INTRODUCTION
Founded in 1878, the University of Pennsylvania’s School of Dental Medicine is a private, Ivy League institution with a history deeply rooted in advancing precedents in dental education, research and patient care. At Penn Dental Medicine, the practice of dentistry is taught in a scientific environment as a specialty of medicine and under the multidisciplinary umbrella of the University of Pennsylvania.

ACADEMIC DEPARTMENTS

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<th>Anatomy &amp; Cell Biology</th>
<th>Oral Surgery &amp; Pharmacology</th>
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<td>Endodontics</td>
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<td>Microbiology</td>
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<td>Oral Medicine</td>
<td>Preventive &amp; Restorative Sciences</td>
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LEADERSHIP: Morton Amsterdam Dean Denis F. Kinane, BDS, PhD

ANNUAL BUDGET: $74.6 Million (FY12)

TOTAL RESEARCH SUPPORT: $13.5 Million (FY12)

NIH RESEARCH SUPPORT: $12.5 Million (FY12)

NIH DENTAL SCHOOL RANK: 7th Place in Extramural Support from NIH (FY12)

PEER-REVIEWED PUBLICATIONS: 160 Journal Articles (FY12)

RESEARCH OVERVIEW
As members of one of the world’s leading biomedical research communities, faculty from Penn Dental Medicine actively pursue interdisciplinary collaborations to advance the practice of dentistry. The University of Pennsylvania has top-ranked Schools in each of the health professions—Dental Medicine, Medicine, Nursing and Veterinary Medicine—located on a single, contiguous campus, as well as renowned Departments in Materials Sciences and Bioengineering (School of Engineering) and the basic sciences (School of Arts & Sciences). Interdisciplinary scholarship and translational research are hallmarks of the University and significantly enhance Penn Dental Medicine’s research enterprise.

Penn Dental Medicine places a high priority on research as it is a central component of excellence in instruction and patient care. With its own basic science faculty (unusual among dental schools nationwide), the School’s research enterprise is broad and encompasses many areas of contemporary biomedical investigation with emphasis on both basic and clinical scientific research.
Research within the School focuses on the structures and functions of tissues and fluids and microbial flora in the oral cavity. Investigations range from oral microbiology and virology, inflammation and immunity, tooth development, mucosal disease, salivary gland disease, orofacial pain and the use of analgesics and sedatives, to the cellular biology of connective tissues and bone, the application of state-of-the-art dental materials and the causes and effects of periodontal disease. Collectively, Penn Dental Medicine’s research enterprise spans scientific disciplines to translate new knowledge into clinical therapies that expand our understanding of oral diseases and advance patient care.

RESEARCH PROGRAMS
The following section is an overview of Penn Dental Medicine’s leading research programs.

PERIODONTAL DISEASE
Investigators pursue novel therapeutic approaches to both treat and prevent this persistent disease.

Dr. George Hajishengallis investigates the use of the DEL-1 glycoprotein to prevent and treat the onset of the disease through regulation of the inflammatory immune response.

Dr. Dana Graves explores the molecular mechanisms by which inflammation induces periodontal disease, interferes with bone formation and impairs fracture healing.

Dr. Denis Kinane & Dr. Joseph Fiorellini employ host-derived diagnostic markers related to soft tissue destruction and bone degradation induced by periodontitis.

Dr. Bruce Shenker investigates the use of a bacterial immunotoxin as a pharmacologic agent for treating cancer and inflammatory disorders like peridontitis.

Dr. Joseph Fiorellini uses molecular approaches for regrowing damaged tissue via regenerative periodontal therapy.

ORAL MUCOSAL DISEASES & BONE DISORDERS
Investigators specialize in treating oral mucosal and bone and tissue disorders, especially those induced and/or exacerbated by conventional cancer therapies.

Dr. Anh Le investigates the use of human gingival-derived mesenchymal stem cells (GMSC) to treat oral mucositis induced by chemotherapy. She is also investigating the use of these stem cells to treat bisphosphonate-related osteonecrosis of the jaw (BRONJ).

Dr. Sunday Akintoye & Dr. Elliot Hersh examine how bisphosphonate drugs negatively affect bone density and impair oral health.

Dr. Thomas Sollecito develops novel oral drug delivery systems and mucoadhesive products for the treatment of mucosal disorders. He is also creating new treatment modalities for precancerous oral lesions, including leukoplakia and lichen planus/lichenoid mucositis.
Dr. Eric Stoopler treats plasma cell disorders, multiple myeloma and oral mucosal toxicities caused by melphalan, a common chemotherapeutic agent.

**OROFACIAL PAIN**
Penn Dental Medicine is a pioneer in the field of complex dental pain disorders, ranging from TMD/TMJ, orofacial neuralgias and neuropathic pain. In 2012, Penn was designated by the NIH as a National Center of Excellence in Pain Education (in collaboration with Penn’s Schools of Medicine, Dental Medicine & Nursing).

Dr. Elliot Hersh is an expert in dental pain models and the pharmacologic management of oral pain. He has directed pivotal studies which led to FDA approval of myriad analgesic and anesthetic agents. He also develops guidelines for postsurgical pain, efficacy and tolerability and dose-ranging studies.

**ADVANCED DENTAL MATERIALS & DEVICES**
The School regularly conducts industry-funded laboratory and clinical trials on advanced dental adhesives, cements, restorative and impression materials, biomaterials, advanced coatings, surface treatments and ceramics and employs advanced CAD/CAM technology.

Dr. Markus Blatz investigates the clinical performance, efficacy and bond strength of new adhesives systems; the dimensional behavior and fracture tolerance of novel materials; and the biological behavior (cytotoxicity, bacterial adhesion) of restorative materials.

Dr. Francis Mante explores the use of biomaterials to restore and replace teeth, elastomeric monomers to strengthen dental composites, and novel materials with antimicrobial properties to prevent secondary caries and infection.

Dr. Fusun Ozer employs new adhesive materials to increase the longevity of resin fillings and the use of resin adhesives to promote the healing of pulp tissue under deep cavities.

Dr. Sunday Akintoye studies biomimetic, calcium-silicate cements that support the differentiation of orofacial mesenchymal stem cells. He also uses beta-catenin to regenerate teeth.

Dr. Syngcuk Kim investigates root end filling materials with osteogenic properties to regenerate periapical bone and biomimetic mineralization and biceramic materials for root repair.

Dr. Kenneth Kent employs drag-reducing, anti-fouling coatings on the exposed components of implant restorations to reduce surface microbial colonization and improve oral hygiene.

Dr. Joseph Fiorellini explores the osseointegration of oral devices and implants, incorporating growth factors to regenerate structure and small molecule signaling and 3-D scaffold development to promote regeneration.
ORAL & SYSTEMIC HEALTH
Penn Dental Medicine recognizes that oral health complications are often implicitly linked to systemic health.

Dr. Marjorie Jeffcoat leads a multi-center, industry-funded trial to assess the effect of advanced daily oral hygiene in the first and second trimesters on gingivitis and birth outcomes.

Dr. Dana Graves explores the link between diabetes and complications that affect bone formation, fracture repair, periodontal disease and soft tissue healing.

Dr. Dana Graves & Dr. Joseph Fiorellini are testing an experimental, biodegradable polymeric pro-drug (NSAID) to reduce inflammation, eliminate bacteria and promote/accelerate bone formation in diabetic patients.

Dr. Denis Kinane investigates the linkages between oral health, diabetes and cardiovascular disease, including inflammation, immunity, microbial pathogenesis and genetics.

PATIENT POPULATION
The School performs over 157,000 procedures annually through its network of ten teaching clinics conveniently located in the Philadelphia metropolitan region. Penn Dental Medicine has unique access to a large and diverse patient population, including medically complex patients (patients with HIV/AIDS, cancer, heart disease) and is an ideal partner for a range of clinical studies. The following table summarizes the most common conditions treated in Penn Dental Medicine’s specialty clinics:

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<th>Acute Dental Pain</th>
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<td>TMD/TMJ</td>
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<td>Chronic Inflammatory Disease</td>
<td>Burning Mouth</td>
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<td>Lichen Planus</td>
<td>Chronic, non-dental, Orofacial Pain</td>
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<td>Cosmetic &amp; Esthetic Restorations</td>
<td>Candidal/Yeast Infections</td>
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<td>Implants</td>
<td>Bisphosphonate-Related Osteonecrosis of Jaw</td>
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<td>Mucositis</td>
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<tr>
<td>Oral Ulcers/Cankersores</td>
<td>Periodontal Disease</td>
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