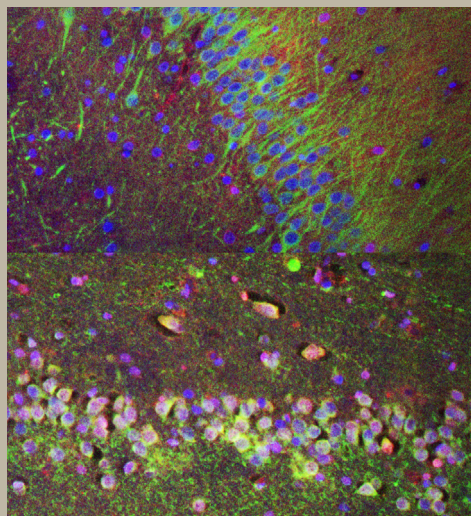
SELECTED RESEARCH RETREAT FACULTY PRESENTER ABSTRACTS

Following are abstract briefs of several of the projects presented by faculty at the School's annual research retreat, held May 29, 2015.

Shear Bond Strength of Dentin and Enamel of Amelogenesis Imperfecta Mouse Incisors

Pugach M.K, Ozer F, Mulmadgi R., Li Y, Suggs C., Wright J.T, Bartlett J.D, Gibson C.W., Lindemeyer R.G.
Presented by Dr. Rochelle Lindemeyer, Associate Professor of Pediatric Dentistry

Amelogenesis imperfecta (AI) is a group of heterogeneous hereditary disorders that affects the structure and appearance of dentin enamel. Adhesive restorations have shown high failure rates in areas of poorly mineralized AI enamel. Patients with AI show varying degrees of success with bonded-resin restorations. Mouse models have been developed to show different forms of AI. The purpose of this study was to investigate adhesion strength of a resin composite bonded with a self-etching bonding system to AI-affected mouse enamel or dentin. Using animal AI models, we concluded that enamel sodium hypochlorite deproteinization of AI-affected enamel did not increase shear bond strength, while removal of the defective enamel allowed optimal dentin bonding.



Mechanisms of Antiretroviral Drug-induced Changes in Amyloid Precursor Protein Processing: Implications for HAND

Gannon, P.J., Akay, C., Yee, A.Y., Briand, L.A., Gelman, B.B., Gao, Y., Haughey, N.J., Zink, M.C., Clements, J.E., Jensen, B.K., Vassar, R., Pierce, R.C., Gill, A.J., Kolson, D.L., Diehl, J.A., Mankowski, J.L., Jordan-Sciutto, K.L.
Presented by Dr. Kelly Jordan-Sciutto, Professor & Chair, Dept. of Pathology

Despite effective viral control by antiretroviral therapy (ART), 30-50% of HIV-infected individuals develop a range of neurocognitive disorders. We hypothesized that HIV protease inhibitors (PI) may be contributing to persistent cellular stress in the CNS, contributing to cognitive dysfunction in HIV patients. Our studies demonstrate that some compounds used in antiretroviral therapy induce damage to neurons, the cell in the brain responsible for function, in laboratory and in animals. Further, our studies suggest that the pathways activated by the HIV PIs result in the activation of an enzyme, B-amyloid convertase 1 (BACE1), implicated in forming amyloid plaques, a major pathologic hallmark of Alzheimer's disease. Finally, inhibition of this process protected neurons from damage and toxicity. These findings suggest that adjunctive therapies targeting these deleterious properties may reduce side effects produced by HIV protease inhibitors.

The B-cell Stimulatory Cytokines BlyS and APRIL are Elevated in Diseased Human Periodontal Tissue and are Required for B-cell-dependent Bone Loss in Experimental Murine Periodontitis

Abe T., AlSarhan M., Benakanakere M.R., Kinane D.F., Cancro M.P., Hajishengallis G., Korostoff J.M.
Presented by Dr. Jonathan Korostoff, Associate Professor of Periodontics

B lymphocytes produce antibodies, can induce the development of cells that degrade bone, and are found in large numbers in tissue affected by periodontitis. We hypothesize that the presence of B cells in periodontitis lesions could be regulated by a proliferation-inducing ligand (APRIL) and B-lymphocyte stimulator (BlyS), two proteins known to influence B-cell survival, proliferation, and maturation. Our data show that there is more APRIL and BlyS produced in natural and experimental periodontitis in humans and mice (vs. healthy controls). The elevated levels of these molecules correlated with increased numbers of B cells/plasma cells. Experimental periodontitis resulted in less bone loss when induced in mice lacking B cells indicating that the bone loss is partially dependent on the presence of B cells. When periodontitis was induced in normal mice, inhibition of the action of APRIL and/or BlyS partially blocked bone loss. This implies that APRIL and BlyS are each required for bone loss that is dependent on the presence of B cells, and may be potential therapeutic targets for treating periodontitis in humans.

RESEARCH RETREAT NON-FACULTY WINNING ABSTRACTS

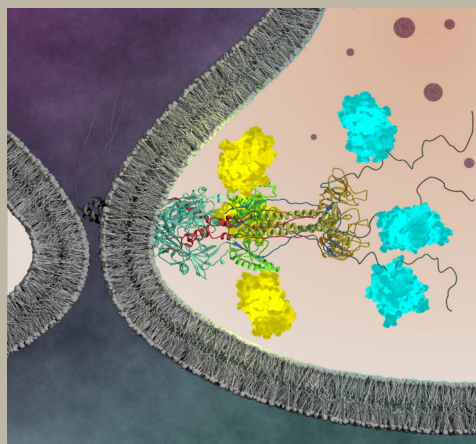
Following are the abstracts of the winning oral presentations by non-faculty at the School's Research Retreat, May 29, 2015.

Visualization of Herpes Simplex Virus Endocytic Entry into Mammalian Cells

Atanasiu D., Cox R.G., Whitbeck J.C., Eisenberg R.J., Cohen G.H.

Doina Atanasiu, PhD, was awarded first place for her presentation of this project from the lab of Dr. Gary Cohen, Professor, Dept. of Microbiology

Herpes simplex virus (HSV) causes human disease, ranging from cold sores to serious infections, some being life-threatening. Our goal is to understand the process of fusion that is necessary for virus entry. Fusion requires HSV glycoproteins such as gB and a receptor. To visualize the dynamics of fusion in live cells, we used fluorescent protein tagging technology. We induced and then watched fusion and content mixing between a cell that contained labeled gB packets and a cell that did not. The cells gave off long, gB containing processes that surrounded adjacent cells, and fused with them to form giant cells with more than one nucleus. The gB packets actively moved during fusion. These exciting results give us a new tool to visualize HSV glycoprotein induced fusion in live cells. Future studies will elucidate whether the viral glycoproteins contribute to a signal given off by the cell during fusion and whether the cell extensions transmit information between cells that participate in fusion.



Activation of Human Mast Cells by Retrocyclin and Protegrin Highlight their Immunomodulatory and Antimicrobial Properties

Gupta K., Kotian A., Subramanian H., Daniell H., Ali H. Akhil Kotian, a PhD candidate from the lab of Dr. Henry Daniell, Professor & Interim Chair, Dept. of Biochemistry, tied for second place for his presentation of this project, conducted in the labs of Dr. Daniell and Dr. Hydar Ali, Professor, Dept. of Pathology

In the U.S., approximately 2 million people are infected by drug-resistant pathogens each year, and nearly 23,000 die, thereby increasing the need for novel antibiotics. Two antimicrobial peptides (AMPs), Retrocyclin (RC101, RC100) and Protegrin (PG1), are ideal for killing drug-resistant pathogens. We report a novel finding that Human Mast Cells (HMCs), important in host defense and wound healing, are activated by chemically synthesized RC-100 and PG-1. However, chemical synthesis of these peptides is prohibitively expensive and inadequate modifications may adversely affect their antimicrobial function. Green fluorescent protein (GFP)-tagged RC-101 (an analog of RC-100) and PG-1 synthesized in the chloroplasts of plant cells are potent both in activation of HMCs and in killing microbes. This novel feature of AMPs to activate host defense/wound healing expands their clinical potential beyond their antimicrobial properties. The high-level protein production of the chloroplast system is extremely cost effective and should facilitate their advancement to the clinic.



Biofilm Elimination and Caries Prevention Using Biomimetic Nanoparticles

Gao L., Liu Y., Li Y., Kim D., Hwang G., Koo H. Lizeng Gao, PhD, tied for second place for his presentation of this project, conducted in the lab of Dr. Hyun (Michel) Koo, Dept. of Orthodontics

There are no clinically effective chemical modalities to disrupt oral biofilms and virulence expression despite the high prevalence (>90%) of biofilm-related oral diseases, such as dental caries, resulting in \$81 billion expenditures annually in the U.S. Treating cariogenic oral biofilms is a three-fold challenge: drugs often fail to kill the clusters of bacteria that are protected by the exopolysaccharide (EPS) matrix; bacteria encapsulated within the matrix create highly acidic microenvironments; and topically applied agents are not effectively retained on tooth surfaces or within the biofilm due to rapid clearance in the mouth. Thus, new approaches should effectively disrupt the matrix and kill the embedded bacteria at acidic pH, where pathogenic bacteria prosper and actively develop biofilms. We developed new antibiofilm nanoparticles that are activated at acidic pH, and capable of eradicating caries-causing biofilms. It can rapidly kill the bacterial pathogens embedded within biofilms, while preventing the onset of dental caries disease in vivo. Our nano-therapeutic approach has broad applicability, as biofilms are associated with many other infectious diseases as well as industry-related issues.

Penn Dental Travel Grant Awardees Present at 2015 IADR/AADR/CADR

Through Penn Dental Medicine's AADR Travel Awards, ten DMD students and two junior researchers took their research to an international stage, presenting at the 2015 IADR/AADR/CADR Annual Meeting, held in Boston, March 11-14, 2015. This group was the first round of recipients of the School's AADR Travel Awards, a new initiative launched last year to advance ongoing research and leadership for junior researchers and students. Following are the projects they presented in either poster or oral presentations.

DMD Student Projects

Hypoxia Sensitizes Irradiated Bone Mesenchymal Stem Cells to Apoptosis

Presented by Mark Guevarra (D'16);
Preceptor: Dr. Sunday O. Akintoye,
Associate Professor, Dept. of Oral Medicine

Bisphosphonate-Mediated Endoplasmic Reticulum Stress Response in Human Mesenchymal Stem Cells

Presented by Meghan Harley (D'17);
Preceptor: Dr. Sunday O. Akintoye,
Associate Professor, Dept. of Oral Medicine

Diabetes Reduces Mesenchymal Stem Cells during Bone Formation through TNF/Foxo1

Presented (oral presentation) by Kang Ko (D'15);
Preceptor: Dr. Dana Graves, Professor and
Interim Chair, Dept. of Periodontics

Effect of Local Growth Factors on the Masseter Muscle and Craniofacial Bone Growth in Mice

Presented by Laura Koo Min Chee (D'16);
Preceptor: Dr. Elisabeth Barton, former
Associate Professor, Dept. of Anatomy & Cell
Biology

Fracture Mechanics of Self-Etch Adhesives Supplemented with PVM/MA and Triclosan

Presented by Joosang Lee (D'16);
Preceptor: Dr. Francis Mante, Professor,
Dept. of Preventive & Restorative Sciences

High Glucose Preconditioning Enhances Immunomodulatory Effects of Gmscs on Macrophages

Presented by Kevin Lin (D'16);
Preceptor: Dr. Anh Le, Chair and Norman
Vine Endowed Professor of Oral Rehabilitation,
Dept. of Oral & Maxillofacial Surgery

Effect of Surfactant on Formation of Hydroxy Apatite in Ceramir Cement

Presented by Ali Abdul Majeed (D'16);
Preceptor: Dr. Francis Mante, Professor,
Dept. of Preventive & Restorative Sciences

Analysis of GAR1 and the DNA Damage Response

Presented by Alexander Margolis (D'16);
Preceptor: Dr. Faizan Alawi, Associate
Professor of Pathology

Dyskerin Depletion Triggers Cellular Senescence

Presented by Maral Mobasher (D'15);
Preceptor: Dr. Faizan Alawi, Associate
Professor of Pathology

The Role of MMP-13 in Primary Myoblast Migration and Differentiation

Presented by Boshi Zhang (D'16);
Preceptor: Dr. Elisabeth Barton, former
Associate Professor, Dept. of Anatomy &
Cell Biology

Junior Researcher Projects

MFG-E8 Homeostatically Regulates Inflammatory Bone Loss In vivo

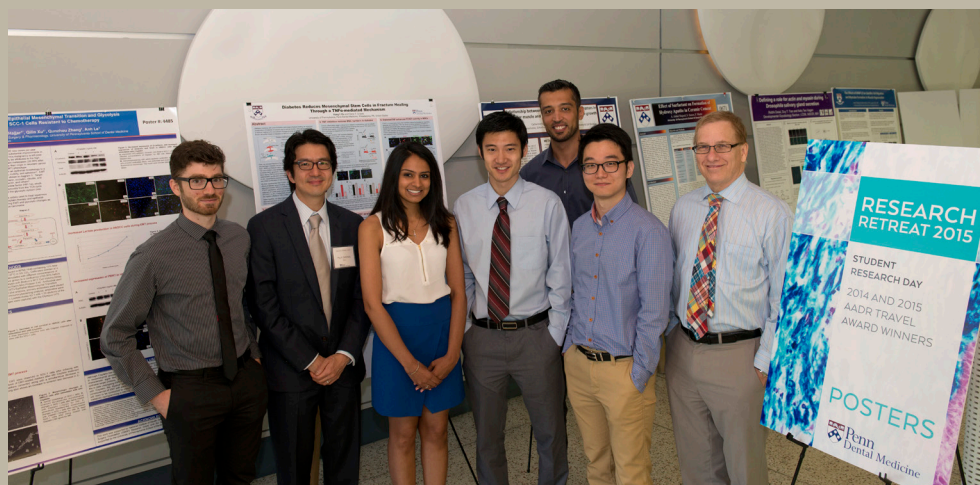
Toshiharu Abe, Dept. of Microbiology

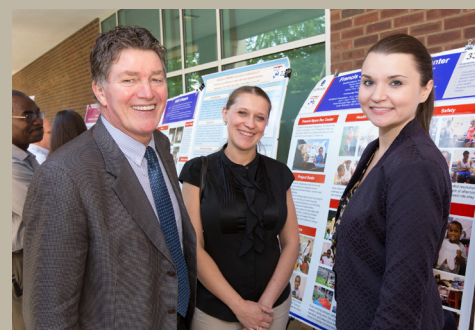
The Mechanical Properties of Streptococcus mutans Biofilms to External Forces

Geelsu Hwang, Dept. of Orthodontics

The 2015 Penn Dental Medicine AADR Travel Awards recipients were selected at the School's 2015 Student Research Day and the 2015 Research Retreat, both held in May; they will present their work at the 2016 AADR/CADR Annual Meeting & Exhibition in Los Angeles, March 16-19, 2016

"The AADR and its joint meetings with the IADR and CADR bring together the top dental researchers on all levels from around the world," says Dr. Michel Koo, Chair of the Penn Dental Medicine AADR Travel Awards Committee, "and it provides a great opportunity for our students and junior researchers to interact with investigators across disciplines and continents."





Research Day Highlights Diversity of Student Projects

PENN DENTAL MEDICINE turned the spotlight on the broad range of research projects conducted by DMD students over the 2014–2015 academic year with its annual Student Research Day, held May 14, 2015 in the School's Fonseca Gardens. Students shared their research activities with the Penn Dental Medicine community through an afternoon of poster presentations. A total of 93 posters were presented, featuring the work of students within the Vernon J. Brightman Research Society, who participated in the School's Summer Research Program; those who took part in the community-based Bridging the Gaps externship; and those students in the School's honors degree programs in research, community health, clinical care, oral medicine, and dentistry for radiological sciences.

"This day showcases the activities of our students in advancing the profession by gaining new knowledge as it relates to delivering clinical care, radiology, medically complex cases, community outreach, and the laboratory, reinforcing that the crown jewel of

Penn Dental Medicine has always been and continues to be our student body," says Dr. Kathleen Boesze-Battaglia, Professor, Department of Biochemistry and Director of the research honors program. Student members of the Vernon Brightman Research Society organized Student Research Day.

The posters from the School's Summer Research Program and Bridging the Gaps were judged by a team of independent faculty members. This year's winners include the following (see pages 51 and 52, for abstract briefs on their projects):

SUMMER RESEARCH PROGRAM

First place: Souren Hajjar (D'17);

Second place: Catherine Campbell (D'17);

Third place: Yoojin Rhee (D'17).

BRIDGING THE GAPS

First place: Brittany Gragg (D'17);

Second place: Abby Yavorek (D'17);

Third place: a tie between Sierra Van Der Dries (D'17) and the project of Jasmine Mohandesi (D'17) and Corey Toscano (D'17).

Awards were also presented for excellence in radiology to students Betty Yip (D'15), Amy Patel (D'15), and Caroline Heidt (D'15).

In addition, ten students, including the three winners of the Summer Research Program, were selected to receive Penn Dental Medicine AADR Travel Awards, which will enable them to attend and present their research at the AADR/CDR Annual Meeting in Los Angeles in March 2016.

All students presenting a poster as part of Student Research Day also submitted an abstract for inclusion in an abstract book, viewable online at www.dental.upenn.edu/StudentResearchDay2015.

"The Penn Dental Medicine research community is proud to have such accomplished students representing our School's research enterprise through Student Research Day," adds Dr. Joseph DiRienzo, Assistant Dean for Student Research and Director of the Summer Research Program. "Among all the participants, the quality of work was exceptional."

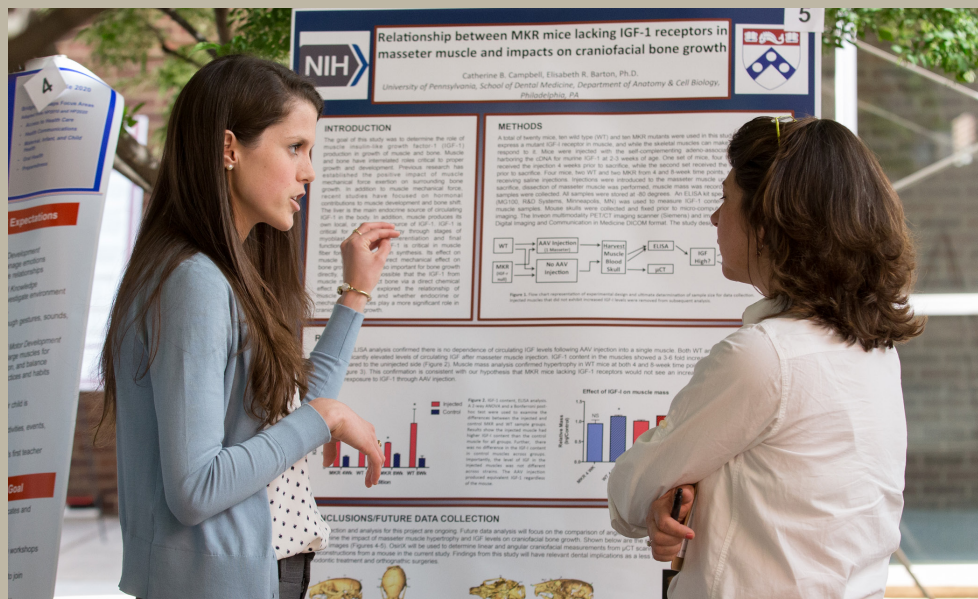
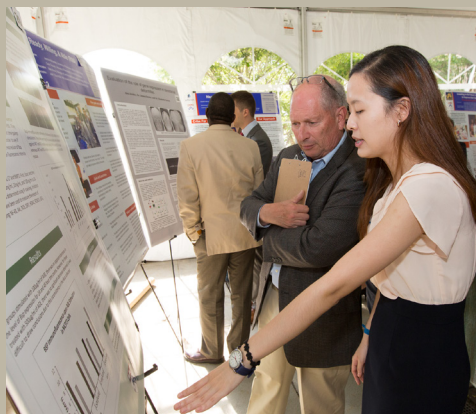
SUMMER RESEARCH PROGRAM WINNING ABSTRACTS

Following are abstract briefs of the winning poster presentations by students participating in the 2014 Summer Research Program, awarded at the 2015 Student Research Day, May 14, 2015.

Cisplatin Induced Epithelial Mesenchymal Transition and Glycolysis Render SCC-1 Cells Resistant to Chemotherapy

Souren Hajjar (D'17) was awarded first place for this study, conducted with preceptor, Dr. Anh Le, Professor, Dept. of Oral & Maxillofacial Surgery & Pharmacology

Squamous cell carcinoma of the head and neck (HNSCC) has an incidence of 500,000 new cases per year globally and is the most frequent malignant tumor of the head and neck. Despite substantial improvements in treatment of HNSCC, the prognosis of this malignancy is still poor with the five-year survival rate not changed for decades. The poor survival can partly be attributed to the high frequency of locoregional recurrence (30–40% after standard treatment) and distant metastases (20–30% after standard treatment). Recurrent tumors are often therapy-resistant and may have their origin in resistant cancer stem cells (CSCs) or in tumor cells with an epithelial-mesenchymal transition (EMT) phenotype. Cisplatin, an alkylating-like agent causing DNA crosslinking, therapy is widely used to treat squamous cell carcinoma. This research project has data supporting EMT and glycolytic changes as a potential pathway for Cisplatin drug resistance for in vitro head and neck squamous carcinoma.



Relationship between MKR Mice Lacking IGF-1 Receptors in Masseter Muscle and Impacts on Craniofacial Bone Growth

Catherine Campbell (D'17) was awarded second place for this study, conducted with preceptor, Dr. Elisabeth Barton, former Associate Professor, Dept. of Anatomy & Cell Biology

Muscle and bone interact through mechanical forces between both tissues that modulate growth. However, there are also chemical factors that when secreted also affect growth. This project tested the differential endocrine and mechanical influences of muscle on craniofacial bone growth. Specifically, we used viral-mediated gene transfer to increase expression of insulin-like growth factor-I (IGF-I) locally in mouse muscle. Muscles secreted IGF-I and increased muscle mass, imposing both chemical and mechanical effects on bone. However, a subset of mice had a genetic blockade of IGF-I receptors in muscle, preventing muscle growth. Thus, there was a chemical effect, but no mechanical effect on bone. Results supported a local boost of IGF-I without altering circulating levels or muscle mass in the receptor-deficient mice. Further study will determine effects on the craniofacial skeleton. Findings from this study may lead to development of less invasive or complementary procedures to orthodontic treatment and orthognathic surgeries.

The Effect of Depression on Expression of the Cell Cycle Protein E2F1 in the Central Nervous System

Yoojin Rhee (D'17) was awarded third place for this study, conducted with preceptor Dr. Kelly Jordan-Sciutto, Professor, Dept. of Pathology

Major depressive disorder is a debilitating chronic condition, affecting about 6.7% of adults in the United States each year. The numerous etiologic factors of depression—likely a combination of genetic, psychological, environmental, and biological factors — can make it difficult to appropriately diagnose and treat depression. While the molecular mechanisms of depression are not clear, there are numerous studies demonstrating a high co-occurrence of neurodegenerative disorders and depression. Importantly, neurodegenerative disorders that may present with depression, such as Alzheimer's and Parkinson's diseases, share several common pathologic features, including oxidative damage, synaptodendritic loss, and neuroinflammation. In addition, they share increased immunoreactivity for two cell-cycle transcriptional regulators — hyperphosphorylated Retinoblastoma Susceptibility gene product (ppRb) and the E2F1 transcription factor, both of which play a role in activating gene expression necessary for normal cell-cycle progression. Results from the study suggest, however, that in depression, different molecular mechanisms (other than those observed in other neurodegenerative diseases) are at play that lead to altered cell-cycle protein expression.

BRIDGING THE GAPS PROJECT WINNERS

Following are abstract briefs of the winning poster presentations by students participating in the 2014 Bridging the Gaps community externship program, awarded at the 2015 Student Research Day, May 14, 2015.

Promoting Positive Oral Health Habits

Brittany Gragg (D'17) was awarded first prize for her project at Sayre Health Center with Kelly Kowalchuk, Penn's School of Social Policy and Practice

Gragg and Kowalchuk worked to raise oral health awareness and to create better access to dental care in the community served by Sayre Health Center in West Philadelphia. They developed an oral health activity book and curriculum, making educational presentations at day care centers and summer camps in the West Philadelphia community served by Sayre. Following their presentation, children were given the oral health activity book, oral hygiene products, and parent information brochures in an effort to reinforce healthy habits at home. The goal of the project was to not only educate the children, but also educate parents about the importance of their family's oral health.

From Tots to Flowerpots: Summer Camp at Francis Myers

Abby Yavorek (D'17) was awarded second prize for her project at Francis J. Myers Recreation Center with Kathlyn York, Penn's School of Social Policy and Practice; Tawnee Sparling, Perelman School of Medicine; and Robert Allen, Jefferson Medical College

Yavorek, along with York, Sparling, and Allen, collaborated with community members to develop a health curriculum for the Center's youth summer camp. The interns implemented health and wellness activities to promote healthy lifestyles and habits with the campers. Each morning the team designed fitness stations to encourage cardiovascular health, and each afternoon classroom activities were planned to further advance the children's understanding of nutrition, wellness, and safety.



Ready, Willing and Able

Corey Toscano (D'17) and Jasmine Mohandesi (D'17) tied for third place for their project at Ready, Willing, and Able

Toscano and Mohandesi worked with staff at the transitional housing center to provide various educational seminars, both dental and health related, to residents. Weekly, they gave presentations to the large group of nearly 70 residents on topics including dental health, heart health, nutrition, and smoking cessation. The two also planned an educational field trip to the iconic Mutter Museum. In addition, Toscano and Mahandesi worked with kitchen staff to develop a healthier menu for the residents, while also holding daily office hours to work with residents individually.

Earth's Keepers: Urban Farming in Southwest Philadelphia

Sierra van den Dries (D'17) tied for third place for her project at Earth's Keepers with Roseanne Day, Penn Medicine; and Caitlin Chin, Penn School of Social Policy and Practice

Van den Dries, Day, and Chin worked alongside teens to grow, harvest, and sell their own produce at this organic urban garden in Southwest Philadelphia. In an effort to build awareness of the importance of fresh produce, the three interns organized a "Night at the Urban Farm." The students worked with the teens employed at the farm to promote the event in the community, obtain donations from local businesses, and even have local musicians provide entertainment. Many families came out to enjoy everything the farm offers the community and were able to buy organic produce at low cost. The goal is for this to continue to be an annual event. In addition, throughout the summer, the interns taught lessons pertaining to dental, cardiovascular, and mental health to the teens working at the farm.