

# TOXICOLOGY

The course-based Master of Toxicology (MTOX) program offers a multidisciplinary curriculum designed to prepare students for careers that deal with toxicological and analytical chemical data. Graduates of this program have a deep understanding of toxicology and chemistry related to risk assessment, environmental concerns, and modern industry. Electives allow students to refine their focus in several possible directions, including emphasis on organic chemistry, medical toxicology, or nutrition. The MTOX curriculum is designed to impart mastery of marketable skills, including the gathering, evaluation, and synthesis of data, effective communication of scientific data and concepts, and contextualization of scientific data in a relevant social, cultural, and global context.

## Administrative Staff

### Director

Richard A. Manderville  
 mtoxdirector@uoguelph.ca  
**Graduate Program Assistant Team**  
 mtoxapps@uoguelph.ca

## Graduate Faculty

*This list may include Regular Graduate Faculty, Associated Graduate Faculty and/or Graduate Faculty from other universities.*

### Craig D.C. Bailey

B.Sc., PhD Queen's - Associate Professor  
 Graduate Faculty

### Clara E. Cho

B.Sc., PhD Toronto - Assistant Professor  
 Graduate Faculty

### Elena Choleris

B.Sc., PhD Parma - Professor  
 Graduate Faculty

### Nuria Daviu

BA, M.Sc., PhD Autonomous University Barcelona - Assistant Professor  
 Graduate Faculty

### Giannina Descalzi

BA Guelph, M.Sc., PhD Toronto - Associate Professor  
 Graduate Faculty

### Wojciech Gabryelski

B.Sc., M.Sc. Technical Gdansk (Poland), PhD Alberta - Associate Professor  
 Graduate Faculty

### Jennifer Geddes-McAlister

B.Sc., M.Sc. Lethbridge, PhD British Columbia - Associate Professor  
 Graduate Faculty

### Andreas Heyland

B.Sc., M.Sc. Zurich, PhD Florida - Professor  
 Graduate Faculty

### Rui Huang

B.Sc. Peking, PhD Michigan - Assistant Professor  
 Graduate Faculty

### Bettina E. Kalisch

B.Sc., M.Sc., PhD Queen's - Associate Professor  
 Graduate Faculty

### Niel A. Karrow

B.Sc. Guelph, M.Sc., PhD Waterloo - Professor  
 Graduate Faculty

### James Longstaffe

B.Sc. Western, M.Sc. Dalhousie, PhD Toronto - Associate Professor  
 Graduate Faculty

### Richard A. Manderville

B.Sc., PhD Queen's - Professor  
 Graduate Faculty

### Jennifer Monk

B.Sc. PhD University of Guelph - Assistant Professor  
 Graduate Faculty

### Mario A. Monteiro

B.Sc., PhD York - Professor  
 Graduate Faculty

### Derek O'Flaherty

B.Sc., PhD Concordia - Assistant Professor  
 Graduate Faculty

### Ryan Prosser

BEd Wollongong, B.Sc., PhD Guelph - Associate Professor  
 Graduate Faculty

### Paul K. Sibley

B.Sc., M.Sc. Guelph, PhD Waterloo - Professor and Interim Director  
 Graduate Faculty

### E. James Squires

B.Sc., M.Sc., PhD Memorial - Professor  
 Graduate Faculty

### Glen J. Van Der Kraak

B.Sc., M.Sc. Manitoba, PhD British Columbia - Professor  
 Graduate Faculty

### Alicia Vilorio-Petit

B.Sc., M.Sc. Venezuela, PhD Toronto - Professor  
 Graduate Faculty

### Sarah Wootton

B.Sc., PhD Guelph - Associate Professor  
 Graduate Faculty

## Admission Requirements

- A four-year science or engineering degree with a minimum 'B' (73%) average in the last two years of study.
- As part of their studies, applicants must have successfully completed one full academic year of general chemistry at a first-year level (or equivalent) as well as at least one course in each of organic chemistry, analytical chemistry and biochemistry.
- Proof of competency in English (for applicants whose prior education was in a language other than English). See the University Regulations on English Language Proficiency Certification.

## Learning Outcomes

Upon completion of the Master of Toxicology,

1. Graduates will be able to identify appropriate sources of toxicological and chemical data and information, in a variety of formats, including numeric, graphic, and text. They will be able to extract information from a variety of resources and organize it systematically to facilitate interpretation and the discovery of new knowledge.
2. Graduates will be able to critically assess, interpret, and validate toxicological and chemical data from various sources. They will demonstrate proficiency in selecting and applying appropriate statistical, analytical, and computational techniques to evaluate data completeness, quality, relevance, and accuracy.
3. Graduates will be able to integrate and analyze toxicological and chemical data from multiple sources to generate meaningful insights in support of informed decision-making. They will demonstrate the ability to identify patterns, relationships, and trends while applying critical thinking.
4. Graduates will be able to accurately and effectively communicate synthesized data through visual, written, and oral formats, ensuring clarity, accuracy, and relevance for diverse audiences.
5. Graduates will be able to effectively communicate scientific concepts, research findings, and evidence-based conclusions to diverse audiences using appropriate modes, formats, and media. They will demonstrate proficiency in translating complex toxicological and chemical information into clear, accurate, and engaging narratives while adhering to disciplinary conventions and ethical standards. Additionally, they will be able to critically evaluate and respond to feedback, fostering meaningful scientific discourse and knowledge dissemination.
6. Graduates will be able to articulate the relevance and impact of scientific inquiry, data, and conclusions within the broader social, cultural and global contexts. They will demonstrate an understanding of how scientific knowledge interacts with cultural and societal values, locally and globally, ideally resulting in informed and ethically responsible decision-making.
7. Graduates will be able to effectively plan, prioritize, and allocate time to achieve objectives, with an efficient and responsible use of resources.
8. Graduates will demonstrate personal and professional integrity by respectfully considering diverse points of view and the intellectual contribution of others. They will exhibit a commitment to honesty and equity, in scientific practice and society at large.

## Program Requirements

The MTOX requires completion of 4.00 credits, as follows:

### Required Courses

| Code                            | Title                                   | Credits |
|---------------------------------|---|---------|
| TOX*6000                        | Advanced Principles of Toxicology       | 0.50    |
| TOX*6200                        | Advanced Topics in Toxicology           | 0.50    |
| TOX*6590                        | Biochemical Toxicology                  | 0.50    |
| CHEM*6020                       | Foundations of Analytical Chemistry     | 0.50    |
| or CHEM*7200                    | Selected Topics in Analytical Chemistry |         |
| Choice of CHEM*6000/7000 course |   | 0.50    |

## Experiential Learning Requirement

| Code                         | Title  | Credits |
|------------------------------|--|---------|
| Select one of the following: |  |         |
| CHEM*6320                    | Toxicological Chemistry: Molecular Characterization and Structural Elucidation | 0.50    |
| CHEM*7970                    | Master's Research Paper  | 0.50    |
| ENVS*6010                    | Toxicology Risk Assessment   | 0.50    |

Note: Students currently working in the field could complete a research paper with their employer.

## Restricted Electives

| Code                                    | Title  | Credits |
|---|--|---------|
| Select 1.00 credit from the following*: |  |         |
| CHEM*3440                               | Chemical Instrumentation   | 0.50    |
| CHEM*3750                               | Organic Chemistry II: Structure and Synthesis                                  | 0.50    |
| CHEM*4020                               | Chemical Discovery   | 0.50    |
| CHEM*6320                               | Toxicological Chemistry: Molecular Characterization and Structural Elucidation | 0.50    |
| ENVS*6010                               | Toxicology Risk Assessment   | 0.50    |
| ENVS*6450                               | Multivariate Environmental Data Analysis                                       | 0.50    |
| ENVS*6501                               | Integrating Science and Policy in Environmental Science                        | 0.50    |
| ENVS*6740                               | Contaminated Environments  | 0.50    |
| NUTR*4510                               | Toxicology, Nutrition and Food   | 0.50    |
| TOX*3360                                | Environmental Chemistry and Toxicology   | 0.50    |
| or CHEM*3360                            | Environmental Chemistry and Toxicology   |         |
| TOX*4000                                | Medical Toxicology   | 0.50    |
| TOX*4100                                | Toxicological Pathology  | 0.50    |

\* Or a CHEM\*6000/7000 course to be chosen in consultation with Graduate Program Co-ordinator.

Note: No student may take more than 1.00 credit at the undergraduate level towards the MTOX.