

# DOCTORATE IN PHILOSOPHY CLINICAL SCIENCE AND TRANSLATIONAL MEDICINE

## Overview

First of its kind in Canada; Clinical Science and Translational Medicine (CTM) is a unique translational, multi-disciplinary, research-based and competency-based graduate program based in the Faculty of Medicine that can be accessed by all clinical and basic sciences departments.

The innovative structure of the Clinical Science and Translational Medicine (CTM) prepares graduates for addressing real-world clinical challenges by bridging the gap between basic science or social sciences research and medical applications in the field of human health and diseases. The CTM program recognizes and targets the high value that future students place on choosing graduate training that precisely matches their individual career aspirations.

## Summary

Degree offered: Master of Science (MSc) or Doctorate in Philosophy (PhD)

Registration status option: Full-time

Language of program: Bilingual

Program options:

- PhD (12 full-time terms; 48 consecutive months)

Concentrations:

- Clinical Science and Translational Medicine
- Medical Imaging and Radiation Sciences (MIRS),
- Cardiovascular Medicine (CVM),
- Clinical Psychiatry (CP),
- Musculoskeletal Sciences (MSK),
- Quality and Patient Safety (QPS),
- Pharmaceutical Sciences (PS), or
- Artificial Intelligence and Computational Sciences (AICS).

Academic units: Faculty of Medicine, Department of Medicine, Department of Psychiatry, Department of Radiology, Radiation Oncology, and Medical Physics, Department of Surgery, Centre for Neuromuscular Disease, Department of Innovation in Medical Education, and the School of Pharmaceutical Sciences.

## Program Description

The Clinical Science and Translational Medicine (CTM) graduate program provides multidisciplinary training in clinical and translational research at the master's and doctoral levels. With eight concentrations to choose from, the program equips students with the necessary competencies to develop innovative approaches in collaborative settings, tackle complex biomedical questions, and translate findings to the patient bedside. The program is designed to cultivate foundational research skills essential to scientific inquiry and specialized skills tailored to the dynamic intersection of biomedical research and clinical research. The

innovative competency-based graduate program builds on the Faculty of Medicine's successful BSc in Translational and Molecular Medicine.

For more information please see the website of the Faculty of Medicine (<https://www.uottawa.ca/faculty-medicine/>).

## Main Areas of Research

- Clinical Science and Translational Medicine
- Biomedical research
- Medicine

## 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 (<https://www.uottawa.ca/study/graduate-studies/funding-financing/>).

International students enrolled in a French-language program of study may be eligible for a differential tuition fee exemption (<https://www.uottawa.ca/study/fees-financial-support/university-fees/tuition-international/>).

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

## Notes

- Programs are governed by the academic regulations (<https://www.uottawa.ca/about-us/policies-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.

**Program Contact Information**  
Graduate Studies Office, Faculty of  
Medicine (<https://med.uottawa.ca/graduate-postdoctoral/>)  
**451 Smyth Road, Room RGN 2016**  
**Ottawa, Ontario, Canada**  
**K1H 8M5**

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**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:

- Hold a master's degree in science with a background in CTM related area (e.g. biology, biochemistry, pharmacology, physiology, human kinetics, biopharmaceutical, biomedical sciences, physics, chemistry, computer science, software engineering or mathematics, human genetics, neuroscience, psychology, computer science, engineering, interdisciplinary health sciences) with a minimum admission average of B+ (75%);
- Demonstrate good academic performance 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 know the applicant and their academic performance; and
- Identify one or two appropriate faculty members willing and available to act as thesis supervisors.

Accepted students may select one of the program's eight concentrations as their official area of specialization. However, it is not compulsory for students to select a concentration, and they can choose to enroll in CTM alone depending on their research project. Depending on the concentration and degree level, the training path includes electives, methods courses, a major research project, various other training activities on specific themes determined by the individual research project, and the original thesis research. Each student's training path is defined based on an individualized study plan (ISP).

## Language Requirements

Applicants must be able to understand and fluently speak the language of instruction 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.

Language tests need to be recognized by the University of Ottawa and scores must meet the thresholds denoted here (<https://www.uottawa.ca/faculty-medicine/graduate-postdoctoral/programs-admission/language-requirements/>).

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 academic regulations (<https://www.uottawa.ca/about-us/policies-regulations/>) in effect for graduate studies.
- 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.

**IMPORTANT:** Candidates and students looking for professors to supervise their thesis or research project can also consult the website of the faculty or department of their concentration of choice. Uniweb does not list all professors authorized to supervise research projects at the University of Ottawa.

## Program Requirements

### Doctorate

Students must meet the following requirements:

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

MED 8166	Professionalism and Professional Skills	
CTM 8101	Research Methods and Experimental Design	3 Units
CTM 8102	PhD Seminar	3 Units
CTM 8103	Comprehensive Examination (PhD)	
CTM 8104	PhD Entrustable Professional Activities	
CTM 8134	Directed studies in clinical and translational medicine	3 Units

#### Electives

1 elective course unit in Clinical Science and Translational Medicine (CTM) at the graduate level <sup>2</sup>

## Thesis

THD 9999 Doctoral Thesis <sup>3,4</sup>

### Note(s)

1

The Faculty of Medicine may require students to take additional courses, or other activities, depending on their backgrounds.

2

The number of optional courses will vary from one concentration to another and will be established based on the individual study plan.

3

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

4

Students are responsible for ensuring they have met all of the thesis requirements (<https://www.uottawa.ca/faculty-medicine/graduate-postdoctoral/student-hub/thesis-find-supervisor/>).

Note: Each concentration at the MSc or PhD level has its own requirements for the expected EPA rating for each of the associated milestones. It is expected that all students demonstrate EPA entrustment at levels that align with their degree's option and level of training.

## Minimum Requirements

The passing grade in all credit courses is C+.

Students who fail two courses must withdraw from the program.

Students must demonstrate entrustment for each of their concentration's 12 EPAs to graduate with a minimum passing grade of 80% (based on the rating scale and expected level of entrustment as per their degree option). Once a competency issue is identified, the graduate program director convenes a remediation meeting with the supervisor and student to discuss, devise, and document a plan to address the issue within an acceptable timeframe. This documentation also describes the consequences for unsatisfactory remediation in the event that student fails to meet the expectations therein.

## Research

### Research at the University of Ottawa

Located in the heart of Canada's capital, a few steps away from Parliament Hill, the University of Ottawa ranks among Canada's top 10 research universities. Our research is founded on excellence, relevance and impact and is conducted in a spirit of equity, diversity and inclusion.

Our research community thrives in four strategic areas:

- Creating a sustainable environment
- Advancing just societies
- Shaping the digital world
- Enabling lifelong health and wellness

From advancing healthcare solutions to tackling global challenges like climate change, the University of Ottawa's researchers are at the forefront of innovation, making significant contributions to society and beyond.

## 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
- 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://uossc.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

### CTM 7101 MSc Seminar (3 units)

Compulsory for all students enrolled in the master program. Presentation of two seminars or one seminar and one poster required during the year as well as regular attendance at the CTM seminar series.

**Course Component:** Seminar

### CTM 7102 MSc with Research Project Entrustable Professional Activities

**Course Component:** Research

**CTM 7103 Research Project (6 units)**

Obligatoire pour tous les étudiants inscrits au programme de maîtrise basé sur le projet de recherche. Les candidats au MSc s'engageront dans un projet de recherche en laboratoire de 8 mois guidé par un membre du corps professoral, englobant le développement de questions de recherche, la conception expérimentale, l'acquisition des données et la rédaction scientifique. Ce projet expérientiel favorise le développement des compétences essentielles, aboutissant à un rapport de projet sous la forme d'un court article de journal/ Compulsory for all students enrolled in the research project based master program. MSc candidates will engage in an 8-month laboratory research project guided by faculty member, encompassing research question development, experimental design, data handling, and science writing. This experiential project fosters core skill development, culminating in a project report in the format of a short journal article.

**Course Component:** Research

**CTM 7104 MSc Thesis Entrustable Professional Activities**

**Course Component:** Research

**CTM 7105 Stage / Internship (6 units)**

Expérience pratique et exécution d'un projet ayant trait aux sciences cliniques et médecine translationnelle, sous la supervision d'un membre du corps professoral. Noté S (satisfaisant) ou NS (non satisfaisant) à partir d'un rapport de stage écrit et des résultats du stage. / Practical experience and completion of a project related to clinical science and translational medicine, under the supervision of a faculty member. Graded S (Satisfactory) / NS (Not satisfactory) based on a written report on the project, and on performance during the internship.

**Course Component:** Praticum

**CTM 7501 MSc Séminaire (3 crédits)**

Obligatoire pour tous les étudiants inscrits au programme de maîtrise. Présentation de deux séminaires ou un séminaire et un poster requis au cours de l'année, ainsi qu'une participation régulière à la série de séminaires MCT.

**Volet :** Séminaire

**CTM 8101 Research Methods and Experimental Design (3 units)**

Introduction to fundamentals of CTM, basic biostatistics, and experimental design in clinical and translational research.

**Course Component:** Lecture

**CTM 8102 PhD Seminar (3 units)**

Compulsory for all students enrolled in the doctorate program. Presentation of two seminars or one seminar and one poster required during the year as well as regular attendance at the CTM seminar series.

**Course Component:** Seminar

**CTM 8103 Comprehensive Examination (PhD)**

**Course Component:** Research

**CTM 8104 PhD Entrustable Professional Activities**

**Course Component:** Research

**CTM 8105 Advanced Focused Topics in Basic and Clinical Cardiovascular Medicine (3 units)**

Advanced exposure to focused topics in Cardiovascular Medicine on either electrophysiology, coronary artery disease, heart function, myocardial disorders, or valvular disorders.

**Course Component:** Lecture

**CTM 8106 Advanced Topics in Cardiovascular Medicine (3 units)**

Advanced mechanisms in Cardiovascular Medicine and survey of cardiac electrophysiology, cardiac pathology, coronary artery disease, heart function, myocardial disorders, and valvular disorders.

**Course Component:** Lecture

**CTM 8107 Introduction to Radiation Sciences (3 units)**

Introduction of classical radiobiology concepts and their clinical applications through relevant calculations and hands-on experience with state-of-the-art equipment and simulation tools.

**Course Component:** Lecture

**CTM 8108 Introduction to Medical Imaging Physics (3 units)**

Introduction of the principles and clinical applications of various medical imaging modalities, the physics of image formation, equipment, safety, image reconstruction, through hands-on experience with state-of-the-art imaging equipment.

**Course Component:** Lecture, Seminar

**CTM 8109 Introduction to AI & Machine Learning in medical imaging (3 units)**

Introduction to AI in medical imaging, focusing on quantitative feature extraction, machine learning, and deep learning. Emphasis on experimental design and rigorous analysis of results.

**Course Component:** Lecture, Seminar

**CTM 8110 Advanced Topics in Magnetic Resonance Imaging and Spectroscopy (3 units)**

Advanced study of Magnetic Resonance Imaging and Spectroscopy with a focus on relaxation theory, k-space, pulse sequence design, sequence optimization, image reconstruction, MR spectroscopy, diffusion imaging, perfusion imaging, quantitative susceptibility MR, accelerated imaging, high-field, and hybrid PET-MR.

**Course Component:** Lecture, Seminar

**CTM 8111 Special Topics in Image Processing (3 units)**

Introduction to current applications of processing utilities and scientific computing tools. Study of image processing in medical imaging, covering file-format conversion, registration, error correction, data fitting, and tissue segmentation.

**Course Component:** Lecture

**CTM 8112 Special Topics in Radiation Oncology (3 units)**

Study of radiation oncology physics with a focus on clinical applications and advanced technologies for graduate students.

**Course Component:** Lecture

**CTM 8113 Special Topics in Cardiac Computed Tomography and Magnetic Resonance Imaging (3 units)**

Study of recent advances in imaging, including cardiac imaging in CT and MRI. Examine the basics of MR and CT physics, CT and MR instrumentation, calcium scoring, non-invasive coronary angiography, cardiac anatomy, function, viability and perfusion imaging, and valvular abnormalities.

**Course Component:** Lecture, Seminar

**CTM 8114 Special Topics in Cardiac Nuclear Imaging (3 units)**

Study of advances in cardiac nuclear imaging and the technologies, techniques and clinical indicators in cardiac nuclear imaging including basics of radiation physics, SPECT and PET.

**Course Component:** Lecture, Seminar

**CTM 8115 Quality Improvement (QI) Methods (3 units)**

Introduction to the TOH Innovation Framework for healthcare improvement and innovation, including case examples of QI tools such as problem analysis, root cause analysis, process monitoring, PDSAs, and methods for sustaining and evaluating an improvement initiative.

**Course Component:** Lecture

**CTM 8116 Patient Safety (3 units)**

Introduction to quality and safety legislation, patient safety methods, Just Culture, safety measurement systems, safety interventions, and human factors.

**Course Component:** Lecture

**CTM 8117 Variation and Statistical Process Control (3 units)**

Introduction to variation theory and process assessment methods, with a focus on run charts and control charts and their relevance to quality outcomes.

**Course Component:** Lecture

**CTM 8118 Advanced topics in microbiome and drug development (3 units)**

Advanced study of recent developments in human microbiome impacts on health and disease, and the development of therapeutics targeting the gut microbiome, and the development of microbiome based assays.

**Course Component:** Lecture

**CTM 8119 Advanced topics in Targeted Pharmacotherapy in Oncology (3 units)**

Introduction to the drug development process in oncology covering the discovery, preclinical and clinical phases, clinical trial conduct, approved anti-cancer drugs including chemotherapy, targeted therapies, and immunotherapies. The course also includes biomarker usage in patient selection for treatment and new therapeutic strategies.

**Course Component:** Lecture

**CTM 8120 Advanced topics monoclonal Antibodies in Therapy (3 units)**

Advanced study of the history, current state, and future of mAb therapy including the hybridoma method, antibody engineering, the translation of mAbs to the clinic, as well as study of mAbs as direct drugs or delivery agents for cytotoxic small molecules.

**Course Component:** Lecture

**CTM 8121 Advanced topics Antibody-drug conjugates (3 units)**

Advanced study of the history, present status, and future of antibody-drug conjugates (ADCs), providing students with an understanding of their construction and technical challenges. Examination of preclinical and clinical trial design and methodology, as well as regulatory and economic aspects of ADC therapy.

**Course Component:** Lecture

**CTM 8122 Advanced topics in The Cell Nucleus in Pharmaceuticals (3 units)**

Advanced study of the structure and function of the cell nucleus and its relevance to pharmaceuticals, including nuclear transport as a pharmacological target and current/future perspectives for pharmacological targeting of the nucleus.

**Course Component:** Lecture

**CTM 8123 Advanced topics in the Treatments of skeletal muscle diseases (3 units)**

Advanced study of diseases affecting the musculoskeletal system and current therapies, including non-surgical management therapies including emerging drugs and nutritional strategies, for treating myopathies.

**Course Component:** Lecture

**CTM 8124 Advanced topics in Integrative Nutrition (3 units)**

Advanced study of recent advances in selected areas of nutritional compounds and their roles in the pathogenicity and treatments these diseases.

**Course Component:** Lecture

**CTM 8125 Special topics in pharmacology (3 units)**

Advanced study of the recent advances in selected areas of pharmacology.

**Course Component:** Lecture

**CTM 8126 Special topics in drug development (3 units)**

Advanced study of the recent advances in selected areas of drug development.

**Course Component:** Lecture

**CTM 8127 Special topics in human microbiome (3 units)**

Advanced study of the recent advances in selected areas of human microbiome.

**Course Component:** Lecture

**CTM 8128 Special Topics in Neuroimaging (3 units)**

Introduction to the scientific and technical foundations of neuroimaging and a focus on data acquisition, research study design, and analysis methods for various neuroimaging modalities.

**Course Component:** Lecture

**CTM 8129 Advanced Topics in Psychiatry (3 units)**

Advanced study of recent progress in psychiatry and clinical neuroscience, examination of psychosocial, biological, developmental, experiential, and environmental factors impact behavior, symptoms, and treatment.

**Course Component:** Lecture

**CTM 8130 Special Topics in Interdisciplinary Social Studies in Medicine (3 units)**

Advanced study of interdisciplinary social research while embedded in clinical settings.

**Course Component:** Seminar

**CTM 8131 Advanced topics in the Treatments of degenerative Musculoskeletal diseases (3 units)**

Advanced study of diseases affecting the musculoskeletal system focusing on degenerative conditions of osteo-articular joints and tendons discussing surgical management ie. Osteotomies, cartilage grafts and joint replacements.

**Course Component:** Lecture

**CTM 8132 Advanced topics in Joint Biomechanics and Biomaterials (3 units)**

Advanced study of the principles of joint mechanics essential for normal joint function as well as factors leading to joint malfunction/pain and properties of biomaterials.

**Course Component:** Lecture

**CTM 8133 Advanced topics in infections affecting the MSK system (3 units)**

Advanced study of infections post-surgical interventions after trauma or joint replacement surgery focusing on the patho-mechanisms as well as antibiotic and surgical treatments.

**Course Component:** Lecture

**CTM 8134 Directed studies in clinical and translational medicine (3 units)**

Individual course aimed at deepening the student's knowledge in a specific area of clinical and translational medicine.

**Course Component:** Lecture

**CTM 8501 Études dirigées en médecine clinique et translationnelle (3 crédits)**

Cours individuel ayant pour objectif d'approfondir les connaissances de l'étudiant dans un domaine particulier de la médecine clinique et translationnelle.

**Volet :** Cours magistral



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**CTM 8502 PhD Séminaire (3 crédits)**

Obligatoire pour tous les étudiants inscrits au programme de doctorat.  
Présentation de deux séminaires ou un séminaire et un poster requis  
au cours de l'année, ainsi qu'une participation régulière à la série de  
séminaires MCT.

**Volet :** Séminaire