DENTAL RESEARCH

Improving health care through discovery

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At Schulich Dentistry there are four main areas of research strength and expertise that contribute to the School’s overall mission of optimizing life-long health. Our interdisciplinary research programs have made significant contributions to our understanding of a number of diseases and disorders of hard and soft tissues, to the development of novel biomaterials for tissue repair and regeneration, and to new diagnostic tools to predict disease.

**Biomaterials and Tissue Engineering**
This is the science of creating synthetic materials that can replace tissues and organs of the body. Our researchers are creating novel biocompatible polymers, testing new dental composites and adhesives, and studying the interaction between biomaterials, including dental implants and cells at the cell and molecular level.

**Biomineralization**
This is the process by which crystals form and add hardness to tissues, such as bone and enamel. Our researchers are studying the mechanisms underlying the development and maintenance of bones and teeth; promotion and inhibition of mineral formation as it relates to dental calculi, kidney stones and atherosclerosis; bone repair and enamel remineralization.

**Salivary Biology**
This is the study of the components of saliva and their roles in saliva functions, such as lubricating the mouth, preventing demineralization of teeth and inhibiting growth of bacteria and yeasts. In addition, a major effort is on the study of saliva as a diagnostic fluid to assist in the rapid diagnosis of a range of illnesses, including periodontal disease, asthma and Dengue Fever.

**Tissue Repair and Regeneration**
The major focus is on promoting the healing of chronic wounds and the regeneration of periodontal tissue. Researchers in this field are working to obtain scarless tissue repair, develop therapies to block chronic fibrotic disease, and understand the mechanism of excess collagen and extracellular proteins.
Protein Regulators of Biomineralization

Dr. Hunter and his collaborators are studying proteins that have the potential to stop the formation of dental calculus, which is strongly associated with tooth decay and periodontal disease. These proteins act primarily to prevent crystals forming in soft tissues of the body – crystals that cause painful, disabling and life-threatening diseases such as kidney stones, arthritis and atherosclerosis (hardening of the arteries). By understanding the mechanism of action of crystal-inhibiting proteins, Dr. Hunter hopes to develop drugs that can be used to stop the progression of atherosclerosis and prevent the recurrence of kidney stones. Such drugs could also be incorporated into toothpaste and mouthwash and used to improve oral health.

Cellular Interactions with Biomaterials

Dr. Hamilton is developing delivery mechanisms for a protein shown to be an important molecule in the regeneration of skin and the periodontal tissues. Impaired healing as a result of aging or systemic conditions, such as diabetes, represents a significant burden to health care systems across the world. Dr. Hamilton’s research focuses on the molecular processes involved in fibrosis and scarring in the oral tissues and skin, situations where the wound healing processes fails to stop. By understanding the molecular switches that cause cells to make too much tissue, these signals can then be incorporated into novel biomaterials to help in situations in which wound healing processes are impaired, such as periodontal disease and non-healing skin wounds.
Dr. Leask is interested in manipulating the oral cavity's ability to heal without scarring, in order to develop new therapies for affected scar tissue in other areas of the body. His research is focused on the causes of fibrotic diseases, which can subsequently cause the excessive and persistent formation of scar tissue. Affecting people living with a variety of different chronic diseases, such as liver cirrhosis, diabetes, heart disease, lung fibrosis and scleroderma, there are no therapies on the market today that have been shown to stop or prevent fibrotic disease, which can result in organ failure and death.

Dr. Les Kalman, DDS
Principal Investigator, Restorative Dentistry
Schulich Dentistry

Digital Devices
Dr. Kalman is currently working on two different research projects, both of which deal with the testing and validation of new dental products. His ingenuity and research has led to the development of a hybrid sport guard prototype and a new age ‘Tablet-Application’ — bringing benefit to both the dental patient and practitioner. The first-of-its-kind Virtual Facebow App is a digital replacement to the traditional version, and offers an easy, efficient and economical way to assist with the diagnosis and treatment planning of all dental cases. Dr. Kalman’s second project introduces his newly developed hybrid sport guard that protects the mouth during competitive and recreational sport activity. This functional, cost-effective product is proving to be superior to anything currently on the market in its protective features.

Andrew Leask, PhD
Principal Investigator, Oral Biology
Schulich Dentistry

Fibroproliferative Disease Research
Dr. Leask is interested in manipulating the oral cavity’s ability to heal without scarring, in order to develop new therapies for affected scar tissue in other areas of the body. His research is focused on the causes of fibrotic diseases, which can subsequently cause the excessive and persistent formation of scar tissue. Affecting people living with a variety of different chronic diseases, such as liver cirrhosis, diabetes, heart disease, lung fibrosis and scleroderma, there are no therapies on the market today that have been shown to stop or prevent fibrotic disease, which can result in organ failure and death.
Dental research has a significant impact on the oral health of Canadians. Schulich Dentistry’s robust research program is having a positive impact with new dental and medical discoveries benefiting patient care, clinical techniques and new treatments and materials development. Schulich Dentistry’s research program includes oral health research in the fields of biomaterials, biomineralization, caries, cell-biomaterial interactions, fibrosis, medico-dental ethics, mineralized-tissue biology, oral cancer, pellicle and salivary proteins.

Faculty members also participate in a wide variety of collaborations with other researchers in the Schulich School of Medicine & Dentistry, the Faculties of Engineering, Health Sciences and Science at Western University and at other universities, nationally and internationally. These collaborations are improving the quality of life for people as they identify medical solutions to serious life-threatening diseases and medical complications.
RESEARCH FUNDING

The Schulich School of Medicine & Dentistry is home to focused, innovative research. Schulich Dentistry has a dynamic environment where investigators can maximize resources for the greatest benefit to their work. This state-of-the-art and cutting-edge research would not be possible without funding contributions from the Canadian Institutes of Health Research (CIHR), Dentistry Canada Fund (DCF), Natural Sciences and Engineering Research Council of Canada (NSERC), The Arthritis Society, Canada Foundation for Innovation (CFI), Canadian Kidney Foundation, the International Team for Implantology (ITI), Straumann, Scleroderma Society Ontario, the Ontario Ministry of Research and Innovation, and internal research grants from the Schulich School of Medicine & Dentistry.

STUDENT OPPORTUNITIES

Exposure to research is a critically important component of dental education. Schulich Dentistry offers students several research opportunities. From its Summer Student Research Program, which offers opportunities to those enrolled in the DDS program, to the Dental Clinician-Scientist program, a joint DDS/PhD program, in addition to other student research opportunities. Students work with faculty supervisors in our state-of-the-art labs and clinics to help answer important research questions. The goal is to not only train the next generation of academic instructors and researchers, but also to equip these students with critical skills to help enrich their practice as dentists.

For more information, contact:
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DENTISTRY RESEARCHERS

Dr. Timucin Ari
Special care dentistry, paediatric dentistry, quality of life and dental caries

Dr. Stephen Ferrier
Restorative dentistry, cariology, non-destructive dentin therapies, dental education

Dr. Harvey A. Goldberg
Extracellular matrix of mineralized tissues

Dr. Douglas W. Hamilton
Interaction of cells with biomaterials, wound healing

Dr. Sahza Hatibovic-Kofman
Long-term prospective clinical studies on probiotics and dental materials

Dr. Graeme K. Hunter
Regulation of biological mineralization

Dr. Les Kalman
Innovations with dental products and technologies

Dr. Andrew Leask
Growth factors, fibroblasts and fibrosis

Dr. Hiran Perinpanayagam
Engineering, biomaterials and endodontics

Dr. Amin S. Rizkalla
Development and characterization of biomaterials

Dr. Gildo Santos
Biomaterials, adhesion, ceramics

Dr. Jacinta Santos
Biomaterials: mechanical properties and clinical behaviour

Dr. Walter L. Siqueira
Salivary research focus on acquired enamel pellicle characterization and salivary proteomics for new therapeutic and diagnostic approaches