The Dows Institute for Dental Research
Oral health research drives innovation by our ability to understand basic, translational and clinical issues, which results in better patient care.

Dental research at the College of Dentistry has contributed to innovations across the spectrum of diseases and oral health prevention. Our research programs reflect these efforts in five areas: Soft Tissue and Oral Cancer; Cariology & Microbiology; Craniofacial Anomalies; Biomaterials, Bone & Tissue Engineering; and Epidemiology, Behavior, Health Policy and Outcomes. These research programs are complimented by collaborative programs in clinical research though our NIH-supported Craniofacial Clinical Research Center and by the excellent support provided by our Biostatistics and Research Design unit. To further these efforts, an intensive program to support our research infrastructure, including the renovation of the first- and fourth-floor laboratory spaces, is ongoing. Dental research is vital to the future of our profession. Understanding the basic mechanisms of disease and its prevention are fundamental to providing the very best in patient care.
Caries research explores factors responsible for dental caries, the disease process from early dimineralization to cavitation, and methods to prevent the disease. In 1975, The University of Iowa was the first U.S. university to develop a cariology division that integrated immunology, histopathology, and epidemiology with an emphasis in root caries.

In 1984, the UI College of Dentistry was one of three cariology centers in the U.S. to receive a NIDCR Specialized Cariology Center grant. This grant was later awarded again in 1994.

In the early days of Dows research, caries research included evaluating the extent of dental caries in extracted teeth. Today, quantitative light fluorescence (QLF) can detect demineralized areas of a tooth, known as white spot lesions, which have not yet progressed to the cavitated stage. With the use of topical fluoride applications and improved oral hygiene in patients, it is possible not only to avoid cavitation but also remineralize dental enamel.

† Dean Donald J. Galagan (1966-1973) includes a dedicated research space in the new dental science building’s fourth floor of the north building. The first researchers include:

- Dr. Ulf L. Karlsson, in Pediatric Dentistry, conducts neuroanatomical research related to pain.
- Dr. James S. Wefel, who joins Pediatric Dentistry, examines the mechanisms of action of fluorides and development of new preventive agents.
- Dr. Charles Kremenak, in Orthodontics, conducts cleft palate research in animal models.
- Dr. Ulf L. Karlsson, in Oral Biology, designs and implements the new research space at the College of Dentistry.
- Dr. Klaus Nuki, in Oral Biology, receives a National Institute of Dental and Craniofacial Research (NIDCR) grant for determining fluoride content of tooth enamel.
- Dr. Barry Rittman is placed in charge of the technical operations of the laboratory research area.
- Dr. Ronald L. Ettinger, who joins Oral Biology and Prosthodontics, is interested in research related to aging, the oral mucosa, and dental care of the elderly.
- Dr. Stephen Wei, in Pediatric Dentistry, receives a National Institute of Dental and Craniofacial Research (NIDCR) grant for determining fluoride content of tooth enamel.
In current microbiology research, recent projects are investigating mechanisms of pathogenicity and the physiology of oral microorganisms in caries in Native American populations. This includes studies of the genotypes of *Streptococcus mutans* associated with severe childhood caries in American Indian children, transmission of specific bacterial genotypes from mother to child, root canal infections and the effects of antimicrobials on oral bacteria. Research also examines how the glucan-binding proteins synthesized by *Streptococcus mutans* contribute to the development of the plaque biofilm and, ultimately, dental caries.

Dr. Charles Sabiston, in Periodontics, establishes a microbiology program to study oral anaerobic bacteria associated with periodontal disease.

Dr. Christopher A. Squier joins Oral Pathology, Radiology, and Medicine and the dental research program.

Dr. Charles Kremenak, Orthodontics and Otolaryngology, becomes co-principal investigator with Dr. Hughlett L. Morris, Otolaryngology and Speech Pathology, on the longitudinal cleft palate research program. His research seeks to improve cleft palate repair using an animal model.

Dr. Ian Mackenzie receives an NIDCR grant to study the effect of chronic dietary deficiencies on oral soft tissues in an animal model.

Sutherland and Judith Dows make a 10-year pledge of support to help establish the Dows Institute for Dental Research, in memory of Sutherland Dows’ mother, Frances Dows.

Dr. Leon Silverstone joins Dows and Pediatric Dentistry and becomes head of the Division of Cariology. His research includes a novel *in vitro* model to simulate tooth decay.

Dr. Brian Clarkson, Dows and Pediatric Dentistry, joins the Division of Cariology.

Dr. Dorothy J. Rowe joins the dental hygiene program faculty. She studies mechanisms of alveolar bone loss in periodontal disease.
**SOFT TISSUE AND ORAL CANCER**

The program examines the response of the lining of the mouth and associated skin to environmental factors, local and systemic disease, the aging process, and traumatic injury. Such responses have important implications for preventing or treating periodontal disease, oral cancer, and other soft tissue diseases. Associated studies of the action of tobacco components and alcohol on the mouth lining help define the etiology of oral cancer and how tobacco use may contribute to periodontal disease.

Circle: When human embryonic palatal mesenchymal pre-osteoblast cells are grown in a rotary cell vessel that mimics a 3-dimensional tissue culture environment, they form a small tissue aggregate like the one shown here (20X magnification) that may serve in future applications requiring bone replacement grafts.

Square: *Porphyromonas gingivalis* is an important bacterium involved in the development of periodontitis and likely attaches to human oral cells via a receptor like the one (#5 –ACVR2) isolated in this preparation by 2 dimensional differential in-gel electrophoresis (2D-DIGE) for study.

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1977

**Dr. Ian Mackenzie** is appointed the first director of the Dows Institute for Dental Research.

**The First Dows Symposium** is held: “Oral Premalignant Lesions—Epithelial Changes Prior to Invasion.” Nineteen participants attend from North America and Europe, as well as observers from the National Institute of Dental Research and the National Cancer Institute.

1978

**Dr. James Beck** joins Preventive & Community. His research interests include behavioral, epidemiological, and health services research.

1979

**Dr. James Wefel**, Dows and Pediatric Dentistry, receives an NIDCR grant to study remineralization of enamel caries. The grant is renewed in 1980.

1980

**Dr. Murray Hill** joins Dows and Oral Pathology, Radiology, and Medicine.

**Dr. Christopher Squier**, Dows and Oral Pathology, Radiology and Medicine, receives an NIDCR award to study the barrier properties of oral mucosa.

**Dr. Ronald Ettinger** receives a Health Resources and Services Administration (HRSA) training grant to develop a curriculum program in geriatric dentistry.

**Dr. Leon Silverstone**, Dows and Pediatric Dentistry, receives an NIDCR grant to study remineralization of enamel caries. The grant is renewed in 1980.

**Dr. Brian Clarkson** receives an NIDCR grant to study anti-caries mechanisms of fluoride complexes. This grant is renewed in 1981.

**Dr. Ronald Ettinger** receives a Health Resources and Services Administration (HRSA) training grant to develop a curriculum program in geriatric dentistry.
CRANIOFACIAL ANOMALIES

Craniofacial anomalies are among the most common forms of birth defects. The goal of this research group is to identify both genetic and environmental causes for facial birth defects, with a primary focus on orofacial clefting, including cleft lip and cleft palate. The UI College of Dentistry has a 40-year history of clinical and research studies on craniofacial anomalies and a variety of approaches are utilized. These include genetic and epidemiologic studies of human populations, and the development of animal models that are characterized through molecular biological and biochemical analyses, in addition to a variety of sophisticated imaging techniques.

1981
Dr. Ronald Ettinger receives a National Institute on Aging geriatric dentistry training grant.

1982
Dr. Murray Hill receives a National Institute on Aging (NIA) grant to study changes in skin and oral mucosa.

1983
The Max L. Smith Young Investigators Award for student researchers is established.

Dr. Charles Kremenak serves as co-director with Dr. D. David Kinser, Orthodontics, on the Iowa Temporomandibular Disorders Longitudinal Study from 1983-1994.

Drs. James Beck and Ron Hunt, Preventive & Community, are awarded an NIDCR grant to study the incidence and prevalence of root caries in the elderly.
With an NIDCR grant, Dr. Brian Clarkson establishes the Specialized Caries Research Center. The center, one of only three research programs of its kind in the U.S., focuses on the etiology, pathogenesis, and prevention of dental caries.

Dr. Mark Jensen joins Dows and Pediatric Dentistry. He works on assessing restorative materials.

Dr. Steven M. Levy joins Preventive & Community Dentistry. He investigates the epidemiology of fluoride intake and dental fluorosis.

Dr. Charles Kremenak assumes directorship of the dental student research program. The Oral and Maxillofacial Implant Research Center is established. Dr. John Keller, its director, receives two NIH grants to study how bone and soft tissues in the mouth respond to dental implant surfaces.

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Dr. John C. Keller joins Dows and Oral & Maxillofacial Surgery. His research focuses on the biological responses to dental implant surfaces.

Drs. James Wefel and Mark Jensen develop an intraoral crown model, which enables them to measure changes in hard tissue lesions in a realistic environment. Over 20 studies are conducted with this model and its use continues today.

Dr. Christopher Squier is named assistant dean for research and director of the Dows Institute for Dental Research.

Dr. James Wefel (left) receives an NIDCR grant to fund a dental student research program. This grant is the basis for what becomes the Dental Student Research Program.

Dr. Mark Jensen is appointed director.

Dr. David R. Drake joins Dows’ Caries Research Center and Endodontics. He studies the transmission of Streptococcus mutans genotypes from mother to child.

Dr. John C. Keller joins Dows and Oral & Maxillofacial Surgery. His research focuses on the biological responses to dental implant surfaces.

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1984

1985

1986

1987

1989

1990

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to receive National Institutes of Health (NIH) funding for a Dentist-Scientist training program. The program continues for more than 25 years, eventually evolving into the Institutional Training Program in Oral Health Research (T32) grant.

Dr. Christopher Squier and the College of Dentistry become one of only 8 U.S. dental schools to receive National Institutes of Health (NIH) funding for a Dentist-Scientist training program. The program continues for more than 25 years, eventually evolving into the Institutional Training Program in Oral Health Research (T32) grant.

The Dows second symposium, “Oral Mucosal Diseases: Biology, Etiology, and Therapy” is held, with participating dental researchers from the U.S. and Europe.

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Dr. Georgia K. Johnson joins Dows and Periodontics. She studies the effects of tobacco products on periodontal host response and the impact of smoking on periodontal treatment outcomes.

Dr. Kevin Donly joins Dows and Pediatric Dentistry. He examines the tooth response to restorative materials and studies the effectiveness of remineralization regimens.

Dr. David Drake receives an NIDCR grant to study the binding of Streptococcus mutans cells to the tooth surface.

Dr. James Wefel receives a grant from NIDCR, which funds the College’s Clinical Core Center for Oral Health Research, the only center of its kind in the United States to have a major focus on older patients and those at high risk for oral disease. The grant is renewed in 1996.

Dr. Peter Damiano receives an Iowa Department of Human Services grant to evaluate the MediPASS Medicaid Demonstration Project. The grant will be continually renewed through 2010.

Dr. Steven Levy receives an NIDCR grant for fluoride research, which becomes the Iowa Fluoride Study, comparing children’s fluoride exposures and intake to the occurrence of dental fluorosis and dental caries. The grant will continue 20 years and its research will also be supported by grants from several organizations, including the U.S. Centers for Disease Control and Prevention, Roy J. Carver Charitable Trust, and the Delta Dental of Iowa Foundation.

Dr. Clark Stanford joins the Dows and Prosthodontics faculty. His studies bridge basic translational science and clinical approaches to dental implant therapy.

Dr. James Wefel becomes director of the Dows Institute.

Dr. Christopher Squier receives an NIDCR program project on oral mucosal aging.

Dr. Philip Wertz receives an NIDCR grant to study lipids and the permeability barrier of oral epithelium.

Dr. John Keller becomes director of the Dental Student Research Program.

Dr. James Wefel is awarded an NIH program project grant to support the Specialized Caries Research Center.

Dr. John Keller receives an NIDCR short-term dental student training grant. With two renewals, this grant will run through 2005.

Dr. David C. Johnsen becomes dean of the College of Dentistry (1995-present).

Drs. Christopher Squier and Philip Wertz receive the UI’s first Interactive Research Project Grant (IRPG) from the NIDCR. They collaborate with pharmacy faculty at the University of California, San Francisco, to study drug delivery across oral mucosa.

Dr. Janet Guthmiller joins Dows and Periodontics. Her research focus is molecular biological studies of periodontal pathogens and expression and function of innate antimicrobials.

Dr. Zoya B. Kurago joins Dows and Oral Pathology, Radiology, and Medicine. She studies the role of the innate immune system with carcinomas of the head and neck.

Dr. Steven Levy receives an HRSA grant to increase the number of trainees in the dental public health specialty training program and expand the curricular emphases on underserved populations, geriatrics and genetics. The grant is renewed in 2003 and in 2006.
Epidemiology and behavior research address several areas of dentistry: research on fluoride includes the epidemiology of fluoride intake and dental fluorosis, dietary fluoride supplement use, and fluoride assays of local water supplies. Research on instructional technology includes collaborating with organizations outside the dental school to develop computer-based skills through the use of patient simulations.

Public health research projects include studies of the utilization of dental services by low income children, oral disease in the elderly, geriatric dental care services, the effects of various developmental disabilities and medical illnesses on oral health, and conducting longitudinal studies, which demonstrate the effects of nutritive and non-nutritive sucking and feeding devices on oral facial growth and development.
The replacement of tissues and organs with synthetic materials has become an increasingly important therapeutic modality and raises important questions about tissue response to a variety of substances. In dentistry, the clinical use of dental implants has intensified interest in collegiate faculty research, which examines changes in implant surfaces that may affect the attachment of soft tissue to implant surfaces, facilitate integration of a prosthesis with bone, or address the relationship between osteoporosis and oral health. Technologies and applications involve biomaterials and tissue engineering. Applications include restorative material adhesion, osseous tissue reconstruction, and tooth replacement therapies. Current research investigates how metal oxide surfaces regulate osteoblastic gene expression; the development of standardized culture models for evaluation of biological/biomaterial responses; how cytoskeletal perturbation (strain) at physiological levels affects cellular and nuclear activities; the mechanical development of approaches for creating physiological levels of strain; and the role of non-collagenous proteins in altering the temporal and spatial formation of a mineralizing extracellular matrix.

Left: Osteoblast cells growing out from a calvarial explant.
The Dental Student Research Program provides several sources of research program opportunities for students. A dental student researcher will learn about a particular research area and become experienced in working with a laboratory team, a dental faculty researcher, and a faculty mentor. The types of dental research available for student researchers encompass the complex nature of current oral health care needs.

Dental student researchers are encouraged to present their research at the annual meeting of the Iowa Section of the American Association for Dental Research (AADR), the annual AADR/IADR meetings, or other specialty meetings.

The program helps instill critical thinking skills through research experience, assists faculty research, supports the scholarly mission of the college, and encourages students to consider dental academics and research as career options.

The Dental Student Research Program is directed by Dr. John Warren, Preventive & Community Dentistry. Dr. Teresa Marshall, Preventive & Community Dentistry, is assistant director, and Ms. Sara Anstoetter, Dows, is program administrator in the Office of Dental Student Research.
The AADR National Student Research Group recognizes the UI College of Dentistry for having the most student abstracts submitted at the 2006 AADR annual session. The College receives the same honor in 2007.

Dr. Jeffrey A. Banas joins Dows and Pediatric Dentistry. His studies on glucan binding proteins of oral streptococci are funded by NIH.

Dr. Daniel J. Caplan joins the College of Dentistry as head of Preventive & Community Dentistry. His research includes links between oral and systemic diseases, diagnostic testing, and outcomes of clinical dental procedures.

Dr. Clark Stanford receives an Astra Tech grant to address basic and translational science and clinical issues regarding the design, technology and clinical use of dental implant therapy.

Dr. David Drake receives an NIDCR grant to study Streptococcus mutans and dental caries in Native American children.

Dr. Raymond Kuthy receives a Delta Dental of Iowa grant to create a master database for use in dental workforce research and planning.

Dr. Clark Stanford is appointed associate dean for research.

Dr. Lina Moreno-UrIBE joins Dows and Orthodontics. Her research concerns genes that affect growth of the human face, using whole genome association methods and facial imaging technology.

Dr. Deborah Dawson receives an NIH grant to study genetic and environmental factors affecting susceptibility to dental fluorosis.

Dr. Clark Stanford collaborates with Palmer Center for Chiropractic Research on an NIH grant study to evaluate the effectiveness of chiropractic manipulation for patients with chronic myofascial temporomandibular disorders (TMD).

Dr. Philip Wertz receives an NIH grant to study antimicrobial lipids in the oral cavity.

Between 1977-2011, the UI College of Dentistry is ranked at least 24 times among the top five schools in the number of presentations given at annual AADR meetings and at least 18 times among the top three schools.

BIOSTATISTICS AND RESEARCH DESIGN

The Division of Biostatistics and Research Design provides statistical support to student, staff and faculty researchers of the College of Dentistry. Members of the unit collaborate with investigators throughout the stages of the research process, from planning through implementation and reporting. This support includes assistance with study design, data collection and management, and conduct and interpretation of statistical analysis. These activities extend to the preparation of grant proposals, presentations, and manuscripts. Instruction in statistics and research design is provided to students and to the collegiate research community.
**Dr. Liu Hong** joins Dows and Prosthodontics. His research focuses on adult stem cell-based craniofacial tissue engineering.

**Dr. Peter Damiano** receives an NIH grant to study the first preventive dental visit: disparities in needs, costs and behavioral insights.

**Dr. Raymond Kuthy** receives an HRSA grant to examine efforts to improve oral health workforce activities in Iowa.

**Dr. Clark Stanford** receives an Astra Tech grant to conduct a multi-center study comparing different sized implants in the posterior maxilla and mandible.

During the past ten years, the UI College of Dentistry has consistently ranked among the top 15 U.S. dental schools in NIDCR funding.

In 2009, the College of Dentistry begins a five-year $61 million building transformation: a 35,000-square-foot addition, renovation of all of the clinics and research areas, and upgrades of infrastructure (e.g. heating and cooling).

**Dr. Jeffrey Banas** receives an NIH grant to study Streptococcus mutans strain susceptibility differences to host defense peptides.

**Dr. Steven Levy** receives an HRSA grant to develop and implement a training program in dental public health.

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The Craniofacial Clinical Research Center (CCRC), formerly the Center for Clinical Studies, moves into the College of Dentistry’s new facility.

Dr. Isabelle Denry joins Dows and Prosthodontics. Her research focuses on ceramics for biomedical and dental applications. She transfers an NIH grant to study ceramic scaffolds with engineered topography and chemistry.

The Dows laboratory space is renovated with $1 million from the Roy C. Carver Charitable Trust and $1 million from the College of Dentistry to provide 25% more research lab space.

The new addition to the College of Dentistry clinic space officially opens.

Dr. Christopher A. Barwacz joins Dows and Prosthodontics. His research area includes clinical trial research on materials and implants and expression of cytokines around dental implant mucosa.

JOINT APPOINTED FACULTY

Galen Schneider, DDS, PhD, FACP
Biomaterials, Bone & Tissue Engineering
Research Interests: Implant osseointegration and bone tissue engineering

John Warren, DDS, MS
Epidemiology, Behavior, Health Policy & Outcomes
Research Interests: Epidemiology of dental caries in early childhood

Rebecca Slayton, DDS, PhD
Cariology & Microbiology
Research Interests: Genetics of dental caries susceptibility and caries risk assessment

Karin Weber-Gasparoni, DDS, MS, PhD
Epidemiology, Behavior, Health Policy & Outcomes
Research Interests: Early childhood caries; psychological theories of motivation

Christopher Squier, PhD, DSc
Soft Tissue & Oral Cancer
Research Interests: Tobacco control; barrier function in mucosa

James S. Wefel, PhD
Cariology & Microbiology
Research Interests: Demineralization/remineralization and caries models

Clark Stanford, DDS, PhD
Biomaterials, Bone & Tissue Engineering
Research Interests: Clinical use of dental implants; management of congenital anomalies

Philip Wertz, PhD
Soft Tissue & Oral Cancer
Research Interests: Structures, functions and metabolism of lipids of skin/oral epithelium

David Soll, PhD
UI Department of Biology
Research Interests: Understanding how signal pathways regulate biological processes and how cancers arise

Jeffrey Murray, MD
UI Department of Pediatrics
Research Interests: Molecular genetics and epidemiology of craniofacial birth defects

J. Madison, MD
UI Department of Dermatology
Research Interests: Relationship of epidermal lipids to cutaneous disease

Larry Oberly, PhD (d. 2008)
UI Department of Radiation Oncology
Research Interests: Role of antioxidant enzymes in cancer and other diseases.