

# MASTER OF SCIENCE MICROBIOLOGY AND IMMUNOLOGY

## Summary

- Degree offered: Master of Science (MSc)
- Registration status option: Full-time
- Language of instruction: English
- Program option (expected duration of the program):
  - with thesis (6 full-time terms; 24 consecutive months)
  - with Research Project (3 full-time terms; 12 consecutive months)
- Academic units: Faculty of Medicine (<http://med.uottawa.ca/en/>), Department of Biochemistry, Microbiology and Immunology (<http://med.uottawa.ca/bmi/>).

## Program Description

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 or research project.

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).

## Main Areas of Research

- Microbiology
- Host biology

## Other Programs Offered Within the Same Discipline or in a Related Area

- Master of Science Microbiology and Immunology Specialization in Bioinformatics (MSc)
- Master of Science Microbiology and Immunology Specialization in Pathology and Experimental Medicine (MSc)
- Doctorate in Philosophy Microbiology and Immunology (PhD)
- Doctorate in Philosophy Microbiology and Immunology Specialization in Pathology and Experimental Medicine (PhD)

## Fees and Funding

- Program fees:

The estimated amount for university fees (<https://www.uottawa.ca/university-fees/>) associated with this program are available under the section Finance your studies (<http://www.uottawa.ca/graduate-studies/programs-admission/finance-studies/>).

International students enrolled in a French-language program of study may be eligible for a differential tuition fee exemption

(<https://www.uottawa.ca/university-fees/differential-tuition-fee-exemption/>).

- To learn about possibilities for financing your graduate studies, consult the Awards and financial support (<https://www.uottawa.ca/graduate-studies/students/awards/>) section.

## Notes

- Programs are governed by the general regulations (<http://www.uottawa.ca/graduate-studies/students/general-regulations/>) in effect for graduate studies.
- In accordance with the University of Ottawa regulation, students have the right to complete their assignments, examinations, research papers, and theses in French or 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.

## Program Contact Information

Graduate Studies Office, Faculty of Medicine (<https://med.uottawa.ca/graduate-postdoctoral/>)

**451 Smyth Road, Room 2016**

**Ottawa, Ontario, Canada**

**K1N 6N5**

**Tel.: 613-562-5215**

**Email: [grad.med@uottawa.ca](mailto:grad.med@uottawa.ca)**

Twitter | Faculty of Medicine (<https://twitter.com/uOttawaMed/>)

Youtube | Faculty of Medicine (<https://www.youtube.com/channel/UCP2nDlrjFEetyfMiOmle2HA/>)

Flickr | Faculty of Medicine (<https://www.flickr.com/photos/uottawamed/>)

## Admission Requirements

For the most accurate and up to date information on application deadlines, language tests and other admission requirements, please visit the specific requirements (<https://www.uottawa.ca/graduate-studies/programs-admission/apply/specific-requirements/>) webpage.

## To be eligible, candidates must:

- Have a bachelor of sciences (BSc) degree with a specialization or major (or equivalent) in one of the following areas: microbiology, virology, immunology, biology, biochemistry, biopharmaceutical or biomedical sciences with a minimum average of 75% (B+).

Note: International candidates must check the admission equivalencies (<https://www.uottawa.ca/graduate-studies/international/study-uottawa/admission-equivalencies/>) for the diploma they received in their country of origin.

- Demonstrate a good academic performance in previous studies as shown by official transcripts, research reports, abstracts or any other documents demonstrating research skills.
- Identify at least one professor who is willing to supervise your research and thesis.
  - We recommend that you contact potential thesis supervisors as soon as possible.
  - To register, you need to have been accepted by a thesis supervisor.
  - The supervisor's name is required at the time of application.

## Language Requirements

Applicants must be able to understand and fluently speak the language of instruction (French or English) in the program to which they are applying. Proof of linguistic proficiency may be required.

Applicants whose first language is neither French nor English must provide proof of proficiency in the language of instruction.

Note: Candidates are responsible for any fees associated with the language tests.

## Notes

- The admission requirements listed above are minimum requirements and do not guarantee admission to the program.
- Admissions are governed by the general regulations (<http://www.uottawa.ca/graduate-studies/students/general-regulations/>) in effect for graduate studies.
- The program can be completed by following either the thesis-based option or research project-based option.

## Program Requirements

### Master's with Thesis

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

Students must meet the following requirements:

#### Compulsory Courses:

MED 8166	Professionalism and Professional Skills	
MIC 5100	Pathogen Interactions and Host	3 Units
3 elective course units in chemistry (CHM), microbiology and immunology (MIC) at the graduate level or MED 5101		3 Units

#### Seminar:

MIC 5366	MSc Seminar <sup>1</sup>	3 Units
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#### Thesis:

THM 7999	Master's Thesis <sup>2, 3</sup>
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#### Note(s)

1

The seminar course involves the presentation of a seminar and regular attendance at the seminars presented by the Department.

2

Successful presentation and defense of a thesis based on original research carried out under the direct supervision of a faculty member of the Department.

3

Students are responsible for ensuring they have met all of the thesis requirements (<http://www.uottawa.ca/graduate-studies/students/theses/>).

## Fast-Track from Master's to PhD

Students enrolled in the thesis-based master's program in Microbiology and Immunology at the University of Ottawa may be eligible to fast-track directly into the doctoral program without writing a master's thesis. For additional information, please consult the "Admission Requirements" section of the PhD program.

## Master's with Research Project:

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

Students must meet the following requirements:

#### Compulsory Courses: <sup>1</sup>

MED 8166	Professionalism and Professional Skills	
6 course units in microbiology and immunology (MIC) at the graduate level <sup>2</sup>		6 Units
6 course units in biochemistry (BCH), chemistry (CHM), cellular and molecular medicine (CMM), microbiology and immunology (MIC), neuroscience (NSC) at the graduate level or MED 5101		6 Units
MED 5301	Seminar <sup>3</sup>	3 Units
MED 5900	Research Project	6 Units

#### Note(s)

1

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

2

The list of courses being offered in each field in any given year will be indicated on the program website.

3

The seminar course involves the presentation of a seminar and attendance at the seminars approved by the Department.

## Minimum Requirements

The passing grade in all courses is C+.

Students who fail 6 units must withdraw from the program.

## Research

### Research Fields & Facilities

Located in the heart of Canada's capital, a few steps away from Parliament Hill, the University of Ottawa is among Canada's top 10 research universities.

uOttawa focuses research strengths and efforts in four Strategic Areas of Development in Research (SADRs):

- Canada and the World
- Health
- e-Society
- Molecular and Environmental Sciences

With cutting-edge research, our graduate students, researchers and educators strongly influence national and international priorities.

### Research at the Faculty of Medicine

"The Faculty of Medicine has a long history of conducting both basic and clinical research of the highest quality. Many of our high profile research projects are conducted in partnership with affiliated-teaching hospitals and research institutes. These partnerships lead to biomedical discoveries that have a significant impact on health care. In the process they educate the next generation of Canadian scientists. Our research activity also attracts significant investment, which stimulates the Ottawa economy."

- Dr. Bernard Jasmin, Vice-Dean, Research

### Facilities, Research Centres and Institutes at the Faculty of Medicine

- Centre for Neural Dynamics (<https://neurodynamic.uottawa.ca/>)
- University of Ottawa Centre for Neuromuscular Disease (<http://med.uottawa.ca/neuromuscular/>)
- Centre for Research in Biopharmaceuticals and Biotechnology (<http://www.med.uottawa.ca/crb/b/eng/>)
- Canadian Partnership for Stroke Recovery (<https://canadianstroke.ca/>)
- Kidney Research Centre (<http://www.ohri.ca/centres/KRC/default.asp>)
- University of Ottawa Skills and Simulation Centre (<http://uoss.ca/>)
- Medical Devices Innovation Institute
- Ottawa Institute of Systems Biology (<http://med.uottawa.ca/oisb/>)
- University of Ottawa Brain and Mind Research Institute (<http://www.uottawa.ca/brain/>)

For more information, refer to the list of faculty members and their research fields on **Uniweb**.

**IMPORTANT: Candidates and students looking for professors to supervise their thesis or research project can also consult the website of the faculty or department (<https://www.uottawa.ca/graduate-studies/students/academic-unit-contact-information/>) of their program of choice. Uniweb does not list all professors authorized to supervise research projects at the University of Ottawa.**

## Courses

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

### MIC 5100 Pathogen Interactions and Host (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.

**Course Component:** Lecture

**Prerequisite:** At least one undergraduate course in microbiology and/or immunology and one course in molecular biology.

### MIC 5102 Principles of Biomanufacturing (3 units)

This course will cover the fundamental biological principles impacting the development and efficacy of biotherapeutics. The course will also include topics such as the steps related to biomanufacturing processes, analytical development, quality control and assurance.

**Course Component:** Lecture

### MIC 5103 Seminar in Biomanufacturing and Commercialization (3 units)

Seminars on topics of current interest in biomanufacturing and related subjects. Seminars will consist of visiting lectures from entrepreneurs and speakers from industry, regulatory agencies and patient advocate organizations with real-life experience, who will share their stories on the path to production, clinical implementation and commercialization of biological therapeutics.

**Course Component:** Seminar

### MIC 5366 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 (Satisfactory) or NS (Not satisfactory).

**Course Component:** Seminar

### MIC 6003 Thesis Research in Microbiology and Immunology III

**Volet / Course Component:** Cours magistral / Lecture

### MIC 8120 Advanced Topics in Immunometabolism (3 units)

An advanced study of the recent literature dealing with the field of immunometabolism, with a focus on both immunometabolic pathways and the specialized techniques that allow for understanding chronic inflammatory/metabolic diseases, such as cancer, type 2 diabetes, obesity, atherosclerosis, neurodegeneration, etc.

**Course Component:** Lecture

### MIC 8122 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.

**Course Component:** Seminar

**Prerequisite:** MIC 4125.

**MIC 8124 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.

**Course Component:** Lecture

**MIC 8125 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.

**Course Component:** Lecture

Prerequisite: Permission of the course coordinator.

**MIC 8126 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.

**Course Component:** Lecture

Prerequisite: MIC 4125.

**MIC 8129 Current Topics in Haematopoietic 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.

**Course Component:** Lecture

Prerequisite: At least one undergraduate course in immunology or cell biology.

**MIC 8134 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.

**Course Component:** Lecture

**MIC 8236 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.

**Course Component:** Lecture

**MIC 8238 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.

**Course Component:** Lecture

**MIC 8241S Seminars II (2 crédits / 2 units)**

Every graduate student will be required to attend the weekly departmental seminars. Compulsory for all graduate students.

**Volet / Course Component:** Cours magistral / Lecture

**MIC 8242S Seminars III (2 crédits / 2 units)**

Every graduate student will be required to attend the weekly departmental seminars. Compulsory for all graduate students.

**Volet / Course Component:** Cours magistral / Lecture

**MIC 8243S Seminars IV (2 crédits / 2 units)**

Every graduate student will be required to attend the weekly departmental seminars. Compulsory for all graduate students.

**Volet / Course Component:** Cours magistral / Lecture

**MIC 8244S Seminars V (2 crédits / 2 units)**

Every graduate student will be required to attend the weekly departmental seminars. Compulsory for all graduate students.

**Volet / Course Component:** Cours magistral / Lecture

**MIC 8366 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 (Satisfactory) / NS (Not satisfactory).

**Course Component:** Seminar

**MIC 8401 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.

**Course Component:** Lecture

Prerequisite: MIC 5224 or equivalent.

**MIC 8500 Special Topics in Health- Related Environmental Microbiology (3 crédits)**

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.

**Volet :** Cours magistral

Prerequisite: MIC 5500 or equivalent.

**MIC 8534 Structure et expression des génomes procaryotes et eucaryotes (3 crédits)**

Le séquençage des génomes eucaryotes et procaryotes, avec un accent particulier sur les technologies récentes, l'alignement des séquences et les bases de données, et l'assemblage des génomes à partir de données générées par séquençage haut débit. Les études de cartographie comparée incluant les études d'associations pangénomiques basées sur le déséquilibre de liaison pour caractériser les variantes fonctionnelles associées aux traits complexes. L'analyse et la structure de métagénomes microbiens issus d'habitats humains et environnementaux incluant l'analyse structure-fonction des communautés microbiennes, les corrélations entre les maladies humaines et le microbiome ainsi que la phylogénie moléculaire. L'expression génique incluant les mesures de transcriptomes et de protéomes ainsi que l'analyse statistique des données. La combinaison des différentes données omiques pour comprendre les interactions gène-environnement.

**Volet :** Cours magistral

**MIC 8700 Biology and Pathogenesis of HIV Infection (3 crédits)**

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.

**Volet :** Séminaire

**MIC 9998 Examen de synthèse / Comprehensive Examination**

**Volet / Course Component:** Recherche / Research