

# FACULTY OF SCIENCE



[www.science.uoit.ca](http://www.science.uoit.ca)



# What's inside

# Our mission

The Faculty of Science at UOIT is committed to excellence and innovation in technology-enhanced, interdisciplinary teaching, and research that is relevant to the needs of society and the environment. We are dedicated to creating and sharing scientific knowledge and infusing the thrill of discovery while inspiring vision, determination, independence, critical thinking and integrity in our students, thereby preparing them for rewarding careers as the next generation of highly skilled scientists and professionals.

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# Welcome from the dean

It is a pleasure to welcome you to the Faculty of Science at UOIT. As the new dean of Science, let me first thank our former dean, William Smith, for all he has accomplished in making our Faculty what it is today. As we move forward, we need to consider how to best achieve our commitment to our mission of “excellence and innovation in technology enhanced teaching” and to remaining “relevant to the needs of society and the environment.” As we transition to the next phase of our development, we recognize that although these are challenging goals, our committed faculty, staff and students have demonstrated they are up to the task.

For you as a student, we offer fantastic undergraduate and graduate programs that set themselves apart by focusing on hands-on experience. These experiences are invaluable in ensuring that a degree from UOIT will provide you with the necessary tools for the career of your choice; whether that is in industry, the public sector or further studies. Our research-intensive programs reflect our commitment to technology at all levels—in our cutting edge laboratories, our wireless classrooms and campus wide facilities, and in our use of technology in the classroom. We promise that your learning experience at UOIT will be top-notch, with instruction from first class researchers who will challenge you to reach your potential, whether as an undergraduate or graduate student.

For undergraduate students, we offer many ways to obtain your degree, including a four-year degree and a five-year co-operative education degree, as well as minors in each area of study. There are also enhanced programs that allow students to pursue concurrent degrees in Science and either Education or Management. For those who aspire to work in the Ontario education system, our five-year Concurrent Science/Education program allows for the combination of a Bachelor of Science (honours) degree with a Bachelor of Education degree. For those whose interests lay in combining science with business, our 5-year Concurrent Science and Management program allows students to pursue training in science, complemented by relevant training in business and management. Regardless of your program, we offer a number of opportunities for hands-on engagement, including co-op and work-study placements, as well as summer research opportunities.

For graduate students, we offer master’s and doctoral training in interdisciplinary fields, including applied bioscience, computer science, modeling and computational science and materials science (Master of Science only). As with all of our offerings, our graduate programs focus on interdisciplinary research with real-world application(s) and the attention of committed professionals who are leaders in their fields.

Please feel free to visit our campus; we’d be pleased to arrange for a tour of the facilities. If you have questions, please contact individual faculty members, academic advisors or myself.

We look forward to meeting with you, to help plan your future path at UOIT!

Regards,

**Dr. Deborah M. Saucier**  
Dean, Faculty of Science



Physics student Raquel Murray conducts an experiment involving modelling the flight pattern of blood spatter using a high-speed camera.



# Start here >

Faculty of Science programs

# Faculty of Science overview

Developed in consultation with leading businesses and industry, UOIT's innovative Science programs emphasize the skills and knowledge needed to succeed in today's knowledge-driven economy. All programs adhere to our interdisciplinary ethos and are built on our common first-year program of study. Over the course of your career, your knowledge requirements will continuously evolve, but the scientific foundations – the analytical and problem-solving skills that form the bedrock of science and our programs – will give you the tools you need to adapt to future developments in the field of any scientific path you choose to pursue.

The Faculty of Science emphasizes the development of leadership and communication skills. Writing grant proposals, competing for additional funding whether in academia or industry, managing a research lab or running a research and development department are all important aspects of a successful and fulfilling scientific career. You will participate in team projects, frequently focused on controversial and complex issues, and learn to communicate clearly and concisely in written, graphical and oral formats for a variety of audiences. We maintain strong links with other faculties of the university, in particular with the faculties of Business and Information Technology; Education; Engineering and Applied Science; and Health Sciences, providing further educational opportunities for students and for research collaboration.

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*“UOIT’s chemistry program provided me with the knowledge and background that I needed to be accepted into the Bachelor of Pharmacy programs at the University of Toronto and the University of Waterloo. UOIT’s strong emphasis on individual student success, with professors, staff and administrators who are always willing to help, provided me with the tools and support I needed to succeed.”*

– Anthony Vo, Chemistry, class of 2012

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## INTERDISCIPLINARITY AS A CORE ELEMENT OF ALL SCIENCE PROGRAMS

From finding a cure for cancer to developing new ways to produce and conserve energy, many of society's most important and difficult technological problems require knowledge of more than one traditional discipline. This philosophy is embedded in all Science programs, from the common first-year set of courses to the integration of courses from several disciplines within programs. Our Forensic Science program is perhaps the foremost example, which integrates courses in biology and chemistry with courses related to legal law and crime scene science.

## THE COMMON FOUNDATION: UOIT’S COMPREHENSIVE FIRST-YEAR SCIENCE PROGRAM

All Science programs entail deep knowledge in the core discipline, preparing you for further studies, including graduate school. You begin your university career with a common program of study in Biology, Physics, Chemistry and Calculus, which gives you a powerful understanding of the basis of life, the basic governing principles of the universe, the reactions and transformations of matter and the mathematical language used to describe the universe.

This introductory year prepares you for changes in your future career, as new knowledge evolves and scientific knowledge is integrated from multiple disciplines. It also creates flexibility in allowing you to change programs after first year with no delay in your studies.

## PROGRAM SPECIALIZATIONS: BASIC SCIENCE AND ITS RELEVANCE TO THE REAL WORLD

Most of our programs allow you to pursue a specialization – a collection of courses emphasizing an application area of a discipline, each oriented towards an important and relevant real-world theme, such as digital media (Computing Science), energy and the environment (Physics), environmental toxicology (Biological Science) and pharmaceutical chemistry (Chemistry).

Within most disciplines, students also have the option to pursue a broad comprehensive specialization. Here, they have the ability to combine elective Science courses with their core program requirements, in consultation with their professors and academic advisor.

## MINOR PROGRAMS

A minor is a set of courses in an area of study providing both basic knowledge and some breadth. In addition to one of the primary programs of study in Biology, Physics, Chemistry and Calculus, you can also pursue a minor in Biology, Chemistry, Physics or Mathematics, or in the interdisciplinary area of Computational Science. Your academic advisor can help you choose a suitable set of courses for your minor.

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### FAST FACT

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The Faculty of Science also offers leading-edge interdisciplinary master's and doctoral programs in Applied Bioscience, Computer Science, Materials Science, and Modelling and Computational Science.

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# Applied and Industrial Mathematics

## (regular and co-op)

Integral to every aspect of scientific endeavour, mathematics is fundamental to problem solving – whether modelling atmospheric phenomena, managing the complexities of risk in financial markets or being applied in cryptography and medical imaging. Students in the Applied and Industrial Mathematics program learn concepts, principles, qualitative and quantitative methods and innovative problem-solving skills. You work with state-of-the-art algorithms and software and learn and apply advanced numerical skills. Applications include statistical analysis of data, modelling physical or biological phenomena and implementing computer algorithms.

After the first year, your studies include:

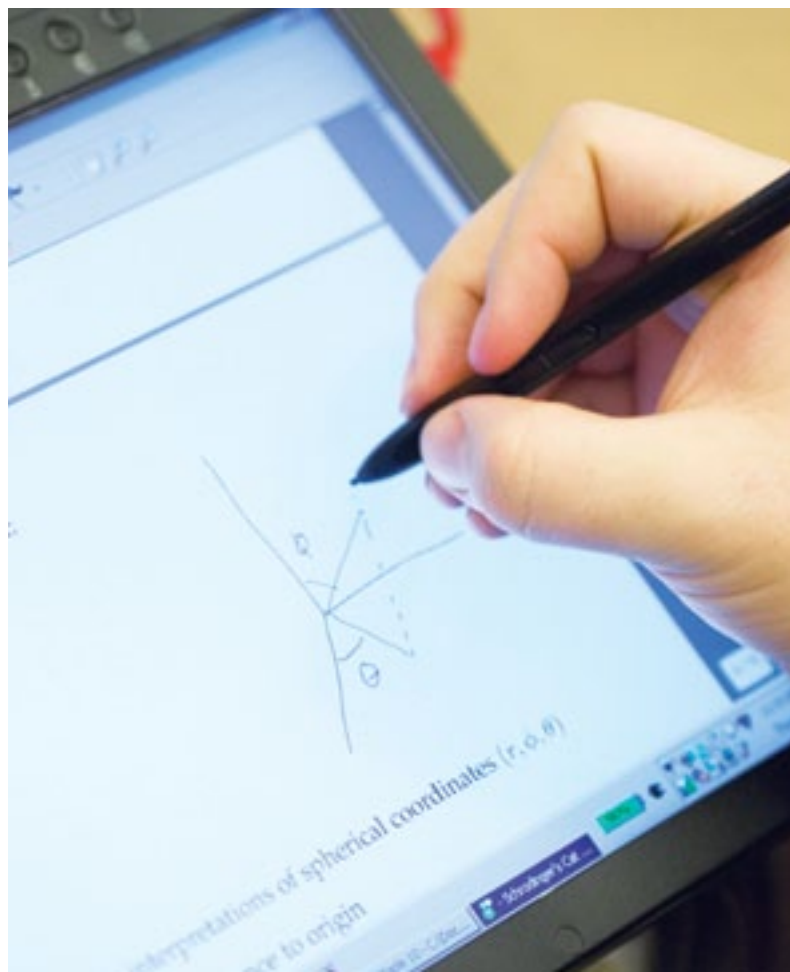
- Applied Functional Analysis;
- Complex Analysis;
- Computational Science;
- Differential Equations;
- Dynamic Systems and Chaos;
- Industrial Mathematics;
- Mathematical Modelling; and
- Optimization.

Careers and post-graduate study opportunities include:

- Communications technology;
- Computer software (systems analyst or cryptography);
- Consulting;
- Financial services (banking and financial sector);
- Government agencies (Statistics Canada, Department of Defence);
- High school teacher (through UOIT's Concurrent or Consecutive Education program);
- Insurance (actuary or analyst);
- Law school;
- Manufacturing; and
- Medical school.

*“UOIT’s comprehensive undergraduate programs in applied mathematics and physics have provided me with a wealth of knowledge and a broad set of computational techniques that allowed me to thrive in my current studies at the University of Oxford. Moreover, the laptop-centric curricula of these programs enabled me to become familiar with a range of mathematical software that I now use regularly in order to perform real-world calculations, which are much too difficult, or even impossible, to be carried out by hand. UOIT strongly emphasizes undergraduate research and this opportunity, under the supervision of a faculty member, was undoubtedly one of the highlights of my undergraduate education. It allowed me to develop essential research skills and also meet and collaborate with other students and faculty from around the world.”*

– Matthew Hennessey, Mathematics and Physics, class of 2009; winner of an Oxford University scholarship in the Master of Science in Mathematical Modelling and Scientific Computing program



# Biological Science

## (regular and co-op)

Biological Science is the study of life at its most fundamental level. The foundational areas of cell biology, genetics and molecular biology, physiology, biochemistry and developmental biology are mastered in the Biological Science program. As you proceed through the program, you have access to specialized courses such as Bioethics, Neuroscience, Functional Genomics and Proteomics. Graduates are in high demand in diverse sectors including biotechnology, the environment, consulting and government. Specializations have common courses during their first two years, allowing for flexibility and transfer.

In addition to the common first year, the common upper-year courses in all Biological Science programs are:

- Biochemistry;
- Bioethics;
- Cell Biology;
- Developmental Biology;
- Biology Thesis Project I and II;
- Genetics and Molecular Biology;
- Introduction to Organic Chemistry;
- Introductory Physiology;
- Microbiology and Immunology; and
- Statistics and Probability for Biological Science.

Careers and post-graduate study opportunities include the following areas:

- Consulting;
- Food industry;
- Governmental or private research laboratory;
- High school teaching (through UOIT's Concurrent or Consecutive Education program);
- Marketing (biotechnology or publishing industry); and
- Medical school.

*“UOIT exposed me to a variety of academic and non-academic experiences that I feel allowed me to produce a strong application for medical schools in Ontario. The professors, teaching assistants, staff and administrators all have the best interests of each individual student in mind and are always willing to help. Small class sizes, access to instructors, a strong student community and the family atmosphere present at UOIT made me feel like it was my second home and motivated me to excel during my time on campus.”*

– Naheed Dosani, Biological Science, class of 2008; medical school student at McMaster University

## LIFE SCIENCES SPECIALIZATION

This specialization is well-suited if you are interested in medical school and related medical and health science careers. The emphasis is on human aspects of biology, providing an integrated grounding in the life sciences with a particular focus on biology and chemistry and additional course work in neuroscience and human anatomy. You have priority access to all required courses at UOIT in this program, in preference to students in other programs taking the courses as electives.

By means of its broad science foundation and its human biology focus, this program provides an excellent basis for writing the MCAT examinations and for satisfying course requirements for applying to medical school. A description of the current entrance requirements for Ontario's medical schools can be found at <http://www.ouac.on.ca/omsas/>.

Courses in the upper years of the Life Sciences specialization include:

- Advanced Biochemistry;
- Advanced Topics in Pharmaceutical Biotechnology;
- Fundamentals of Neuroscience;
- Fundamentals of Nutrition;
- Human Anatomy;
- Organic Chemistry;
- Physiology of Regulatory Systems; and
- Principles of Pharmacology and Toxicology.

Careers and post-graduate study opportunities include:

- Medical school; and
- Post-degree health-related programs such as Physiotherapy.

## PHARMACEUTICAL BIOTECHNOLOGY SPECIALIZATION

Biotechnology is a rapidly growing area with many applications in health, agriculture and industry. The Pharmaceutical Biotechnology specialization combines a primary emphasis on biology and chemistry with molecular and cell biology, and microbiology. You will build a strong understanding of cell and molecular biology, microbiology, immunology, biochemistry and physiology.

Courses in the upper years of the Pharmaceutical Biotechnology specialization include:

- Advanced Biochemistry;
- Advanced Topics in Pharmaceutical Biotechnology;
- Analytical Chemistry for Biosciences;
- Applied Molecular Biology;
- Functional Genomics and Proteomics;
- Instrumental Analytical Chemistry;
- Laboratory Methods in Molecular Biology;
- Physiology of Regulatory Systems; and
- Principles of Pharmacology and Toxicology.

Students will find careers and post-graduate study opportunities in the pharmaceutical area.



## ENVIRONMENTAL SUSTAINABILITY SPECIALIZATION

Starting in the 2012-2013 academic year, the Faculty of Science will be offering a new specialization in Biological Science called Environmental Sustainability Science (ESS). While many universities have Environmental Science programs that typically offer a broad range of courses from all the natural science disciplines, specializations in Environmental Sustainability tend to be mainly social science based (e.g., geography, policy studies). The ESS program at UOIT is unique in that it is the first of its kind to have a strong biological science focus, from genomes to ecosystems. The integrated approach of the ESS specialization exposes students to a variety of science disciplines, providing them with the scientific basis necessary for understanding the physical, chemical and biological behaviour of the Earth's ecosystems.

The sustainability theme inherent in the program provides a framework for the analysis of the human impacts on the environment, as well as an introduction to the socioeconomic, political, technological and cultural influences that govern choices we make about the environment. The ESS program offers an integrated set of courses that provide scientific understanding with the underlying principles of sustainability. Students have access to modern laboratories, computational tools and sophisticated equipment with state-of-the-art facilities.

Courses in the upper years of the Environmental Sustainability specialization include:

- Analytical Chemistry for Biosciences;
- Aquatic Ecology;
- Bioethics;
- Biostatistics;
- Conservation Biology;
- Ecology;
- Ecosystem Science;
- Environmental Biotechnology;
- Environmental Chemistry;
- Environmental Risk Characterization;
- Instrumental Analytical Chemistry;
- Introduction to Environmental Research Methods;
- Plant Biology; and
- Principles of Pharmacology and Toxicology.

Jobs in the environmental sector, also referred to as green jobs, are believed to be an important area of growth and demand for highly skilled and trained personnel. Careers and post-graduate study opportunities include the following areas:

- Alternative fuels industry; management;
- Environmental compliance; • Non-governmental organizations (NGOs); and
- Environmental/energy consulting and policy development; • Sustainability/environmental initiatives and regulation.
- Natural resource

The broad skills base acquired through the ESS program will permit a variety of complementary career paths in business administration, urban affairs, regional planning, communications studies (such as environmental journalism), environmental design, law and education.

## ENVIRONMENTAL TOXICOLOGY SPECIALIZATION

Environmental toxicology is an interdisciplinary applied field involving health, agriculture, urban development and industry. It combines a strong base in biology and chemistry, with a focus on physiology, biochemistry, environmental science and environmental chemistry.

Courses in the upper years of this specialization include:

- Advanced Topics in Environmental Toxicology;
- Analytical Chemistry for Biosciences;
- Biostatistics;
- Environmental Chemistry;
- Environmental Risk Characterization;
- Instrumental Analytical Chemistry;
- Introduction to Environmental Research Methods; and
- Principles of Pharmacology and Toxicology.

Students will find careers and post-graduate study opportunities in the environmental area.

## COMPLEMENTARY STUDIES SPECIALIZATION

This specialization provides broad coverage of fundamental topics in biology. It can be customized to your particular interests and career goals. Consult your academic advisor for assistance and approval when building your program map.

Management option in Biological and Physical Science (regular and co-op) (five-year program)\*

\*Please refer to Physical Science section on page 22 for full details.

*"I strongly believe that an undergraduate education at UOIT has not only provided me with a strong work ethic but has prepared me in a practical sense for a future career in medicine. Medicine is becoming increasingly collaborative – I strongly feel that UOIT reflects this ideal, encouraging interaction between students, helpful and passionate professors, and hard-working faculty members. Finally, the integration of technology in the field of medicine is becoming quite common; as a laptop-based university, UOIT has inspired me to integrate technology as a useful learning tool in my future studies."*

– Shaqil Peermohamed, Biological Science, class of 2008; medical school student at the University of Calgary.



# Chemistry

(regular and co-op)

Chemistry, the central science, is the study of elements and compounds, their properties and the ways they react to form new substances. From the practical to the theoretical, UOIT exposes you to all major fields of chemistry: physical, analytical, organic, inorganic and biochemistry. You can follow the comprehensive program or choose to specialize in either Pharmaceutical Chemistry or Biological Chemistry (courses are accepted by the Pharmacy programs at the University of Toronto and the University of Waterloo).

Courses common to all Chemistry specializations beyond the first year are:

- Advanced Organic Chemistry;
- Analytical Chemistry;
- Biochemistry;
- Chemistry Thesis Project I and II;
- Fundamentals of Physical Chemistry;
- Inorganic Chemistry I and II;
- Instrumental Analytical Chemistry I and II;
- Introduction to Organic Chemistry;
- Organic Chemistry;
- Physical Chemistry;
- Statistics and Probability for Physical Science;
- Structure and Bonding;
- Structure Determination of Organic Molecules; and
- Thermodynamics and Kinetics.

## Careers and post-graduate study opportunities include:

- Chemical processing;
- Consulting;
- Environmental sector;
- Government research laboratories;
- Graduate and other post-degree studies (medical school, pharmacy or dentistry);
- High school teacher (through UOIT's Concurrent or Consecutive Education program); and
- Marketing (chemical or publishing industry).

## PHARMACEUTICAL CHEMISTRY SPECIALIZATION

This specialization provides an integrated base in chemical science fundamental to the pharmaceutical industry.

Courses in the upper years of the Pharmaceutical Chemistry specialization include:

- Advanced Biochemistry;
- Advanced Topics in Pharmaceutical Biotechnology;
- Advanced Topics in Pharmaceutical Chemistry;
- Introductory Physiology;
- Pharmaceutical Discovery;
- Principles of Pharmacology and Toxicology; and
- Structure Determination of Organic Molecules.

Students will find careers and post-graduate study opportunities in the pharmaceutical industry.

## BIOLOGICAL CHEMISTRY SPECIALIZATION

This specialization provides an orientation towards biological processes at the molecular level.

Courses in the upper years of the Biological Chemistry specialization include:

- Advanced Biochemistry;
- Advanced Topics in Biological Chemistry;
- Bio-organic Chemistry;
- Cell Biology;
- Genetics and Molecular Biology; and
- Laboratory Methods in Molecular Biology.

## Career opportunities and post-graduate studies include:

- Biotechnology sector; and
- Food industry.

## COMPREHENSIVE PROGRAM

The comprehensive program provides broad coverage of fundamental topics in Chemistry. In addition to the courses common to all specializations, it includes distinctive courses in:

- Environmental Chemistry;
- Industrial Chemistry; and
- Molecular Spectroscopy.

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*"After completing a Science degree in Chemistry at UOIT in 2007, I was accepted into medical school at the University of Toronto. UOIT gave me a broad set of skills across the sciences, which helped me succeed in the MCAT exam. The research experience I gained during my undergraduate program at UOIT has proven to be highly valuable at medical school since there is a large research component to the program. Many of my colleagues pursued graduate degrees before entering medical school, but I felt well-equipped with the essential research skills I developed under the supervision of my Chemistry professor."*

– Katey Jakins, Chemistry, class of 2007; medical school student at the University of Toronto

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# Computing Science

(regular and co-op)

Computing science is the study of the theoretical foundations of information and computation and their implementation and application in computer systems. Our program explores concepts, principles, qualitative and quantitative methods, innovative problem-solving skills and practical applications. Graduates understand the principles of information technology and communications relevant to science and related fields using computer-based tools to access information and are prepared to adapt easily to new technologies. You can choose to follow the Digital Media or Digital Forensics specialization, or the comprehensive program.

Courses common to all Computing Science programs beyond first-year level are:

- Analysis and Design of Algorithms;
- Compilers;
- Computational Science I;
- Computer Architecture I and II;
- Computer Networks;
- Database Systems and Concepts;
- Discrete Structures in Computer Science;
- Ethics, Law and the Social Impact of Computing;
- Operating Systems;
- Principles of Computer Science;
- Scientific Visualization and Computer Graphics;
- Simulation and Modelling;
- Software Systems Development and Integration; and
- Statistics and Probability for Physical Science.

## Careers and post-graduate studies include:

- Computer consultancy;
- Computer programming;
- Graduate studies (such as Computing Science);
- High school teaching (through UOIT's Consecutive Education program);
- Information technology;
- Marketing (publishing industry);
- Software engineering;
- Systems analysis; and
- Technical support analysis.

## DIGITAL MEDIA SPECIALIZATION

Interactive computer applications such as sound, images, graphics and video are an area of explosive growth in computing science. Entertainment, media, education, advertising and telecommunications are being profoundly impacted as computer games, educational software, mobile devices, marketing, advertising and location-based services become pervasive and replace traditional media. Designed to complement the existing Game Development and Entrepreneurship program in UOIT's Faculty of Business and Information Technology, this program explicitly addresses the underlying technologies used in game development and other forms of digital media through the science that informs it.

Courses in the Digital Media specialization include:

- Advanced Computer Graphics;
- Digital Media;
- Interactive Media;
- Mobile Devices;
- Software Engineering; and
- System Analysis and Design in Applications.

Students will find careers and post-graduate study opportunities in the digital media sector.



## DIGITAL FORENSICS SPECIALIZATION

As computers infiltrate every aspect of public and private life, there is a corresponding need for workers who understand computers and digital technology as repositories of evidence.

UOIT is one of the few academic institutions in the world that offers an undergraduate program that addresses the complex issue of digital forensics. Based on a core Computing Science program, it includes a selection of specialized courses that provide both an introduction to forensic science principles and applications of computer science in this area.

UOIT is the only Canadian university to offer a Digital Forensics specialization within a full Bachelor of Science (Honours) Computing Science program. Courses in the Digital Forensics specialization include:

- Advanced Topics in Forensic Science;
- Crime Scene Science;
- Criminalistics;
- Digital Evidence;
- Forensic Informatics;
- Introduction to Forensic Science; and
- Law for Forensic Scientists.

Students will find careers and post-graduate study opportunities in forensics.



## COMPREHENSIVE PROGRAM

The comprehensive program provides broad coverage of fundamental topics in Computing Science. In addition to the common set of courses for all Computing Science programs, the comprehensive program contains the following courses:

- Software Engineering; and
- System Analysis and Design in Applications.

*"The research opportunities I had while doing my degree gave me an advantage while applying to graduate school. Upon graduating from UOIT, I started my Master's degree at the University of Toronto along with a Natural Sciences and Engineering Research Council of Canada (NSERC) scholarship. My UOIT research experience has been invaluable in kickstarting my academic career."*

– Michael Mior, Computing Science, class of 2009; Computer Science graduate student at the University of Toronto



# Forensic Science

Forensic science is an emerging interdisciplinary area drawing strongly upon social science to apply scientific principles to the analysis of evidence for legal investigations. UOIT's Forensic Science program is distinguished by a strong scientific foundation in biology and chemistry. It contains sufficient biology content to proceed to graduate school in biological science and most of the chemistry requirements in that area. Your electives deepen your knowledge of either chemistry or biology, opening up additional career options. Due to the laboratory intensive nature of the Forensic Science program, UOIT can only accept a limited number of students and you are required to maintain a minimum cumulative grade point average (GPA) of 2.0 to continue in the program. Work placement opportunities are available in the upper years of the program.

The Forensic Science program at UOIT is enhanced by the existence of the Crime Scene House adjacent to the university's north Oshawa location, which is outfitted with mock crime scenes and provides a laboratory setting for some of the courses in the program. UOIT was the first university in the province to create such a facility.

In the upper years of the program, students are equipped with tablet computers. In addition to using them in all their courses, particular use is made of them at the Crime Scene House. For example, crime scene evidence can be conveniently collected in the field and transmitted wirelessly to computers elsewhere and portable USB-connected microscopes provide an enhanced evidence collection mechanism.

UOIT has a Forensic Science Program Advisory Board, which consists of prominent members of the forensic community. The program has frequent guest speakers, including representatives from the Ontario Centre of Forensic Sciences, the Ontario Coroner's Office and several police forces.

In addition to courses common to all first-year Science programs, the Forensic Science program includes the following courses:

- Advanced Topics in Forensic Science;
- Analytical Chemistry;
- Biochemistry;
- Cell Biology;
- Crime Scene Science;
- Criminalistics;
- Drug Chemistry and Toxicology;
- Genetics and Molecular Biology;
- Human Anatomy;
- Introductory Physiology;
- Introductory Psychology;
- Law for Forensic Scientists;
- Organic Chemistry;
- Physical Chemistry for Biosciences; and
- Principles of Pharmacology and Toxicology.

## Careers and post-graduate studies include:

- Consulting;
- Forensic science;
- Government agencies (customs and immigration or document examination);
- Graduate or other post-degree studies (law school, medical school, pharmacy, dentistry or physiotherapy);
- High school teaching (through UOIT's Consecutive Education program);
- Insurance company claims investigation;
- Marketing (publishing industry); and
- Police agencies (after required training).

# Physics

## (regular and co-op)

Physics is the science of nature. Force, motion, light, sound, electricity, magnetism and the structure of matter all lay at the heart of natural sciences and technology. You benefit from exposure to the cutting-edge research interests of faculty members in renewable energy, semiconductor devices, microelectronics, materials science and computational physics. You can also choose to specialize in Energy and the Environment, Forensic Physics, Medical Physics or pursue the comprehensive program.

Courses common to all Physics programs include the following:

- Differential Equations;
- Electronics;
- Electricity and Magnetism I and II;
- Fluid Mechanics;
- Linear Algebra;
- Mechanics I;
- Physics Thesis Project I and II;
- Quantum Mechanics I;
- Statistical Mechanics I;
- Statistics and Probability for Physical Science;
- Thermodynamics and Heat Transfer; and
- Waves and Optics.

### Careers and post-graduate studies include:

- Consulting;
- Graduate studies (traditional physics, medical physics or related fields);
- Government agencies (research laboratory or Department of National Defence);
- High school teacher (through UOIT's Concurrent or Consecutive Education program);
- Marketing (publishing industry); and
- Post-degree studies (law school, pharmacy or dentistry).

## ENERGY AND THE ENVIRONMENT SPECIALIZATION

Unique in Canada, this specialization in physics is designed to meet the urgent demand for graduates with the knowledge and skills to address global issues of escalating energy consumption and declining resources. It emphasizes expertise in alternative and conventional energy and the scientific principles underlying the development of novel and economical means of generating and harvesting energy, while simultaneously minimizing their environmental impact.

In addition to the core Physics courses common to all specializations, courses in the Energy and the Environment specialization include:

- Earth-based Energy Systems;
- Economics and Politics of the Environment;
- Hydrogen-based Energy Systems and Fuel Cells;
- Introductory Energy Science;
- Introductory Environment Science;
- Nuclear Physics and Relativity; and
- Solar Energy and Photovoltaics.

### Careers and post-graduate studies include:

- Energy specialist; and
- Energy supply industry.



## FORENSIC PHYSICS SPECIALIZATION

Physics plays a key role in many aspects of forensic analysis, including the ballistics of bullets and other projectiles, vehicle collisions, the physics of explosions and bloodstain patterns. This specialization enhances a basic Physics program with an introduction to the physics underlying these areas. UOIT was the first university in Canada to offer a Forensic Physics specialization based on a full BSc (Honours) Physics program.

In addition to the core Physics courses common to all specializations, courses in the Forensic Physics specialization include:

- Advanced Topics in Forensic Science;
- Crime Scene Science;
- Criminalistics;
- Forensic Physics;
- Introduction to Forensic Science; and
- Law for Forensic Scientists.

Students will find careers and post-graduate study opportunities in the various fields of forensic physics.

## MEDICAL PHYSICS SPECIALIZATION

Medical physics is a growing and important field, which applies physics-based principles to the diagnosis, treatment and monitoring of diseases through the use of modern techniques such as magnetic resonance imaging (MRI) scanning, computerized tomography (CT) scanning, X-ray, ultrasound and laser surgery. Primary areas of application are cancer treatment (ionizing radiation), brain and heart disorders (bioelectric and biomagnetic investigations) and radiation hazards and protection. The Medical Physics specialization in the BSc (Honours) Physics program provides graduates with core skills in physics and related mathematics. The university is linked to the Lakeridge Health Education and Research Network through the UOIT Education Partnership, thereby providing the necessary environment for practical experience with medical problems and equipment.

In addition to the core Physics courses common to all specializations, courses in the Medical Physics specialization include:

- Cell and Molecular Biology;
- Health Physics Laboratory;
- Medical Applications of Radiation Techniques;
- Medical Imaging;
- Nuclear Physics and Relativity;
- Radiation Biophysics and Dosimetry;
- Radioisotopes and Radiation Machines; and
- Radiological and Health Physics.

Careers and post-graduate studies include:

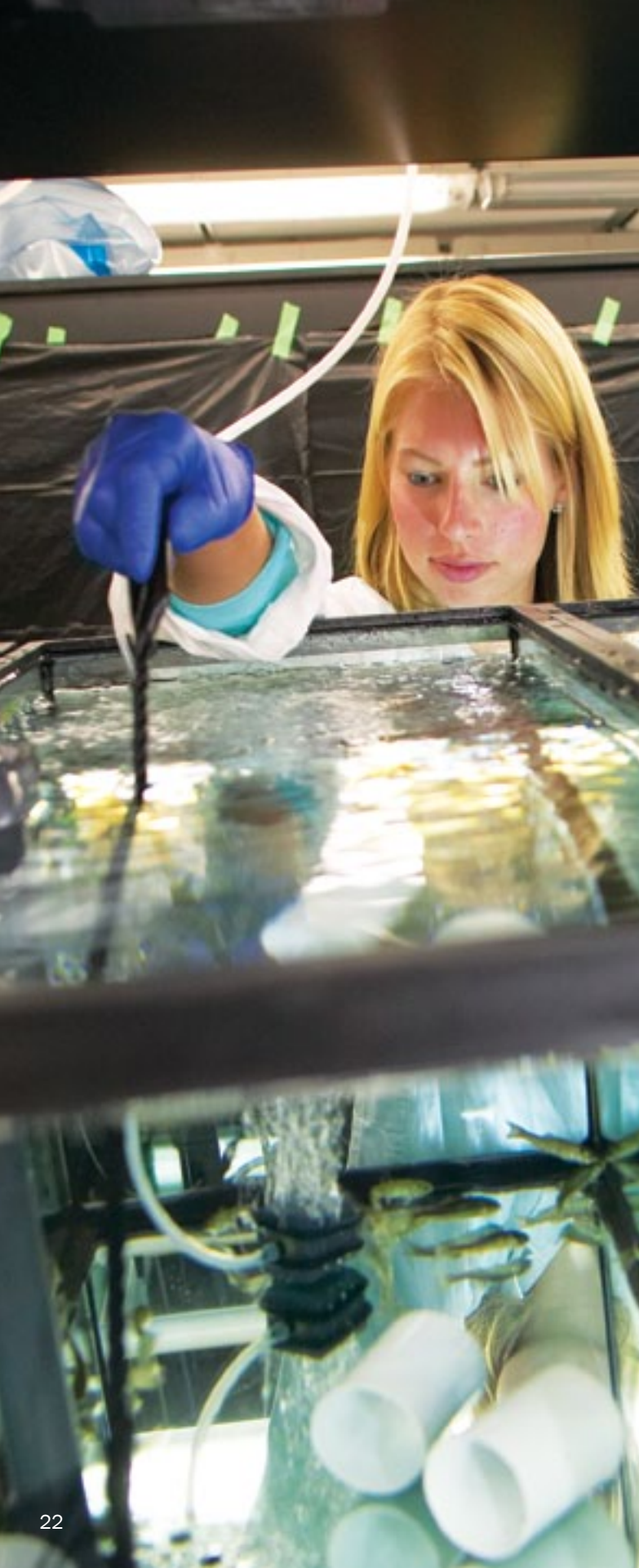
- Biophysics;
- Health-care technology, including radiation therapy, medical imaging technologies or cancer clinics;
- Medical equipment manufacturing, including development, service or sales;
- Medical physics; and
- Medical school.

## COMPREHENSIVE PROGRAM

The comprehensive program provides a broad coverage of fundamental topics in physics. In addition to the courses common to all specializations it includes the following courses:

- Mathematical Physics;
- Modern Physics;
- Statistical Mechanics II; and
- Quantum Mechanics II.





# Physical Science

(regular and co-op)

The Physical Science program provides a personalized course of study in the physical sciences of chemistry, mathematics and physics. Working with an academic advisor, we help you customize a program that matches your interests and career plans. Consult with your academic advisor for assistance and approval when building your program map.

## MANAGEMENT OPTION IN BIOLOGICAL AND PHYSICAL SCIENCE

Students interested in managerial and leadership roles in commercial and industrial scientific enterprises should consider UOIT's Bachelor of Science and Management (Honours) program. Available to students in the Physical Science or Biological Science program, it includes 10 courses in Business and Management, taken in the final year of the five-year program. Graduates have a solid foundation in the key functional areas of business and management, including financial management, accounting, operations, human resources management and marketing management and may qualify for credit against the first year of a Master of Business Administration (MBA) degree.

The fifth year of study includes:

- Finance I and II;
- Financial Accounting;
- Introduction to Human Resources Management;
- Introduction to Operations Management;
- Introduction to Project Management and Supply Chain Management;
- Managerial Accounting;
- Marketing I and II; and
- Organizational Behaviour.

# Bachelor of Science (Honours)/ Bachelor of Education

(Concurrent)

A strong emphasis on technology in teaching is a defining element of the BSc (Honours)/Bachelor of Education (Concurrent) (BEd) program, a five-year program that combines a BSc (Honours) degree with a BEd degree. Students complete all of the required course work for a BSc (Honours) degree, taking a minimum of 10 courses in their first teachable subject and six courses in their second teachable subject.

The program is structured in such a way that the BSc degree is conferred after the first four years, and the final BEd degree requirements are completed in the fifth year of study. The program thus provides a guaranteed route into a BEd program, as opposed to the alternative of first completing a science degree and then competing with many applicants to enter a one-year BEd program. It also allows you to go on to alternative studies after completing the BSc portion.

Teachable subjects offered in the Concurrent Education program are:

- Applied Mathematics;
- Biology;
- Chemistry;
- Physics.

To continue to the fifth year of the Concurrent Education program, students must have an overall minimum cumulative GPA of 2.7 (or B average) based on an average of years 3 and 4, in addition to a minimum average of B in the 10 courses in the first teachable subject and six courses in the second teachable subject.



# Graduate Studies

[www.gradstudies.uoit.ca](http://www.gradstudies.uoit.ca)

Graduate students benefit from innovative instructors, progressive research and academic tools unique to UOIT. The Faculty of Science offers master's and PhD programs in Applied Bioscience, Computer Science, Materials Science and in Modelling and Computational Science.

## GRADUATE STUDENT VENTURES TO YUKON

Thanks to UOIT's partnership with the Royal Canadian Mounted Police (RCMP) and Yukon College in Whitehorse, Yukon, Katherine Bygarski, a Master of Science student in the Applied Bioscience program spent two months conducting research in Yukon Territory. Bygarski carried out a forensic entomology study in Canada's north under the supervision of Dr. Helene LeBlanc, assistant professor, Forensic Science.

## RESEARCH OPPORTUNITY IN THE UK PAYS DIVIDENDS FOR UOIT GRADUATE STUDENT

Under the supervision of Dr. Julia Green-Johnson, associate professor, Biology, Justin McCarville, a Master of Science student in Applied Bioscience took part in a three-month international internship at the Institute of Food Research (IFR) in Norwich, United Kingdom. The IFR's mission is harnessing food for health and preventing food-related diseases.

What's  
next >

# Hands-on experience: your competitive advantage

## CO-OP PROGRAMS: COMBINE WORK TERMS WITH YOUR STUDIES

A five-year Co-operative Education option is available in all UOIT Science programs (except for Forensic Science, which already has an embedded experiential component), all of which satisfy the guidelines of the Canadian Association for Co-operative Education (<http://www.cafce.ca>). These five-year programs combine an Honours BSc program with embedded work terms. The co-op experience allows you to apply your classroom and lab concepts to real-world situations and help you gain valuable, relevant work experience to promote networking and lifelong career success.

Co-op work terms give you the opportunity to earn a competitive salary that will help pay for your university degree and the work experience to help clarify your career objectives. More importantly, a co-op degree gives you a distinct advantage when seeking full-time employment after graduation or for being readily accepted into graduate school to pursue further studies. Studies have shown that university students who graduate with a co-op degree have lower debt loads, are employed faster and have higher starting salaries.

We are committed to providing you with outstanding opportunities to work with today's highest-quality employers in business and industry. UOIT has developed strong partnerships with leading employers in Durham Region and beyond to allow you to connect with experts in the field and gain hands-on, real-world experience.

## INTERNATIONAL EXCHANGE OPPORTUNITIES

The Faculty of Science has undergraduate exchange programs in Physics with the University of Leipzig in Germany and the Polytechnic University of Turin in Italy. Donald McGillivray, a 2011 Bachelor of Science in Physics (Honours) graduate, participated in the Leipzig exchange program and was selected by the German Academic Exchange Service (Germany's federal equivalent to the Ontario's Ministry of Training, Colleges and Universities) to be a young ambassador to promote study in Germany.

Financial assistance is available to students participating in these programs.

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*"The experience of living, studying and playing in Germany blew me away. The environment there was very different to what I was used to back home but I quickly adapted. I succeeded in their very challenging physics program and came back to my school with many more tricks and a greater knowledge of the subject."*

– Donald McGillivray, Physics, class of 2011

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## UNDERGRADUATE RESEARCH – RIGHT FROM YOUR FIRST YEAR

At UOIT, you do not have to wait to make a difference – we help you start now!

The Faculty of Science believes the availability of research opportunities is a key component of an undergraduate science education. Through one of the most intensive undergraduate research programs in Canada, these projects benefit society by turning innovative ideas into real solutions and help undergraduate students gain the valuable hands-on experience demanded by employers.

Enhanced learning opportunities abound in the research laboratories of our professors, including an extensive program of faculty-supervised paid summer research assistantships. Awarded on a competitive basis, more than two dozen undergraduate students undertake research internships with our professors each summer. A number of our students have co-authored and published research papers with their supervising professors and their innovative research teams.

These collaborative research opportunities with our professors contribute to the advanced training of Canada's next generation of science workers. Available research awards include the prestigious NSERC Undergraduate Student Research Awards, UOIT Student Training Assistantships in Research (STAR) Awards and Science Undergraduate Student Research Awards (SUSRA).

## INDUSTRY CONNECTIONS: STUDENT RESEARCH PROJECTS

A few illustrative examples of recent student research projects include:

### A Cognitive Camera Network

**Student researcher:**

Wiktor Starzyk, fourth-year Computing Science student

**Faculty supervisor:** Dr. Faisal Qureshi

This project developed a (simulated) cognitive camera network that automatically captures high-quality surveillance video of selected pedestrians during their prolonged stay in an area of interest. The camera network is comprised of active pan/tilt/zoom (PTZ) cameras and wide field-of-view (FOV) passive cameras. A PTZ camera can only follow one pedestrian at a time, whereas passive cameras can track multiple pedestrians simultaneously, albeit at a much lower resolution. The problems of camera assignment and hand-off occur naturally as pedestrians meander through the field of view of different cameras and these problems must be addressed in order to carry out observational tasks autonomously or with little human intervention.

### Synthesis and Properties of Uracil and Adenine Triazole-Linked Nucleic Acid Dimers

**Student researcher:**

Jillian Fischer, third-year Chemistry student

**Faculty supervisor:** Dr. Jean-Paul Desaulniers

Short interfering RNA (siRNA) has the potential to target gene-specific messenger RNA (mRNA) to down-regulate a particular gene. However, new chemical modifications are needed because siRNA still has problems with non-specific toxicity, instability due to degradation and poor cell-membrane permeability. Using a triazole-linked modified backbone is a novel chemical approach to these problems because they are inert to hydrolysis, are neutral in charge and may improve cell-membrane permeability.

### Optical Characterization of Carbon Nanotubes prepared by Chemical Vapour Deposition

**Student researcher:**

Victoria Davis, third-year Physics student

**Faculty supervisor:**

Dr. Franco Gaspari

Carbon represents the most versatile element in nature, thanks to the various bonding configurations it can achieve. Among the allotropes of carbon, carbon nanotubes (CNT) represent one of the major novel areas of research in materials science. Indeed, carbon nanotubes are mechanically stronger, electrically and thermally more conductive, and chemically and biologically more active than graphite. In this project, SEM and Raman studies of CNTs prepared by Chemical Vapour Deposition (CVD) were performed.

### Insect Succession in a Closed Vehicle Environment

**Student researcher:**

Alicia Buetter, second-year Forensic Science student

**Faculty supervisor:**

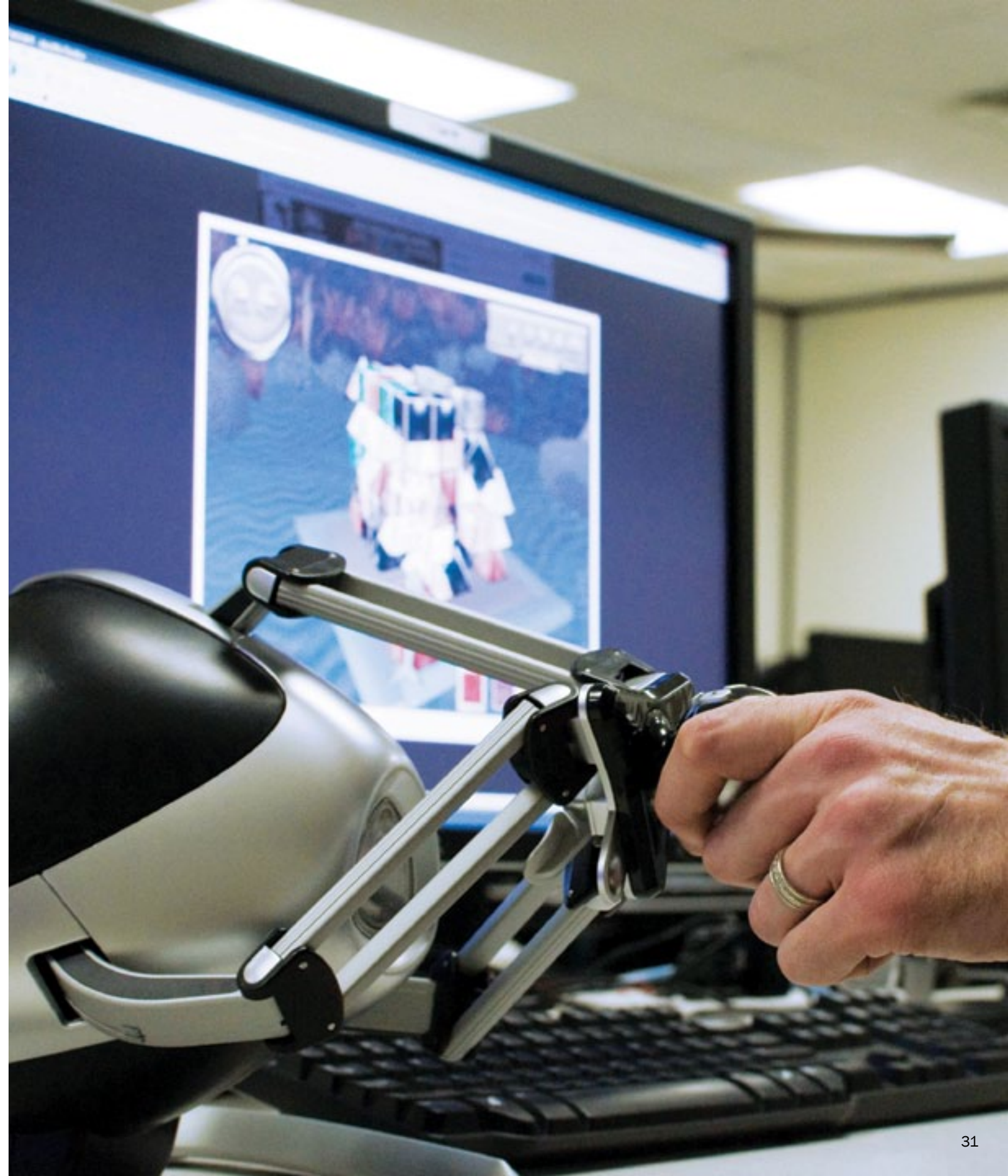
Dr. Helene LeBlanc

Forensic entomologists are commonly consulted when the post-mortem interval of a carcass must be determined. Beyond 48 to 72 hours, the forensic pathologist can no longer determine time of death using conventional methods such as body cooling; however, insects can be used to determine a post mortem interval of months, even years, after death. Although the succession of insects on cadavers outdoors is well researched, few studies have been performed in a closed environment. A 25-kilogram pig carcass was placed in the trunk of a vehicle for 62 days and a control pig carcass was placed on the soil surface 20 metres from the vehicle. Entomological samples were collected from both pigs regularly throughout the experiment and were identified using a variety of identification keys in order to evaluate the insect succession. The data collected from this experiment will serve as a starting point for research studying cases where a body is found in the trunk of a vehicle or other enclosed areas.

# Leading-edge learning environment

UOIT's ultra-modern four-storey Science building features state-of-the art laboratories and classrooms. Some of the laboratory equipment used by our faculty's undergraduate students is so innovative that it is not used by students at other universities until graduate school! Examples of these facilities include:

- The Laboratory for Advanced User Interfaces and Virtual Reality, which provides a range of specialized equipment for 3D graphics, user interface and haptics research;
- The Aquatic Toxicology Lab, a leading-edge 20,000-litre wet lab;
- The Computer Science Lab, which houses workstations, servers and other equipment such as a DELL PowerEdge 2950 and embedded wireless environmental sensors;
- The Crime Scene House Lab, an actual house retrofitted with mock crime scenes and used in the Forensic Science program. It was the first such facility in Ontario; and
- The Mobile and Pervasive Computing Lab, an advanced high-performance computing infrastructure that supports pervasive and ubiquitous computing.



# Globally experienced and award-winning faculty help broaden your knowledge

Establishing a strong faculty depends largely on attracting outstanding professors. At UOIT, our professors are experts in their fields and hold advanced degrees from universities from around the globe. These women and men will challenge and inspire you to push your own boundaries of thinking and learning while broadening your knowledge and understanding in your chosen field

## AWARD-WINNING FACULTY MEMBERS

The Faculty of Science holds two prestigious Canada Research Chairs (Dr. Douglas Holdway, in Aquatic Toxicology and Dr. Shari Forbes, in Decomposition Chemistry), and a SHARCNET (<http://www.sharcnet.ca>) Research Chair (Dr. Christopher Collins, in the area of high-performance computing).

The faculty has received major grants and significant research funding awards from various funding authorities such as the Natural Sciences and Engineering Research Council of Canada (NSERC), the Canada Foundation for Innovation (CFI) and the Ontario Research Fund (ORF). Ninety-two per cent of eligible Science faculty members hold NSERC Discovery Grants, a widely-accepted key indicator of faculty research success in science and engineering. Our faculty members use these research grants in part to support undergraduate and graduate student research, post-doctoral fellowships and research associates.

Our faculty members are multidisciplinary and conduct research across many areas of science with a primary focus in five fields:

- Applied bioscience;
- Computational and computer science;
- Energy;
- Materials science; and
- Mathematical modelling.

Specific areas of faculty research include (but are not limited to):

- Aquatic toxicology;
- Computer games and graphics;
- Digital media;
- Electrochemistry;
- Environmental science;
- Forensic science;
- Fuel cells;
- Hydrogen technologies;
- Invasive species;
- Microbial ecology;
- Neurochemistry;
- Pesticides;
- Pharmacology;
- Photovoltaics;
- Protein modification;
- Pulp mill effluents;
- Software development;
- Traffic flow; and
- Virtual reality.

To view our faculty's publications list and current research topics, please visit [www.science.uoit.ca](http://www.science.uoit.ca).

The faculty is proud of the recognition our faculty members receive for their teaching excellence, a list which includes Dr. Rupinder Brar, a Physics lecturer who won the 2010 TVOntario Big Ideas Best Lecturer competition. This marked the second time in the five-year history of the competition that a UOIT lecturer won top prize. A total of 692 Ontario professors were originally nominated and of those 332 accepted the nomination. Dr. Brar's winning lecture was titled Exoplanets: The Search for Other Earths. For being named Ontario's top lecturer, a \$10,000 TD Meloche Monnex scholarship was awarded to UOIT for future students.

In addition, another lecturer and two teaching assistants have received internal UOIT teaching awards.





# Our faculty

## ADMINISTRATION

### Dean

Deborah Saucier, BSc, MSc, PhD

### Associate dean

Douglas Holdway, BSc, MSc, PhD  
(Tier I Canada Research Chair in Aquatic Toxicology)

### Assistant dean

Luciano Buono, BSc, MSc, PhD

### Cooperative education co-ordinator

John Easton, BSc, PhD

## PROFESSORS

Anatoli Chkrebti, MSc, PhD

Mark Green, BSc, MSc, PhD

## ASSOCIATE PROFESSORS

Dhavid Aruliah, BSc, MSc, PhD

Peter Berg, MSc, PhD

Dario Bonetta, BSc, MSc, PhD

Shari Forbes, BSc, PhD  
(Tier II Canada Research Chair in Decomposition Chemistry)

Sean Forrester, BSc, MSc, PhD

Julia Green-Johnson, BSc, MSc, PhD

Holly Jones-Taggart, BSc, PhD  
(cross-appointed with Faculty of Health Sciences)

Greg Lewis, BSc, MSc, PhD

Fedor Naumkin, MSc, PhD

## ASSISTANT PROFESSORS

Sean Bohun, BSc, MSc, PhD

Jeremy Bradbury, BSc, MSc, PhD

Christopher Collins, MSc, PhD  
(SHARCNET Research Chair in Interactive  
and Collaborative Scientific Visualization)

Jean-Paul Desaulniers, BSc, PhD

Brad Easton, BSc, PhD

Franco Gaspari, BSc, MSc, PhD

Andrea Kirkwood, BSc, PhD

Helene LeBlanc, BSc (Hons), MSc, PhD

Krisztina Paal, BSc, PhD

Ken Pu, BSc, MSc, PhD

Faisal Qureshi, BSc, MSc, PhD

Janice Strap, BSc, MSc, PhD

Liliana Trevani, BChem, PhD

Lennaert van Veen, MSc, PhD

## LECTURERS

Mihai Beligan, BA, MA, PhD

Rupinder Brar, BSc, MSc, PhD

Paula Di Cato, BA, MSc

Cristen Hucaluk, BSc, MSc

Joseph MacMillan, BSc, MSc, PhD

## SENIOR LABORATORY INSTRUCTORS

Sylvie Bardin, BSc, MSc, PhD

Richard Bartholomew, BSc, MSc, PhD

Kevin Coulter, BSc, PhD

Christopher Garside, BSc, MSc, PhD

Valeri Kapoustine, MSc, PhD

Ilona Kletschin, BSc, BEd, MSc

Kimberly Nugent, BSc, MSc

## ACADEMIC ADVISORS

### Senior Academic Advisor

Sarah Innes, BJ (on leave)  
Clarissa Livingstone BSc (acting)

### Academic Advisor

TBD

# Challenge yourself outside the classroom

## UOIT SCIENCE COUNCIL

Student societies are a great way to establish your own web of relationships, flex your leadership and organizational skills – and just have fun. The original Science Society was founded during UOIT's very first semester, in the fall of 2003. Officially sanctioned and supported by the Faculty of Science, membership is open to all science students.

Renamed the Science Council in fall 2009, its mandate is to:

- Provide a channel of communication between the faculty and undergraduate body of the Faculty of Science at UOIT;
- Initiate, encourage and support academic, social and athletic activities within the Faculty of Science;
- Promote, in general, the interests and welfare of the undergraduate body of the Faculty of Science; and
- Create awareness and interest in the Science programs at UOIT through Open House events.

### FAST FACT

Many of our students have won distinguished scholarships to pursue graduate studies at UOIT and other prestigious universities, and a growing number have been accepted to Canadian and international medical schools (more than 10 per cent of the first two Science graduating classes went on to medical school).



# Admission requirements

UOIT expects Ontario secondary school applicants applying for admission to all undergraduate Faculty of Science programs to present at a minimum an Ontario Secondary School Diploma (OSSD) (or equivalent) with a minimum of six 4U or 4M credits, including:

- English (ENG4U);
- Two of Calculus and Vectors (MCV4U), Biology (SBI4U), Chemistry (SCH4U) or Physics (SPH4U).
- Advanced Functions (MHF4U); and

In addition, a combined minimum average of 70 per cent in math and science courses is required. It is recommended that all four of MCV4U, SBI4U, SCH4U and SPH4U be taken.

The specific average or standing required for admission varies from year to year. Students are selected by taking into consideration a wide range of criteria including school marks, distribution of subjects taken, and performance in subjects relevant to the academic program. Possession of minimum requirements does not guarantee acceptance. Preference will be given to applicants with the best qualifications.

For complete information on the current admission requirements to UOIT undergraduate programs, please visit [www.uoit.ca/programs](http://www.uoit.ca/programs).

## How to apply

[www.ouac.on.ca](http://www.ouac.on.ca)

Apply for all UOIT programs through the Ontario Universities' Application Centre (OUAC) website. Ontario high school applicants can apply to up to three programs at UOIT for a base application fee of \$120.

For questions about the application process, contact OUAC at:

T: **519.823.1063** | F: **519.823.5232**

## Financing your education

[www.uoit.ca/safa](http://www.uoit.ca/safa)

Because your education is one of the most important investments you'll ever make, our Student Awards and Financial Aid (SAFA) office works hard to ensure you have everything you need to meet your financial obligations. We are committed to helping you with the financial aspect of your post-secondary experience and encourage you to take advantage of the Ontario Student Assistance Program (OSAP), budget counselling and on-campus and summer employment opportunities to help offset the cost of your tuition, books and other fees.

We offer a variety of scholarship awards and bursaries to help you meet the cost of a university education. In addition, thanks to the generosity of donors, there are a variety of other student awards available if you are in financial need and in good academic standing.

## Open House events

[www.uoit.ca/openhouse](http://www.uoit.ca/openhouse)

Twice a year we host an Open House and invite you to join us for a tour of our award-winning campus. During this event you will have the opportunity to meet current students, staff and faculty and learn more about academic programs and student life opportunities at UOIT.

### FALL OPEN HOUSE

Saturday, November 5, 2011  
10 a.m. to 2 p.m.

### WINTER OPEN HOUSE

Saturday, March 3, 2012  
10 a.m. to 2 p.m.



## We are here to help.

Faculty of Science  
2000 Simcoe Street North  
Oshawa, Ontario, Canada  
L1H 7K4

T: 905.721.3190

F: 905.721.3178

[www.science.uoit.ca](http://www.science.uoit.ca)

[www.uoit.ca](http://www.uoit.ca)



UNIVERSITY OF ONTARIO  
INSTITUTE OF TECHNOLOGY