The Department of Biochemistry, Microbiology and Immunology is located in the Faculty of Medicine and offers graduate programs leading to the degrees of Master of Science (MSc) and Doctor of Philosophy (PhD) in Microbiology and Immunology.

The programs refine critical and scholarly skills in fields and areas of specialization and prepare students for a variety of careers in teaching and research both within and outside of academia, including in a governmental, clinical, or industrial setting. Graduates are expected to have acquired autonomy in conducting research, in preparing scholarly publications, through a training that includes course work, research seminars, and independent research leading to a thesis.

Members of the Department are engaged in two main research fields: microbiology and host biology. Additional information is posted in the departmental website.

The Department is a participating unit in the following collaborative programs: the Bioinformatics program (at the master’s level) and the Pathology and Experimental Medicine program (at the master’s and doctoral levels).

The doctoral program participates in the Combined MD / PhD Program, which allows students to graduate with both a PhD in Microbiology and Immunology and an MD. For more information please see the website of the Faculty of Medicine.

Most of the courses in these programs are offered in English. Research activities can be conducted either in English, French or both, depending on the language used by the professor and the members of his or her research group.

In accordance with the University of Ottawa regulation, students have a right to submit their work, thesis, and exams in French or in English.

The programs are governed by the general regulations of the Faculty of Graduate and Postdoctoral Studies (FGPS).

### Programs

- Master of Science Microbiology and Immunology
- Master of Science Microbiology and Immunology Specialization in Bioinformatics
- Master of Science Microbiology and Immunology Specialization in Pathology and Experimental Medicine
- Doctorate in Philosophy Microbiology and Immunology
- Doctorate in Philosophy Microbiology and Immunology Specialization in Pathology and Experimental Medicine

### Professors

- **Alain, Tommy**, Assistant Professor
  - Apoptosis; Cancer Research; Infectious Diseases; Oncology; Pediatric Cancer; Programmed Cell Death.

- **Allan, David**, Cross-appointment

- **Angel, Jonathan**
  - Surgical stress, metastases, coagulation, immunotherapy, oncolytic viruses

- **Côté, Marceline**, Assistant Professor

- **Crawley, Angela**, Adjunct Professor
  - Anti-viral responses, immunopathogenesis of HIV and Hepatitis C (HCV) infection, T-cell biology, immunotherapy
Dixon, Brent, Adjunct Professor
Fairhead, Todd, Cross-appointment
Farber, Jeffrey, Adjunct Professor
Food safety; food microbiology; foodborne pathogens
Giguère, Patrick, Assistant Professor
Hou, Sheng T., Adjunct Professor
Neurodegeneration; regeneration; apoptosis; axonal guidance; stroke
Korneluk, Robert, Cross-appointment
Modulation of programmed cell death (apoptosis) for therapeutic benefit in disease
Krishnan, Lakshmi
Kumar, Ashok
Langlois, Marc-André, Associate Professor
Lee, Barry Craig
Lee, Jonathan, Associate Professor
Breast cancer and molecular biology of cell motility
Lee, Seung-Hwan, Assistant Professor
Natural Killer Cell; Cytokines; Virus Infection; Immunoregulation
Li, Sean
Lin, Min
Logan, Susan, Adjunct Professor
Bacterial pathogenesis; prokaryotic protein glycosylation systems
Macpherson, Paul, Cross-appointment
Effects of the HIV Tat protein on IL-7 receptor expression on CD8 T-cells; terminal differentiation of CD8 T-cells in HIV infected patients; IL-7 receptor expression in HIV+ patients with slow or nonprogressive disease, transcriptional regulation of the IL-7 receptor in CD8 T-cells
Mah, Thien-Fah, Assistant Professor
Understanding of the molecular mechanisms utilized by bacteria to increase their resistance to antimicrobial agents once they become part of a biofilm, Mutants of Pseudomonas aeruginosa; bacterial biofilms
Makrigiannis, Andrew, Assistant Professor
Pagotto, Franco, Adjunct Professor
Bacterial pathogens; Microbiological safety and control of fresh-cut produce; Hazard identification and risk assessment in foods; Molecular typing and genomic characterization of foodborne bacterial pathogens and foodborne viruses, Pathogenesis and virulence determinants of foodborne pathogens, molecular diagnostics using DNA microarray technology, and DNA chip technology for detection of genetically modified organisms and foods
Parks, Robin
Pezacki, John
Pineault, Nicolas, Adjunct Professor
Ramirez, Sandra, Adjunct Professor
Bacterial contamination in blood products; bacterial cell division and cell growth; cell division mechanisms of Staphylococcus epidermidis
Sad, Subash
Stanford, William, Cross-appointment
To understand and manipulate the behavior of pluripotent and somatic stem cells to understand mechanisms of human disease and develop novel therapeutics.
Stojdl, David
Admission

Doctorate

Admission to the graduate program in microbiology and immunology is governed by the general regulations of the FGPS.

Applications are evaluated based on the following criteria:

- Be the holder of a master's degree in microbiology or immunology (or equivalent) with a minimum average of B+ (75%) calculated in accordance with the FGPS guidelines.
- Demonstrate a good academic performance in previous studies as shown by official transcripts, research reports, abstracts or any other documents demonstrating research skills.
- Provide at least two confidential letters of recommendation from professors who have known the applicant and are familiar with the student work.
- Provide a statement of purpose indicating the career goals and the interests in the proposed research area.
- Identify at least one professor who is willing and available to act as thesis supervisor.

Transfer from Master’s to PhD Program

Outstanding students enrolled in the MSc program may be allowed to transfer to the PhD program without being required to write a master’s thesis provided they meet the following conditions:

- Successful completion of the seminar and all the core courses required for the master's program.
- Satisfactory progress in the research program.
- Written recommendation by the supervisor and the advisory committee.
- Approval by the graduate studies committee.

The transfer must take place within sixteen months of initial enrollment in the master’s. Please note that the minimal admission average requirements for the doctoral program must also be met.

Program Requirements
Doctorate

PhD in Microbiology and Immunology

The following requirements must be met:

- Successful completion of compulsory course MED8166 Professionalism and Professional Skills.
- Six units of MIC graduate courses including at least 3 units at the 8000-level, approved by the Department.
- Enrollment in the seminar course MIC8366, which involves the presentation of a seminar and regular attendance at the departmental seminars.
- Successful completion of a comprehensive examination (MIC9998).
- Successful presentation and defense of a thesis (MIC9999) based on original research carried out under the direct supervision of a research faculty member in the Department.

NOTE: The Department may require students to take additional courses, depending on their backgrounds.

Collaborative program in Pathology and Experimental Medicine

The requirements of both the primary program and those of the collaborative program must be met.

The requirements specific to the collaborative program are as follows:

- One course (3 units) in the primary program.
- One Pathology and Experimental Medicine specialization course (3 units).
- Successful completion of the Pathology and Experimental Medicine seminar course.
- Successful completion of the Comprehensive Examination as required by the respective primary program.
- Successful preparation and defense of a thesis under the supervision of a professor who is a member of the Pathology and Experimental Medicine program. The thesis must be relevant to the focus of the Pathology and Experimental Medicine program. At least one of the examiners must be a member of the Pathology and Experimental Medicine collaborative program.

Transfer from master's to PhD

Following the transfer, all of the requirements of the doctoral program must be met:

- doctoral seminar (MIC8366)
- six units of course work
- comprehensive examination (MIC9998)
- pre-thesis seminar (MIC9997)
- thesis (MIC9999)

Duration of the program

The requirements of the program are usually fulfilled within four years. The maximum time permitted is six years from the date of initial enrollment in the program, or seven years in the case of the students transferring from the master’s to the doctorate.
Residence

All students must complete a minimum of six terms (sessions) of full-time enrollment. In the case of transfer students, the residency period is nine full-time terms (sessions) from the initial enrollment in the program.

Minimum standards

The passing grade in all courses is C+. Students who fail two courses (equivalent to 6 units), the thesis proposal, or the comprehensive exam or whose research progress is deemed unsatisfactory are required to withdraw.

Thesis Advisory Committee

During the first term (session) of the program, a thesis advisory committee (TAC) is formed for the candidate. The Committee’s membership will be determined by the specific interests of the candidate. It will be composed of the supervisor and 2-3 additional professors. At least one member of the thesis committee, in addition to the supervisor, must be from the Faculty of Medicine. The TAC is responsible for guiding the student throughout the program, including course selection, the comprehensive examination, thesis proposal, and thesis defense.

Regular meetings between the student and thesis committee members will take place at least once per term (session). The thesis examining board may include members who are not part of the TAC.

Courses

Not all of the listed courses are given each year. The course is offered in the language in which it is described.

**MED8166 PROFESSIONALISM AND PROFESSIONAL SKILLS**
Basic professional skills related to academic integrity, proper referencing techniques, avoidance of plagiarism, professional etiquette, public speaking, time and stress management, conflict management, teamwork, knowing when and how to access student support services. Compulsory for all students enrolled in master’s or doctoral programs at the Faculty of Medicine. Graded S/NS (Satisfactory/Not satisfactory).

**MIC5100 HOST/PATHOGEN INTERACTIONS AND MOLECULAR IMMUNOLOGY (3 units)**
This course will examine current issues in microbiology/immunology. Topics to be chosen to allow discussion across the broad areas of virology, immunology and bacteriology. Within each of the modules, the focus will be on host-pathogen interactions at the molecular level, how microorganisms utilize, modify or disrupt host cell functions, including immune cell functions and immune responses, to establish infection and cause diseases, or on immunological diseases which may have an infectious component. **Prerequisite:** At least one undergraduate course in microbiology and/or immunology and one course in molecular biology, or permission of the course coordinator.

**MIC5366 MSc SEMINAR (3 units)**
Attendance at two half-day symposia with guest speakers, attendance and participation in the annual BMI Student Symposium and BMI Poster Day, attendance at BMI seminars relevant to Microbiology and Immunology. Students must present at least one poster and one oral presentation during the course of their program. Graded S/NS

**MIC7999 THÈSE DE MAÎTRISE / MSc THESIS**
Avant la soutenance de sa thèse, il faut que chaque étudiant donne un séminaire portant sur ses recherches au Département / Prior to defending their thesis, each student will be required to present a formal seminar about their research to the department.

**MIC8122 ADVANCED TOPICS IN IMMUNOLOGY (3 units)**
Focus on cellular immunology, including thymocyte maturation, induction and regulation of cellular responses, immune responses to pathogens, immunological memory, tolerance. Student assessments to be conducted by two methods: Weekly assessment of student presentations and participation in class discussions; assessment of take-home assignments such as completion of a research grant on a topic covered in the course. To be offered alternate years subject to sufficient demand. **Prerequisite:** MIC 4125 or equivalent.

**MIC8124 ADVANCED TOPICS IN CELL DEATH (3 units)**
Molecular mechanisms of cell death. Particular attention to be paid to role of aberrant cell death in human disease. Offered in the Fall of odd numbered years.

**MIC8125 SPECIAL TOPICS IN MICROBIOLOGY AND IMMUNOLOGY (3 units)**
Discussion of current topics in Microbiology and Immunology. Topics to vary from year to year depending on the interest of faculty members.
offering the course and students. Student assessments to be conducted by two methods: Weekly assessment of student presentations and participation in class discussions; assessment of take-home assignments such as completion of a research grant on a topic covered in the course. Prerequisite: Permission of the course coordinator.

MIC8126 IMMUNOCHEMISTRY (3 units)
Focus is on antigen structure of protein and carbohydrate antigens, receptor structure of B cells and T cells, structure of MHC molecules, accessory molecules and cytokine receptors and cell signalling pathways induced by the antigen and cytokine receptors. Student assessments to be conducted by two methods: Weekly assessment of student presentations and participation in class discussions; assessment of take-home assignments such as completion of a research grant on a topic covered in the course. To be offered alternate years subject to sufficient demand. Prerequisite: MIC 4125 or equivalent.

MIC8129 CURRENT TOPICS IN STEM CELLS AND IMMUNE DEVELOPMENT (3 units)
This course will focus on the haematopoietic system that gives rise to the many cell types of the immune system. Topics to be covered include the developmental processes of embryonic stem cell differentiation into mesoderm and then into haematopoietic and non-haematopoietic progenitors; development of adult haematopoietic and immune systems; symmetric and asymmetric division of cells; intrinsic transcription factors and extracellular microenvironment factors regulating cell fate; immunological aspects of stem-cell based therapy; new technologies and their use in the field, and experimental design. Prerequisite: At least one undergraduate course in immunology or cell biology, or permission of the course coordinator.

MIC8134 STRUCTURE AND EXPRESSION OF EUKARYOTIC AND PROKARYOTIC GENOMES (3 units)
Sequencing of eukaryote and prokaryote genomes with emphasis on recent technologies, sequence alignments and databases and assembly of genomes from massively parallel sequencing data. Focus on mapping studies, including linkage disequilibrium-based genome-wide association study (GWAS), to characterize functional variants associated with complex traits. Analysis and structure of microbial metagenomes from environmental and human habitats, including structure-function analysis of microbial communities, microbiota-human disease correlations, and molecular phylogeny. Genome expression, including measures of RNA transcripts and proteins and statistical analysis of data. Combination of various -omics data to understand gene-environment interactions.

MIC8236 ADVANCED TOPICS IN VIROLOGY (3 units)
An in-depth presentation of current topics in virological research. Topics will vary from year to year. To be offered every alternate year subject to sufficient demand. Prerequisite: MIC 4126 or equivalent.

MIC8238 ADVANCED TOPICS IN BACTERIOLOGY - MECHANISMS OF PATHOGENESIS (3 units)
Recent advances and current topics in selected areas of bacteriology with emphasis on mechanisms of pathogenesis. Students present and discuss journal articles. Offered every alternate year subject to sufficient demand. Prerequisite: MIC 4124 or its equivalent.

MIC8366 PhD SEMINAR (3 units)
Attendance at two half-day symposia with guest speakers, attendance and participation in the annual BMI Student Symposium and BMI Poster Day, attendance at BMI seminars relevant to Microbiology and Immunology. Students will present a poster in their first and every alternate year, and an oral presentation the second and every alternate year until they have permission to write their thesis. Graded S/NS.

MIC8401 ADVANCED TOPICS IN BACTERIAL GENETICS (3 units)
Microbial genetic and genomic methods: origin, purpose and functioning. Analysis and use of genomes to study bacterial pathogenesis and host-microbe interactions. Prerequisite: MIC5224 or equivalent.

MIC8500 SPECIAL TOPICS IN HEALTH-RELATED ENVIRONMENTAL MICROBIOLOGY (3 units)
Recent advances and current topics in selected areas of health-related environmental microbiology. Topics reflect student interest. Offered in alternate years subject to sufficient demand. Prerequisite: MIC 5500 or equivalent.

MIC8700 BIOLOGY AND PATHOGENESIS OF HIV INFECTION (3 units)
Biology and pathogenesis of Human Immunodeficiency Virus (HIV) infection. Genetics, replication, structure, regulation of gene expression, immunopathogenesis, antiviral therapy and vaccine development. Offered in alternate years subject to sufficient demand. Prerequisite: BCH 3170 or equivalent and permission of instructor.

MIC9998 EXAMEN DE SYNTHÈSE (DOCTORAT) / COMPREHENSIVE EXAMINATION (PhD)

MIC9999 THÈSE DE DOCTORAT / PhD THESIS

HMG8106 CLINICAL CYTOGENOMICS (3 units)
Comprehensive review of the basic principles and technologies in cytogenomics and their clinical application for diagnostic and prognostic
purposes. Registrations may be limited depending on enrolment. Prerequisite: Permission of the course coordinator.

**HMG8107 CLINICAL BIOCHEMICAL GENETICS** (3 units)
Presentation of the biomechanical and molecular bases of inborn errors of metabolism. The course consists of a series of lectures followed by student discussion of a related paper assigned the previous week. Registrations may be limited depending on enrolment. Prerequisite: Permission of the course coordinator.

**HMG8108 CLINICAL MOLECULAR GENETICS** (3 units)
Comprehensive review of all aspects of clinical molecular genetics acquainting students with clinical applications of various molecular technologies. Registrations may be limited depending on enrolment. Prerequisite: Permission of the course coordinator.