DOCTORATE IN PHILOSOPHY EARTH SCIENCES AND SPECIALIZATION CHEMICAL AND ENVIRONMENTAL TOXICOLOGY

Summary

- Degree offered: Doctorate in Philosophy (PhD)
- Registration status option: Full-time
- Language of instruction: English
- Primary program: PhD in Earth Sciences
- Collaborative specialization: Chemical and Environmental Toxicology
- Program option (expected duration of the program):
  - with thesis (12 full-time terms; 48 consecutive months)
- Academic units: Faculty of Science (http://science.uottawa.ca/), Department of Earth and Environmental Sciences (http://science.uottawa.ca/earth/), Ottawa-Carleton Geoscience Centre (http://science.uottawa.ca/earth/ocgc-institute/).

Program Description

Ottawa-Carleton Geoscience Centre

Established in 1982, the Ottawa-Carleton Geoscience Centre (OCGC) combines the research strengths of the University of Ottawa and Carleton University. The Centre offers graduate programs leading to the master's (MSc) and doctoral (PhD) degrees in Earth sciences.

Research facilities are shared between the two campuses. Students have access to the professors, courses and facilities at both universities; however, they must enroll at the "home university" of the thesis supervisor.

The Centre is one of the participating units in the collaborative program in chemical and environmental toxicology (at the master's and doctoral levels).

Collaborative Program Description

Toxicology is the study of effects of toxic substances on living systems. These toxic substances can either be organic or inorganic, synthetic or natural materials. Environmental toxicology further extends to aspects of chemical transport, fate, persistence and biological accumulation of toxic substances and their effects at the population and community levels. While individual researchers usually specialize in a particular area, toxicologists today must be able to appreciate significant research in other fields and therefore require an understanding of the basic principles of other disciplines. To meet this challenge the University of Ottawa and Carleton University offer a joint collaborative program leading to a master of science or a PhD degree with specialization in chemical and environmental toxicology.

This Ottawa-Carleton collaborative program in Chemical and Environmental Toxicology is intended to augment the research and training available to students through the individual supporting institutes.

Main Areas of Research

- Environmental geoscience
- Geochemistry
- Petrology
- Geomathematics
- Geomatics
- Mineral resources studies
- Sedimentary systems
- Tectonics
- Geophysics

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

- Master of Science Earth Sciences (MSc)
- Master of Science Earth Sciences Specialization in Chemical and Environmental Toxicology (MSc)
- Master of Science Earth Sciences Specialization in Science, Society and Policy (MSc)
- Doctorate in Philosophy Earth Sciences (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 academic regulations (https://www.uottawa.ca/about-us/leadership-governance/policies-regulations/) in effect for graduate studies at each of the two universities.
- 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 Science (https://science.uottawa.ca/en/faculty-services/graduate-studies/)

30 Marie-Curie Street, Gendron Hall, Room 181

Ottawa, Ontario, Canada

K1N 6N5

Tel.: 613-562-5800 x3145

Email: gradsci@uOttawa.ca

Twitter | Faculty of Science (https://twitter.com/uOttawaScience/?lang=en)

Facebook | Faculty of Science (https://www.facebook.com/uOttawaScience/)

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 master's degree in earth sciences (or equivalent) 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.
- Meet the funding requirements.

  Note: International students must provide proof of financial support: i.e., a stipend provided by a supervisor as well as a combination of awards and/or trust funds.

- 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.
  - The choice of supervisor will determine the primary campus location of the student. It will also determine which university awards the degree.
- Be sponsored into the collaborative specialization by a faculty member of the collaborative program, normally the thesis supervisor, who must be appointed, cross-appointed or stand as an adjunct at the primary program.
- Meet the following additional requirements:
  - Complete a relevant introductory course in toxicology, either:
    - Prior to admission to the collaborative program in chemical and environmental toxicology; or
    - While enrolled in the program by taking one of the two introductory courses (TOX 8156 or TOX 9104).

Language Requirements

Applicants must be able to understand, write and fluently speak the language of instruction (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 academic regulations (https://www.uottawa.ca/about-us/leadership-governance/policies-regulations/) in place for graduate studies and by the general regulations of the Ottawa-Carleton Geoscience Centre (OCGC).
- Candidates must apply to the primary program and indicate in their application for admission to the PhD program in Earth Sciences that they wish to be accepted into the collaborative specialization in Chemical and Environmental Toxicology. To be admitted to the collaborative program, candidates must also be accepted in the primary program.

Fast-Track from Master's to PhD

Students enrolled in the master's program in Earth Sciences at the University of Ottawa may be eligible to fast-track directly into the doctoral program without writing a master's thesis, provided the following conditions are met:

- Completion of two graduate courses (six units) with a grade of A- or better in each;
- Satisfactory progress in the research program;
- Written recommendation by the supervisor and the advisory committee;
- Approval by the graduate studies committee.

Notes:

- The transfer to the PhD must take place within sixteen months of initial enrollment in the master's.
- Following the transfer, all the requirements of the doctoral program must be met: six units of coursework in addition to the six already completed, the comprehensive exam (to be completed within 12 months of transfer), participation in the geoscience seminar series, and the thesis.

Program Requirements
Doctorate with Collaborative Specialization

Requirements for this program have been modified. Please consult the 2019-2020 calendars (http://catalogue.uottawa.ca/en/archives/) for the previous requirements.

The Department may require students to take additional courses, depending on their backgrounds. The units completed for the specialization count also towards the primary program.

Students must meet the following requirements for the doctorate with collaborative specialization:

Compulsory Courses:		
3 course units from:		3 Units
TOX 8156	Principles of Toxicology	
TOX 9104	Ecotoxicology	
3 optional course units in Earth sciences (GEO) at the graduate level [1]		3 Units
Seminar:		
GEO 8900	PhD Seminar	
TOX 9105	Seminar in Toxicology [2, 3]	3 Units
Comprehensive Examination:		
GEO 9998	Comprehensive Examination (Ph.D.) [4]	
Thesis:		
THD 9999	Doctoral Thesis [5, 6]	

Note(s)

1

The optional course units may also be selected from related disciplines approved by the Department of Earth Sciences.

2

Students who completed the seminar course TOX 9105 for the master's specialization are exempted from this requirement.

3

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

4

The comprehensive examination must be successfully completed within twelve months of the initial admission into the program.

5

Presentation and defense of a thesis in toxicology based on an original research carried out under the supervision of a faculty member participating in the chemical and environmental toxicology collaborative program.

6

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

Minimum Requirements

The passing grade in all courses is B.

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.

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 Science

The Faculty of Science has become a true centre of excellence in research through its world-class professors as well as its programs and infrastructure in Biology, Chemistry, Earth Sciences, Mathematics and Statistics, and Physics.

The research accomplished by its 140 internationally recognized professors, its approximately 400 graduate students and its dozens of postdoctoral researchers and visiting scientists has positioned the Faculty of Science as one of the most research intensive science faculties in Canada. Our professors have received many international and national awards including three NSERC Gerhard Herzberg Gold Medal winners and numerous Fellows of the Royal Society of Canada.

The Faculty of Science, through its strategic use of infrastructure programs, hosts world-class Core Facilities and is at the leading edge for the study of Catalysis, Experimental and Computational Chemistry, Environmental Toxins, Nuclear Magnetic Resonance, Isotope Analysis, Molecular Biology and Genomics, X-Ray Spectrometry/Diffractometry, Geochemistry, Mass Spectrometry, Physiology and Genetics of Aquatic Organisms, and Photonics. The Faculty is also associated with the Fields Institute for research in mathematical science and the Centre de recherche mathématiques (CRM) at the Université de Montréal, providing a unique setting for mathematical research.

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/study/graduate-studies/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.
A 3-unit course at the University of Ottawa is equivalent to a 0.5-unit course at Carleton University.

GEO 5114 Mineralogy (3 units)
An advanced course covering selected topics in mineralogy, such as crystallography, crystal chemistry, crystal structure, mineralogy of rock-forming mineral groups, and instrumental methods in mineralogical research, such as use of electronic optical instruments, spectroscopy, and X-ray crystallography; seminar presentations and practical exercises included. This course is equivalent to ERTH 5104 at Carleton University.
Course Component: Lecture

GEO 5115 Thermodynamics, Kinetic Theory and Metamorphic Petrology (3 units)
Phase equilibria, phase diagrams, and the kinetics of mineral reactions; mass transfer, regional and global aspects of metamorphic, petrogenesis. Course may include one or two weeks of field-based instruction with costs borne by students. This course is equivalent to ERTH 5105 at Carleton University.
Course Component: Lecture

GEO 5122 Advanced Igneous Petrology (3 units)
The course focuses on particular aspects of the discipline and integrates physical and chemical processes with the dynamics of magmatic systems to understand igneous processes. This course is equivalent to ERTH 5202 at Carleton University.
Course Component: Lecture

GEO 5124 Geology and Geochemistry of Ore Deposits (3 units)
An advanced course in ore deposits examining aspects of their geology, geochemistry, and exploration. Topics will be selected from a range of different deposit types, including hydrothermal and magmatic ore deposits, as well as laboratory and field examination of different ores and their host rocks. This course is equivalent to ERTH 5204 at Carleton University.
Course Component: Lecture

GEO 5125 Natural Hazards in Canada - Risk and Impacts (3 units)
Overview of natural hazards and severe weather phenomena in Canada. Notions of risk, return period and probability of occurrence of natural disasters. Impact on society and infrastructure. Mitigation policies and strategies. This course is equivalent to ERTH 5215 at Carleton University.
Course Component: Lecture

GEO 5131 Siliciclastic Sedimentology (3 units)
Origin and significance of physical and sedimentary processes and structures. Analysis of ancient siliciclastic depositional environments in a facies model and sequence stratigraphic framework. Course involves lectures, seminars and field excursions. This course is equivalent to ERTH 5301 at Carleton University.
Course Component: Lecture

GEO 5135 Carbonate Sedimentology (3 units)
Aspects of modern depositional systems, dynamic facies models, sequence stratigraphy, mineralogy, and diagenesis of carbonate sediments. The practical part of the course will consist of a field-laboratory project that integrates various techniques in carbonate sedimentology (mapping, petrography, staining, cathodoluminescence, fluorescence, SEM).This course is equivalent to ERTH 5305 at Carleton University.
Course Component: Lecture

GEO 5136 Paleobiology (3 units)
Extinctions, micro- and macro- evolutionary processes, long-term trends and cycles in the Phanerozoic; functional morphology; application of invertebrates to biostratigraphy, paleoceanography and paleolimnology. May include one or two weeks of field-based instruction with costs borne by the student. This course is equivalent to ERTH 5306 at Carleton University.
Course Component: Lecture

GEO 5137 Evolutionary Developmental Biology (3 units)
Explores the mechanistic basis of organismic evolution from genetic, morphogenetic and epigenetic perspectives, within a phylogenetic context of living and extinct vertebrates. Lectures two hours a week and a laboratory of three hours a week. This course is equivalent to ERTH 5307 at Carleton University.
Course Component: Lecture

GEO 5138 Advanced Micropaleontology (3 units)
Paleobiology, biostratigraphy and paleoecology of microfossils in the context of paleoceanography, paloelimnology and paleoclimatology. Course may involve a field trip with costs to be paid by students. This course is equivalent to ERTH 5308 at Carleton University.
Course Component: Laboratory

GEO 5143 Environmental Isotopes and Groundwater Geochemistry (3 units)
Geochemistry and environmental isotopes in studies of groundwater dynamics, age and contaminant hydrogeology. Environments from shallow groundwater and surface water to deep crustal brines are examined. Low temperature aqueous geochemistry and mineral solubility with emphasis on the carbonate system. This course is equivalent to ERTH 5403 at Carleton University.
Course Component: Lecture

GEO 5144 Isotope Mapping and Provenance Applications (3 units)
Isotopes are used to trace provenance of organic and inorganic materials. This course will discuss how traditional isotope systems vary in the environment at different spatiotemporal scales and how mapping their variations can solve problems in hydrology, climatology, ecology, and archeology. This course is equivalent to ERTH 5414 at Carleton University.
Course Component: Lecture

GEO 5145 Radioisotope Geochemistry Methods (3 units)
Overview of the basic principles of radiochemistry and examination of the occurrence, sources and production of radionuclides in the earth system that have been used extensively in environmental and geochemical studies. Discussion of and practice using the key methods of radionuclide detection. Equivalent to course ERTH 5405 at Carleton University
Course Component: Lecture

GEO 5147 Aqueous Inorganic Geochemistry and Modelling (3 units)
Covers concepts in aqueous geochemistry including ion hydration and hydrolysis, aqueous activity, complexation, mineral solubility, carbonate system, redox, adsorption/surface complexation and reaction kinetics. Bi-weekly assignments provide an introduction to equilibrium geochemical modelling. This course is equivalent to ERTH 5407 at Carleton University.
Course Component: Lecture

GEO 5149 Reactive Transport Modelling (3 units)
Introduction to the theory of numerical models and application of reactive transport models in hydrogeology. Focus will be on development of appropriate conceptual models of flow, transport and bio- and geochemical reactions and simulation of these conceptual models using reactive transport codes. This course is equivalent to ERTH 5409 at Carleton University.
Course Component: Lecture

GEO 5151 Precambrian Geology (3 units)
Geology of the main Archean cratons and Proterozoic belts with emphasis on North America. Formation of the Earth, composition and evolution of the crust and mantle during the first 4 billion years of Earth's history, from its formation to the end of the Proterozoic. This course is equivalent to ERTH 5501 at Carleton University.
Course Component: Lecture

GEO 5153 Computer Techniques in the Earth Sciences (3 units)
A practical course for mapping; quantitative analysis, integration and modeling of spatial data related to geosciences and engineering applications using a combination of GIS, statistical and geostatistical analysis techniques. This course is equivalent to ERTH 5503 at Carleton University.
Course Component: Lecture

GEO 5155 Climate Change (3 units)
Considers climate changes and their driving mechanisms over a broad range of timescales based on observations from geological archives and more recent instrumented evidence. Future climate projections and their accuracy are also considered. This course is equivalent to ERTH 5505 at Carleton University.
Course Component: Lecture

GEO 5157 Tectonic Processes Emphasizing Geochronology and Metamorphism (3 units)
Applications of empirical, analytical and quantitative techniques to problems in regional geology and crustal tectonics; orogenic processes; heat and metamorphism; isotopic geochronology as applied to thermal history. This course is equivalent to ERTH 5507 at Carleton University.
Course Component: Lecture

GEO 5160 Chemistry of the Earth (3 units)
Examine the composition of the mantle and crust in selected tectonic settings, such as subduction zones and hot spots. Topics may include how geochemical data constrain geodynamic settings of study area. This course is equivalent to ERTH 5600 at Carleton University.
Course Component: Lecture

GEO 5163 Stable Isotope Geochemistry (3 units)
Mechanisms of isotope fractionation, fractionation in nature; physical and chemical isotope fractionation, kinetic isotope effects. Variations of stable isotope ratios (hydrogen, carbon, oxygen and sulphur) in nature. Preparation techniques of natural samples for isotope analysis. Applications of stable isotopes to study magma genesis, ore genesis, nature of water and formation fluids and sedimentary environments. This course is equivalent to ERTH 5603 at Carleton University.
Course Component: Lecture

GEO 5169 Radiogenic Isotope Geochemistry (3 units)
Radiogenic isotope systematics applied to the solid Earth and their use to understand various geological processes. Evolution of large-scale isotopic reservoirs throughout Earth's history. Application of different radiometric dating techniques, assessment of geochronological data, models and interpretations. This course is equivalent to ERTH 5609 at Carleton University.
Course Component: Lecture

GEO 5171 Physics of the Earth (3 units)
The physics and dynamics of the solid Earth: seismology; gravitational and magnetic fields; thermal state. Geophysical constraints on the structure and composition of the interior. Geodynamic processes. This course is equivalent to ERTH 5701 at Carleton University.
Course Component: Lecture

GEO 5173 Structural Geology (3 units)
Deformation processes and the analysis of geological structures at all scales. This course is equivalent to ERTH 5703 at Carleton University.
Course Component: Lecture

GEO 5174 Tectonics (3 units)
Dynamical and geological aspects of plate tectonics throughout Earth history. This course is equivalent to ERTH 5704 at Carleton University.
Course Component: Lecture

GEO 5177 Engineering Seismology (3 units)
Seismological topics with engineering applications. Characterization of seismicity and seismic sources (areas and faults). Seismic hazard analysis. Empirical and theoretical modeling of strong ground motion in time and frequency domains. This course is equivalent to ERTH 5707 at Carleton University.
Course Component: Lecture

GEO 5178 Geophysical Signal Processing (3 units)
Practical aspects of earthquake and other geophysical signal processing; focus on application of Fourier analysis, digital filters, instrument response. This course is equivalent to ERTH 5708 at Carleton University.
Course Component: Lecture

GEO 5191 Research Topics in Earth Sciences (3 units)
Directed reading/field/laboratory studies unrelated to thesis research, under the guidance of directors other than the thesis supervisor. A written proposal including research plan, deliverables, and evaluation must be submitted for departmental approval prior to registration. Written report required. This course is equivalent to ERTH 5901 at Carleton University.
Course Component: Research

GEO 5193 Field Studies (3 units)
Field investigations, unrelated to thesis research, not under the guidance of the thesis supervisor. Minimum of ten days field work, plus library/lab research. Individual projects require an approved research plan, deliverables, and evaluation scheme prior to registration. Field costs may be borne by the student. This course is equivalent to ERTH 5903 at Carleton University.
Course Component: Research

GEO 5301 Seminars in Earth Sciences (3 units)
Covers a spectrum of Earth Sciences topics and research problems, ranging from the solid Earth to its surface environment and climate. A strong discussion component and has the primary aims of exposing students to current research problems and improving their communications skills (oral and written). This course is equivalent to ERTH 5001 at Carleton University.
Course Component: Seminar

GEO 5306 Hydrothermal Ore Deposits (3 units)
An advanced course in economic geology related to hydrothermal ore deposits, including their geology and geochemistry, physical and chemical controls on hydrothermal mineralization, the recognition and characterization of ore-fluid reservoirs, and the nature of large-scale fluid flow and alteration, with an emphasis on applications to exploration. This course is equivalent to ERTH 5206 at Carleton University.
Course Component: Lecture

GEO 5900 Séminaire de Maîtrise / MSc Seminar
Une fois inscrits au programme, les étudiants doivent présenter leurs recherches oralement à l'un des symposiums biannuels du Centre de géoscience Ottawa-Carleton. La conférence sur la recherche en sciences de la Terre, qui se tient périodiquement à l'Université d'Ottawa ou à l'Université Carleton, est un alternatif acceptable pour ces présentations. / Once during their enrolment in the program, students are required to present their research orally at one of the biannual Ottawa-Carleton Geoscience Centre graduate symposia. The Advances in Earth Science Research Conference, which is hosted periodically at the University of Ottawa or Carleton University, is an acceptable alternative venue for these presentations.
Volet / Course Component: Séminaire / Seminar

GEO 8900 Séminaire de doctorat / PhD Seminar
Une fois inscrits au programme, les étudiants doivent présenter leurs recherches oralement à l'un des symposiums biannuels du Centre de géoscience Ottawa-Carleton. La conférence sur la recherche en sciences de la Terre, qui se tient périodiquement à l'Université d'Ottawa ou à l'Université Carleton, est un alternatif acceptable pour ces présentations. / Once during their enrolment in the program, students are required to present their research orally at one of the biannual Ottawa-Carleton Geoscience Centre graduate symposia. The Advances in Earth Science Research Conference, which is hosted periodically at the University of Ottawa or Carleton University, is an acceptable alternative venue for these presentations.
Volet / Course Component: Séminaire / Seminar

GEO 9998 Examen de synthèse (doctorat) / Comprehensive Examination (Ph.D.)
L'examen de synthèse comprend une proposition de thèse et un examen oral dans trois domaines de spécialisation différents. Cet examen doit être passé dans les douze premiers mois suivant l'inscription au programme. Ce cours est équivalent à ERTH 6908 à l'Université Carleton. / The Comprehensive Examination involves a thesis proposal and oral examination in three different areas of specialization. This exam should be taken within the first twelve months of registration in the program. This course is equivalent to ERTH 6908 at Carleton University.
Volet / Course Component: Recherche / Research

TOX 5129 Adverse Outcome Pathways: A Framework to Support the Modernization of Chemical Risk Assessment (3 units)
This course will introduce the Adverse Outcome Pathway (AOP) framework and how it can be used to support the integration of modern test methods (e.g. in silico, in vitro, high throughput, etc..) into the chemical risk assessment process. Students will first learn about current practices and recent advances in both human health and ecological chemical risk assessment. Then students will receive an advanced introduction to the AOP framework, including the theory of AOPs, how they can be used in regulatory toxicology for facilitating the use of mechanistic data, test paradigm development, and risk assessment, and training on best practices for contributing to the AOP knowledge base. This will include in-class case studies on AOP development and a final assignment where student will be responsible for developing a novel AOP for a specific toxicity.
Course Component: Lecture

TOX 8156 Principles of Toxicology (3 units)
The basic theorems of toxicology with examples of current research problems. The concepts of exposure, hazard and risk assessment will be defined and illustrated with experimental material from some of the more dynamic areas of modern research. This course is equivalent to BIOL 6402 at Carleton University.
Course Component: Lecture

TOX 8158 Environmental Chemistry and Toxicology (3 units)
Overview of environmental chemistry and toxicology principles including chemical sources, fate, and effects in the environment. Examining organic reactions occurring in abiotic environments and biological systems, study aspects of toxicant disposition and biotransformation. Emphasis on contemporary problems in human health and the environment.
Course Component: Lecture

TOX 9104 Ecotoxicology (3 units)
Selected topics and advances in ecotoxicology with emphasis on the biological effects of contaminants. The potential for biotic perturbance resulting from chronic and acute exposure of ecosystems to selected toxicants will be covered along with the methods pesticide, herbicide and pollutant residue analysis and the concept of bound residues. This course is equivalent to BIOL 6403 at Carleton University.
Course Component: Lecture

TOX 9105 Seminar in Toxicology (3 units)
A one-session course in seminar format highlighting current topics in toxicology. The student will present a seminar and submit a report on the seminar topic. Student, faculty and invited seminar speakers.
Course Component: Seminar

TOX 9106 Genetic Toxicology (3 units)
Topics in mutagenesis and DNA repair, including spontaneous and induced mutagenesis, genetic toxicology testing, the genetics and biochemistry of replication, DNA repair and recombination, and the role of mutagens in the development of genetic disease and cancer. This course is equivalent to BIOL 6406 at Carleton University.
Course Component: Lecture

TOX 9107 Toxicology and Regulation (3 units)
This course will help students develop the understanding and skills to apply research results in toxicology to real-world needs for the management of risks posed by environmental contaminants as well as the development of regulation and policy involving such management.
Course Component: Lecture