

Program Description

PhD in Oral Biology

Boston University Henry M. Goldman
School of Dental Medicine
Department of Molecular and Cell Biology

Table of Contents

p. 3	Program Description
p. 4	Research Areas
p. 5	Requirements and Curriculum
p. 6	Course Descriptions
p. 9	Program Administration Clinical Activities Eligibility for Admission
p. 10	Graduation Requirements
p. 12	Faculty PhD Mentors Contact Information

Program Description

The oral cavity is unique in its microbiology, connective tissue structures, and host responses. Moreover, oral diseases present unsolved scientific challenges and novel biological phenomena. The importance of understanding the oral biology of diseases, whose incidence and severity increase with age, is clearly understood within the context of current demographic trends.



Future Home of the Henry M. Goldman School of Dental Medicine

A PhD in Oral Biology is offered by The Division of Oral Biology in the Department of Molecular and Cell Biology, Boston University Henry M. Goldman School of Dental Medicine (GSDM). This program is administered through the Division of Graduate Medical Sciences of Boston University School of Medicine and is part of the Program in Biomedical Sciences (PiBS).

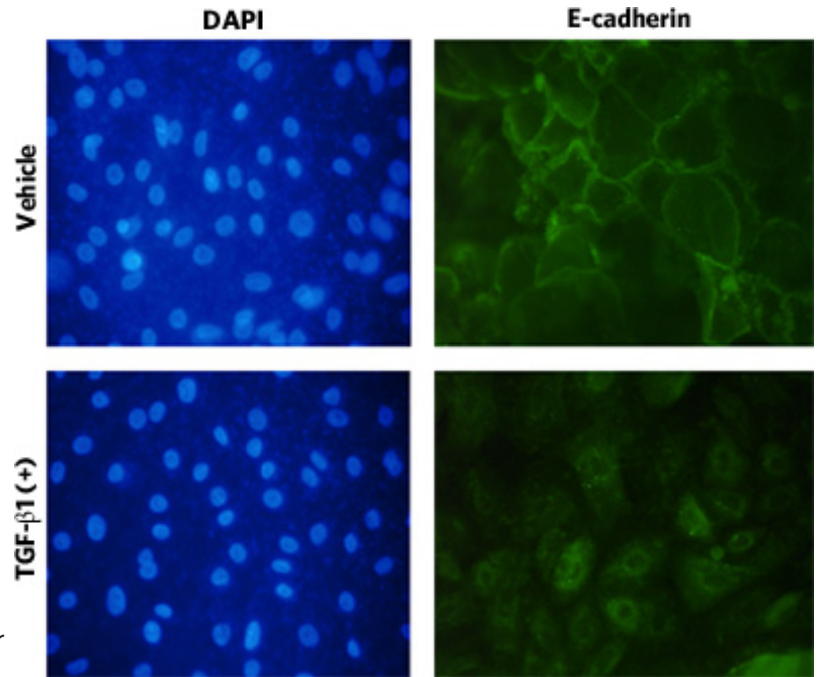
The program:

- Recruits students with strong backgrounds in the life and basic sciences who are interested in additional advanced training in dental and medical sciences. Applicants should have a BS in a life science; DMDs and MDs or equivalent can be eligible depending on the strength of scientific training.
- Aims to educate students in modern scientific approaches to oral biology and oral disease research.
- Accommodates and trains students whose primary goal is to pursue research in oral biology as a primary professional activity.

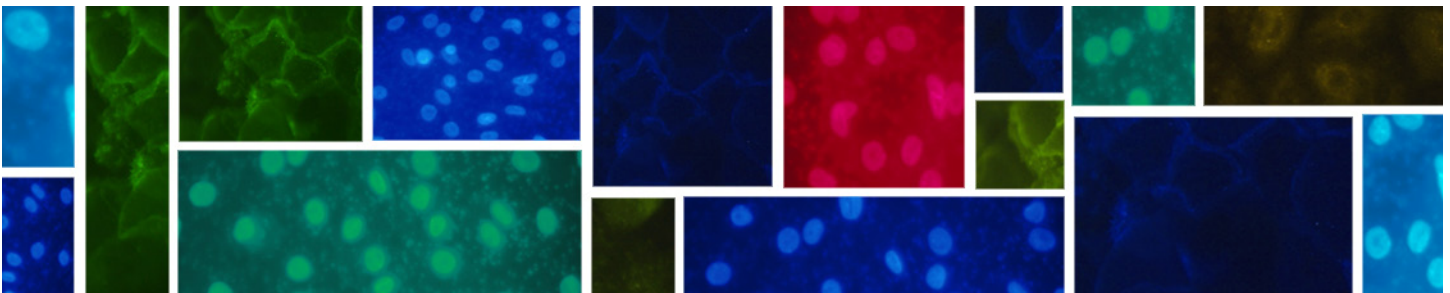
The PhD Program in Oral Biology adds a new dimension to graduate programs at the GSDM. It is not a substitute for the existing DSc degree in Oral Biology. The DSc program is limited to three years, and provides dentists the opportunity to expand knowledge in basic science research related to oral biology. Students typically complete 20 credits of didactic course work. In contrast, the PhD program will train people whose goals are to pursue research in oral biology as a primary professional activity. The PhD will typically require five years, with extensive didactic and research training described below. Thus, compared to the DSc degree, the PhD Program in Oral Biology will be longer in duration, more rigorous, and will prepare students for a career in basic oral biology research.

Research Areas

- Intercellular signaling, focusing on chemotaxis of monocytes to inflamed tissues
- Regulation of connective tissue accumulation in mineralized and non-mineralized oral tissues
- Production of growth and chemotactic factors by normal and transformed mesenchymal and hematopoietic cells
- Oral cancer research
- Sjogren's syndrome research
- Connective tissue production by primary periodontal cells and effects of fibrogenic drugs and cytokines
- Mechanisms of tumor suppression
- Molecular and cellular aspects of oral cancer to develop novel therapeutic opportunities
- Regulation of genes
- Genetic mouse models of inherited human oral pathologies to determine molecular mechanisms of disease
- Osteocyte biology and systemic interactions
- Mechanisms of mitochondrial diseases
- Mechanisms of pancreatitis
- Cell stress and regulation of gene expression



In addition, research projects may include clinical components focusing on inflammation, periodontal disease, tissue fibrosis, aging, developmental defects, and oral cancer. These studies will be carried out in collaboration with the clinical faculty at Clinical Research Center, located at the Henry M. Goldman School of Dental Medicine.



Requirements and Curriculum

Post-Bachelors PhD Candidates

Post-bachelors PhD candidates will complete 40 credits of didactic course work and credits in dissertation directed laboratory research for a total of 64 credits. Most candidates require five years to fulfill these requirements.

Additional credits will be obtained from at least two courses in biochemistry, biophysics, physiology, anatomy, microbiology, or other Division courses with permission from the instructor, the advisor and the PhD Program Director.

Master's degree -OR- Dental and Medical Degree Candidates

Students already holding a Master's degree or dental and medical degrees may be permitted to complete 12-16 credits of didactic course work. This requires approval from the Student Affairs Committee, and must be specifically requested by the student. The choice of courses will depend on the candidate's background and training.

The course curriculum consists of the following core didactic courses, plus supplementary courses selected from the following list of graduate school courses offered by GSDM.

Required Courses - All PhD Candidates

GMS OB 700	Biostatistics	GMS FC 701	Protein Structure, Catalysts & Interaction
GMS OB 763	Basic Processes in Oral Biology (A)	GMS FC 702	Structure & Function of the Genome
GMS OB 764	Basic Processes in Oral Biology (B)	GMS FC 703	Architecture & Dynamics of the Cell
GMS OB 766	Oral Immunology & Oral Microbiology	GMS FC 704	Mechanisms of Cell Communication
GMS OB 800	Advanced Oral Biology		
GMS OB 805/806	Oral Biology Seminar		

* Specific permission for enrollment of new PhD candidates/year must be obtained from the course directors.

Anticipated Typical Course Selections by Candidates

First Year

Basic Processes in Oral Biology	(2 semesters)
Oral Microbiology & Immunology	(1 semester)
Oral Biology Seminar	(2 semesters)
Protein Structure, Catalysts & Interaction	(1 semester)
Structure and Function of the Genome	(1 semester)
Architecture and Dynamics of the Cell	(1 semester)
Mechanisms of Cell Communication	(1 semester)

Second Year

Applied Statistics	(1 semester)
Advanced Oral Biology	(1 semester)
Oral Biology Seminar	(2 semesters)
Elective Course	(2 semesters)

Note that GSDM offers Advanced Oral Biology (SDM OB 800) every two years. This allows for a class size of four PhD candidates from the Division of Oral Biology. Thus, some PhD candidates take this course in year 3 instead of year 2. If the class size is greatly increased due to course enrollment by interested students from other Division of Graduate Medical Sciences departments, GSDM will consider offering this course every year.

Course Descriptions

Oral Biology Courses

GMS OB 700: Biostatistics

Introduces the concepts and techniques of biostatistics used in dental research. Emphasizes the fundamentals of statistical logic and presents the basic principles of experimental design, statistical inference, and probability. Examples from current basic sciences research, survey research, and clinical trials augment the presentation of statistical theory.

(2 credits, Fall semester)

GMS OB 763 & 764: Basic Processes in Oral Biology

An introductory survey course that examines biological processes at the cellular and molecular levels. Provides a basis to understand the events that regulate inflammation; wound healing; bone formation and resorption; salivary proteins and physiology; tooth development, eruption, and movement; and fluoride action.

(4 credits, 2 semesters)

GSM OB 766: Oral Immunology & Microbiology

This course has two modules: oral immunology and oral microbiology. The purpose of this course is to present material relative to the subject of oral immunobiology. The course will deal with the basics of the immune reaction from a subcellular level to an entire host reaction as they pertain to the etiology and pathogenesis of the disease processes in the oral cavity. This course will relate basic science findings to the clinical situations with an emphasis on treatment modalities for delivering clinical care. It is also the purpose of the course to provide an understanding of disease pathogenesis so that an informed basis of therapy can be recommended. The course will examine the complex microbial ecology of the mouth, with focus on the key microbes involved in dental diseases. The lectures will include the basic aspects of oral biofilm formation and microbial pathogenicity, with focus on the microbial diversity involved in caries, periodontal and periapical infections. There will be a short analysis of diagnostic microbial identification, as well as treatment modalities. The overall goal of the second module will be to link microbial clinical problems with basic infectious disease concepts, for a well informed approach to treatment.

(2 credits, 1 semester)

GMS OB 800: Advanced Oral Biology

This advanced course will explore in-depth current topics in oral biology research. The format of the course consists primarily of formal didactic lectures, but students will also be challenged to analyze experimental approaches and methods from current literature in a group-discussion "journal" club format in which papers from current literature are assigned and discussed. This course is designed to provide students with basic knowledge and to develop critical thinking abilities. Topics will include host molecular, cellular, and genetic bases of periodontal diseases; microbiology of periodontal diseases; molecular events in inflammation, wound healing, and periodontal tissue regeneration; molecular components and function of the periodontal ligament, cementum, and attachment structures; extracellular matrix accumulation and turnover in mineralized and non-mineralized tissues; the etiology and complications of diabetes, with emphasis on oral tissue pathology and mechanisms, biosynthesis and functions of oral mucins, endocrine-dependent periodontal changes, effects of growth factors on periodontal tissues and cells, biosynthesis and structure of salivary proteins, and mechanisms of non-immune antibacterial processes in the oral cavity.

(4 credits, 1 semester)

GMS OB 805 & 806: Oral Biology Seminar

All PhD candidates will attend a weekly seminar series organized by the Department of Oral Biology. Faculty and invited speakers will give seminars, as will students nearing completion of their thesis research projects. Students will be encouraged to suggest invited speakers. Enrollment in this course will be required for two years (2 credits per semester, for a total of eight credits). All PhD candidates are required to attend all seminars for their entire period of study.

(2 credits, 2 semesters)

Foundations in Biomedical Sciences Core Curriculum

GMS FC 701: Protein Structure, Catalysts & Interaction

The first module of the Foundations in Biomedical Science course will provide students with a quantitative understanding of protein structure, function, post-translational modification and the turnover of proteins in the cell. In addition, students will gain facility with thermodynamics, catalysts, kinetics and binding equilibria as they apply to proteins and also to other molecules in biological systems (e.g. nucleic acids, lipids, vitamins, etc.). The quantitative aspects of the module will be reinforced with two graded problem sets that students will peer-mentor in breakout sessions. One breakout session will introduce key elements in bioinformatics including protein sequence searching and three dimensional molecular graphics in a problem-based format. Readings from *Molecular Biology of Cell* by Alberts et al., and *Biochemistry* by Berg et al., will reinforce and expand upon material covered in the lectures. Reading from current and classic literature will also be used. Lecture notes and figures will be available to students online. Students will be evaluated based on their performance on one quiz, one exam two problem sets and participation in the breakout sessions.

(2 Credits, Fall semester, 1st year)

GMS FC 702: Structure & Function of the Genome

The second module of the Foundations in Biomedical Science course will focus on the mechanisms of biological processes that influence the inheritance, regulation and utilization of genes. Genetic and genomic, molecular, cell biological, and biochemical experimental approaches to understanding these processes will be explored. In addition, the possibilities of utilizing these technologies in medical treatments will be discussed. The course is aimed toward first year PhD students in the Division of Graduate Medical Sciences. The class will be taught by members of the Division in a variety of Departments utilizing a combination of traditional lectures and discussion sections focusing on primary research to total 7 hours of class time per week. Supplementary study materials used will be made available online on "Blackboard" to aid students in their review of the material. Reading materials will primarily be taken from current literature but will be supplemented by handouts supplied by the faculty. Students will be evaluated on their performance on take home exams and discussion sections. These exercises will be designed to test the students' ability to think critically and apply genetic concepts to biological problems.

(2 credits, Fall semester, 1st year)

Foundations in Biomedical Sciences Core Curriculum

GMS FC 703:

Architecture & Dynamics of the Cell

The third module of the Foundation course will focus on the movement of proteins and membranes within the cell, the secretory process and communication with the extracellular matrix. Molecular, cell biological, and biochemical experimental approaches to understanding these technologies will be explored. In addition, possibilities of utilizing these technologies in medical treatments will be discussed. The course is aimed towards first year PhD students in the Division of Graduate Medical Sciences. The class will be taught by members of the Division from a variety of Departments utilizing a combination of traditional lectures and discussion sections focusing on primary research to total 7 hours of class time per week.

Supplementary study materials used will be made available online on "Blackboard" to aid students in their review of the material. Reading materials will primarily be taken from the current literature but will be supplemented by handouts supplied by the faculty. Students will be evaluated on their performance on a quiz, problem set, and examination along with active participation in discussion sections.

(2 credits, Fall semester, 1st year)

GMS FC 704:

Mechanisms of Cell Communication

The fourth module of the Foundations in Biomedical Sciences course will focus on the mechanisms of cell communication. This module will begin discussion overarching concepts before examining the specific types of molecules that initiate and transduce signals. Examples of cell signaling and subsequent cellular responses will then be considered in different contexts to provide a framework on which future learning can be applied. As the module progresses, the complexity of the systems explored will increase from individual cells to multi-cellular environments such as tissues, organs and organisms.

In addition, normal processes as well as the dysregulation of cell-cell communication in disease will be studied. The course is aimed towards first year PhD students in the Division of Graduate Medical Sciences. The class will be taught by members of the Division in a variety of Departments utilizing a combination of traditional lectures and discussion sections focusing on primary research. There will be a total of 7 hours of class time per week. Supplementary study materials will be made available using "Blackboard" to aid students in the review of the material. Reading materials will be taken primarily from scientific literature and will utilize examples of classical studies as well as recent works. Students will be evaluated on their performance on a quiz, problem set, and examination along with participation in discussion sections.

(2 credits, Spring semester, 1st year)

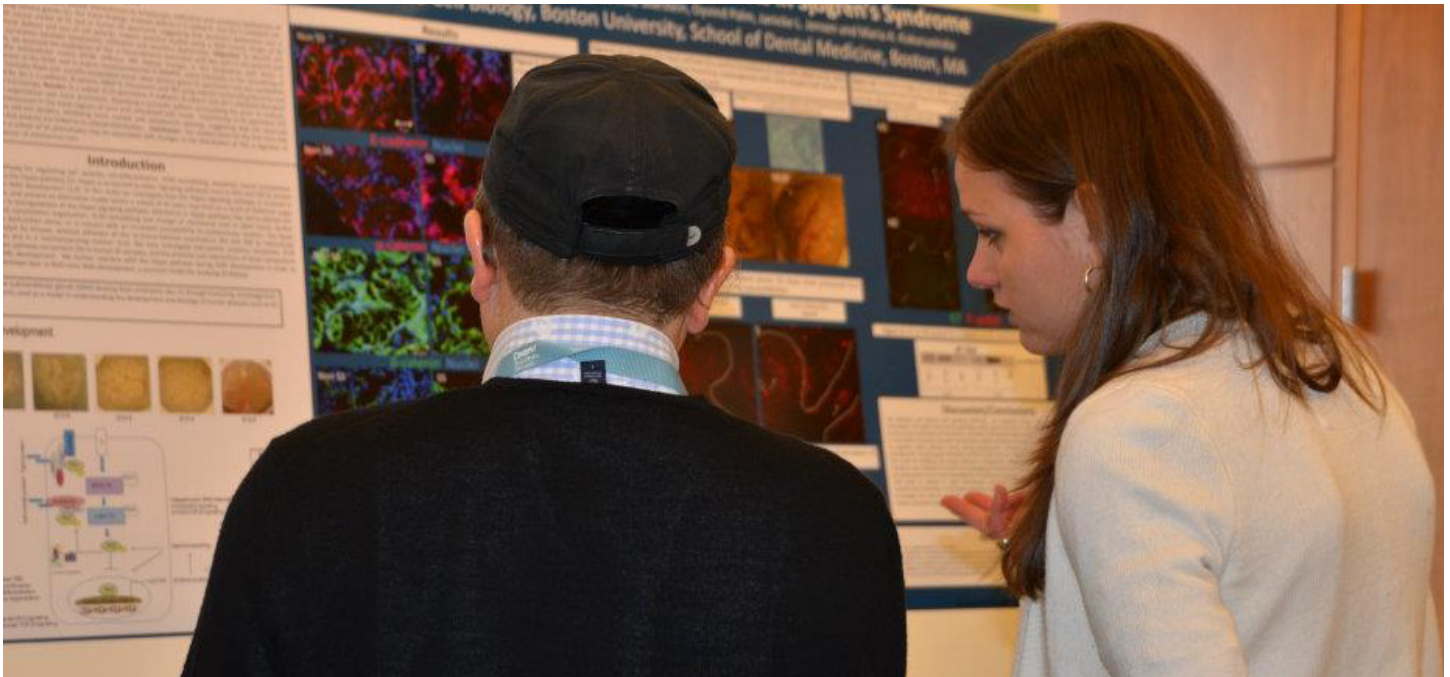
Program Administration

Student Affairs Committee

The Student Affairs Committee, chaired by Dr. Philip Trackman and compiled of all core faculty of the Division of Oral Biology, administers the Oral Biology PhD program. This committee coordinates laboratory rotations, addresses student and faculty concerns and works closely with the Qualifying Exam Committee.

Clinical Activities

Clinical activities for PhD candidates are discouraged. Under rare circumstances a maximum of half-day per month of clinical practice may be allowed. This arrangement requires approval by the PhD Program Director, the Chairman of the Department of Molecular & Cell Biology, and the Dean.



Eligibility for Admission

Requirements for admission to the Oral Biology PhD program are identical to those for all departmental PhD degrees administered by the Division of Graduate Medical Sciences as described in the Academic Policies and Procedures. Principal requirements are summarized as follows:

1. Students, who have completed an undergraduate degree, preferably with a major in the biological, chemical, or physical sciences, as well as master, dental and medical degree holders, will be eligible for the PhD program.
2. A minimum of 28 credits, or the equivalent, of courses in the biological and physical sciences is required.

3. Applicants are required to take the Graduate Record Exam (GRE) General Test. In addition, a GRE Subject Test in a basic science field such as Biology, Chemistry, or Biochemistry and Molecular Biology is encouraged*.

Applicants must apply through the Program in Biomedical Sciences website (PiBS) at the Division of Graduate Medical Sciences.

<http://www.bumc.bu.edu/gms/pibs/>

*Applicants whose native language is not English must take the Test of English as a Foreign Language (TOEFL) and must achieve a score of at least 95 (internet exam).

Graduation Requirements



A. Successful candidates will pass a comprehensive qualifying examination by the end of the second year. The qualifying examination committee consists of five core faculty members of the Division of Oral Biology. The committee meets yearly to evaluate students' performance and to design the examination. The examination includes written and oral components. The written component consists of short answer and essay questions, and is given at the end of the first year and covers knowledge in biochemistry, oral microbiology, and topics covered in Basic Processes in Oral Biology (GMS OB 763 and 764). The oral exam is given upon completion of the second year. The exam is designed for each student, taking into consideration the completed courses. For example, as GMS OB 800 is offered every two years, some students will not completed the courses by the end of the second year. Elective course(s) selected by each student are also considered.

The two hour oral exam covers both knowledge and ability to critically evaluate current research in oral biology. Recent scientific papers are chosen and assigned by the committee in advance of the exam.

Students are asked to read and present an oral critique of the paper. This is followed by a question period that

includes testing each candidate's knowledge of oral biology, and the candidate's critique of the assigned paper. The examination committee administers both the written and oral components of the exam.

Students who fail a qualifying exam will be given one additional opportunity to pass a new version of the failed exam. A second failure, of either the written or oral qualifying exam, will result in termination of the student from the PhD Program in Oral Biology. Students may petition the Student Affairs Committee for the award of the MSD based on performance in didactic courses. Award of the MSD will be decided on a case by case basis, based on the student's performance in didactic courses and research, and also requires approval from the Dean of the Boston University Henry M. Goldman School of Dental Medicine. Petitions for an award of an MS degree from another GMS department may also be possible and is determined on a case-by-case basis.

B. Students are required to maintain a minimum of a B average in all course work. Six credits of C+ or lower will result in termination of the student from the program.

C. During the first year, each student is required to complete at least three research rotations in the program faculty laboratories. This is supervised and coordinated by the Chairman of the Student Affairs Committee, who will serve as advisor to all PhD candidates prior to choosing his/her research advisor. By the end of the first year, each student is required to request a research advisor and a research topic, as directed by the Student Affairs Committee. Dissertation research is conducted under the supervision and guidance of the research advisor, a member of the faculty (see Faculty Listing). Assignment of students to laboratories by the Student Assignment Committee is made at a summer faculty meeting of the Division of Oral Biology. In consultation with the advisor, a student selects a minimum of four additional faculty members to act as the Dissertation Advisory Committee. The Dissertation Advisory Committee meets with the candidate annually to monitor the progress of research and course work. This committee has the power to recommend to the Student Affairs Committee that a student be placed on probation. If the student fails to meet requirements specified by the Student Affairs Committee, in consultation with the Dissertation Advisory Committee, the student may be dismissed from the PhD Program in Oral Biology without award of the PhD degree.

D. Candidates for PhD degrees are required to submit a written dissertation describing original research and demonstrating the development of independent scholarship.

E. Students are required to defend their dissertations at final oral examinations. Students are expected to demonstrate expertise in their chosen field of specialization and to provide documentation of their contribution to the accumulated body of

knowledge. The oral examination is conducted by the Dissertation Committee composed of at least five members of the GSDM and Boston University School of Medicine faculty. It is expected that members of the candidate's Dissertation Advisory Committee will also serve on the Dissertation Committee. One member of the Dissertation Committee must be from a department other than the Division of Oral Biology. In some cases, at the discretion of the Chair of the Dissertation of the Committee, one of the five Dissertation Committee members could be appointed from outside of the university.

F. Students who fail to meet any requirement for the PhD degree may be dismissed from the PhD Program without award of any degree. Students can petition the Student Affairs Committee for award of the MSD and an MS degree. The award of Master's degrees depends upon didactic and research accomplishments, and will be considered on a case by case basis. Award of the MSD requires, in addition, approval by the Dean of the Henry M. Goldman School of Dental Medicine.





Faculty

Dr. David Levin

Professor and Chair, Department of Molecular & Cell Biology

Dr. Levin's research interests are summarized at profiles.bu.edu/David.Levin

Department of Molecular and Cell Biology Research Mentors:



Ruslan Afasizhev

Professor

Dr. Afasizhev's research interests are summarized at profiles.bu.edu/Ruslan.Afasizhev



Inna Afasizheva

Associate Professor

Dr. Afasizheva's research interests are summarized at profiles.bu.edu/Inna.Afasizheva



Paola Divieti Pajevic

Associate Professor

Dr. Divieti Pajevic's research interests are summarized at profiles.bu.edu/Paola.DivietiPajevic



Maria Kukuruzinska

Professor
Associate Dean for Research

Dr. Kukuruzinska's research interests are summarized at profiles.bu.edu/Maria.Kukuruzinska



Mikos Sahin-Toth

Professor

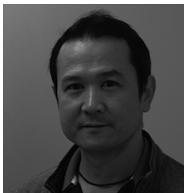
Dr. Sahin-Toth's research interests are summarized at profiles.bu.edu/Miklos.SahinToth



John C. Samuelson

Professor

Dr. Samuelson's research interests are summarized at profiles.bu.edu/John.Samuelson



Makoto Senoo

Associate Professor

Dr. Senoo's research interests are summarized at profiles.bu.edu/Makoto.Senoo



Philip Trackman

Professor
Director of Graduate Programs

Dr. Trackman's research interests are summarized at profiles.bu.edu/Philip.Trackman

Contact

Boston University Henry M. Goldman School of Dental Medicine
Department of Molecular and Cell Biology
700 Albany Street | Boston, MA 02118

For more information email trackman@bu.edu or visit www.bu.edu/dental-research