FACULTY OF

SCIENCE

science.uOttawa.ca

2017 PROGRAM GUIDE
FACULTY OF SCIENCE

In science, you explore, you question, you discover. You open your mind. You develop a passion for pushing back the boundaries of the unknown. Come and develop this passion with us at the University of Ottawa. Our Faculty of Science offers programs that will expand your knowledge of the natural world at all levels of organization from primary physical forces through chemical interactions to whole organisms including humans and ecosystems. They will give you the tools for a rewarding career in natural sciences, life sciences, physical sciences, or mathematics.

You will be investing wisely in your future. In all of our programs, the training you will receive is an ideal gateway to the labour market and other professional programs.

The future in science has never been so promising or exciting... be part of it!

CONTACT US

We can help you make the right decisions at the right time. If you have any questions regarding admission and course selection, or if you want information about our programs, please contact us:

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30 Marie Curie
Ottawa ON K1N 6N5 Canada
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PASSION FOR SCIENCE!

A SETTING WHERE SCIENCE THRIVES

The University of Ottawa is nestled in the heart of Canada’s Capital. Because of our location, we can tap directly into several government, private research centres and laboratories. The Faculty of Science boasts partnerships with researchers at Agriculture and Agri-Food Canada, Health Canada, Environment Canada, the Geological Survey of Canada, Statistics Canada, the Ottawa Hospital Research Institute, the Canadian Museum of Nature and the National Research Council Canada, to name a few.

THREE GERHARD HERZBERG MEDALLISTS

The Faculty of Science includes no fewer than three recipients of the Gerhard Herzberg Medal, the biggest science award in Canada. Professor Paul Corkum, one of the leading physicists internationally, received the medal in 2009. Chemists Juan “Tito” Scalano (2002) and Howard Alper (2000) have also received this prestigious award presented by the Natural Sciences and Engineering Research Council of Canada (NSERC). The medal comes with a 1.25 million dollar research grant. The Herzberg Medal is awarded annually to an individual who has demonstrated sustained excellence and influence in research for a body of work conducted in Canada that has substantially advanced the fields of natural sciences or engineering.

DEDICATED PROFESSORS, RENOWNED RESEARCHERS

The Faculty of Science has more than 160 full-time professors who teach and lead cutting-edge research. On the strength of our national and international reputation, we attract over $32 million per year in grants and research contracts from the public and private sectors. These represent both rewards for our leadership in science and an investment in our future. Our professors thrive in passing along their knowledge and passion for research to students, and not just in the classroom. Each year, many students work in research labs and field sites as part of their undergraduate program, or as hired research assistants.

TABLE OF CONTENTS

2 Faculty of Science
4 Your success is our top priority
5 World class facilities
6 Research opportunities
7 Coop and careers
8 Extended French Stream
9 Recommended courses
10 Admission
13 Study at uOttawa Science
14 Biochemistry
18 Biochemistry and Chemical Engineering (Biotechnology)
20 Biology
24 Biomedical Science
28 Biopharmaceutical Science
30 Chemistry
33 Environmental Science
36 Geology
39 Mathematics and Statistics
44 Music and Science
45 Ophthalmic Medical Technology
46 Physics
50 Physics and Electrical Engineering
51 Life Sciences
YOUR SUCCESS IS OUR TOP PRIORITY

Recognizing that the transition from high school or CEGEP to university represents a major challenge, the Faculty of Science has many support programs for our new students.

SUMMER 2017
- Science Preparatory Workshop focuses on the skills and services that you will need to perform at your full potential.
- Math Workshop reviews the material that you will need to succeed in your first-year math courses.
- Summer Orientation helps you discover how your faculty works, the services that will be offered to you and where to find key campus locations.

BEGINNING OF THE SEMESTER
- Early testing in class, and the interim grades are forwarded to the coordinator of the Faculty’s Centre for Academic Success.

ONGOING, EVERY SEMESTER
- Evening study groups.
- Your Science Buddies, drop-in help center lead by senior students and opened from Monday to Thursday.

For more information on success tools, consult: science.uOttawa.ca/en/faculty-services/undergraduate-studies

Success in the classroom and in the lab depends a lot on the quality of the facilities. Ours are second to none.
The world class biosciences complex is just one example of the state-of-the-art facilities that offer our students additional opportunities to become the leaders of tomorrow. The complex houses teaching and research space and more than 40 faculty members in fields including biology, biochemistry, bioinformatics, biopharmaceutical science, biomedical science, environmental science, and genomics.

The complex comprises some of the best-equipped undergraduate biology and biochemistry teaching labs in Canada. The 400 biology workstations in 10 labs include top-of-the-line microscopes and digital imaging cameras and software. A digital network allows a lab instructor to broadcast images captured by one microscope to any or all workstations in the same room or even to other labs. Students can also retrieve images via the network to work on them at remote locations. This means that the lab experience can be extended outside the classroom.

The two biochemistry labs are outfitted with modern equipment where students are trained on the latest technologies, to better prepare them for their post-degree endeavours. The 42 stations have a network of screens (TVs) that allows us to include a multimedia approach in our teaching. Every year, there are investments in equipment and upgrades to enhance the learning experience.

The Earth Sciences microscopy laboratory is another example of the faculty’s high quality teaching facilities. The principal component of this lab is a fleet of 18 Olympus BX-41 polarizing microscopes that are equipped for both transmitted and reflected light observation, the kind of state-of-the-art equipment you will normally find in research labs.

Add to this our newly renovated chemistry laboratory that can accommodate up to 180 students at once and our new Science, Technology, Engineering and Mathematics (STEM) building to be ready for 2018, and you have a very special science campus.
RESEARCH OPPORTUNITIES
UNDERGRADUATE RESEARCH SCHOLARSHIP

A UNIQUE EXPERIENCE!

The Faculty of Science gives undergraduate students the opportunity to work with scientists and take part in important scientific discoveries. By obtaining the prestigious Undergraduate Research Scholarship (URS), you can live this unique experience.

This $10,000 award gives you the opportunity to work with one of our world-class research groups. You will earn $3,750 as a research assistant to one of our professors during the summer before your first year of studies. By succeeding in your first year of studies, you can continue your research the following summer, earning $6,250.

Research positions are available in various areas of science and medicine: biochemistry, biology, biopharmaceutical science, biotechnology, chemistry, earth sciences, environmental science, immunology, mathematics and statistics, microbiology, neurology, pharmacology, physics, physiology, virology.

Every year, scholarships are awarded to exceptional students from across the country. To qualify, you must be a Canadian citizen or a permanent resident, have an admission average of at least 92 per cent, be registered full-time for the first time in an undergraduate program of the Faculty of Science, and most importantly, demonstrate research skills and involvement in extracurricular activities of a scientific nature. To ensure renewal, you need a minimum grade point average of 8.5 in your first academic year.

Eligibility criteria and an application form are available on the Faculty’s website. The deadline is March 1st.

Undergraduate Research Opportunity Program (UROP), SCINAPSE, Connecting Young Minds …

Find out more on research opportunities for undergraduates at science.uOttawa.ca/en/research/undergraduate

2015-2016 RECIPIENTS

Shobhitha Balasubramaniam
Three Oaks Senior High School, Summerside PE

Iona Buchanan
Sir Robert Borden High School, Ottawa ON

Yike Cheng
Colonel By Secondary School, Ottawa ON

Mélanie Cyr
Polyvalente Thomas-Albert, Grand Sault NB

Valérie Desjardins
École secondaire catholique Béatrice-Desloges, Ottawa ON

Jérémie Gagnon-Bischoff
Cégep de l’Outaouais, Gatineau QC

Stephen Ronald Harrigan
École secondaire Louis-Riel, Ottawa ON

Teresa-Rose Kattackal
Colonel By Secondary School, Ottawa ON

Fiona Macdonald
Sir Winston Churchill Collegiate and Vocational Institute, Thunder Bay ON

Zachary Roberts
Sir William Mulock Secondary School, Newmarket ON

Laurie-Anne Roy
École secondaire Daniel-Johnson, Pointes-aux-Trembles QC

Alexander Sorrini
All Saints Catholic High School, Ottawa ON

Hanna Tang
Bell High School, Ottawa ON

Gayashan Tennakoon
Colonel By Secondary School, Ottawa ON

Anastasia Turner
École secondaire catholique Pierre-Savard, Ottawa ON

Tanya Yeuchyk
Woodroffe High School, Ottawa ON

2016-2017 RECIPIENTS

Front row, left to right: Olivia Dupuis, Florence Grenapin, Madisyn Turcotte, Amit Scheer, Mikaël Ladouceur

Back row, left to right: Keshav Goel, Cédric Albert, Olivier Brandts-Longtin, Ayni Sharif, Lukas Lesniak, Tyler Dacosta, Alison Cane, Mariam Taktek (absent: Rishi Gupta)
COOP AND CAREERS

COOP PROGRAM
The University of Ottawa is home to one of Canada’s most successful co-operative education programs. You will alternate study terms with work terms related to your area of study, allowing you to gain practical experience in the public or private sector as part of your undergraduate experience. At the Faculty of Science, all of our programs of study include the coop option, with the exception of Ophthalmic Medical Technology. By alternating four- eight- or twelve-month paid work terms with your study terms, you apply your classroom knowledge in a real employment setting. In the end, you will have acquired up to 16 months of experience and given yourself a leg up in the search for your first full-time job. What’s more, co-op placements are available throughout the globe – offering you a world of opportunities. The choice is yours!

SCIENTISTS WORK IN VARIOUS ECONOMIC SECTORS
Many interesting careers are available to students who complete their university education in science. Whether it is in life sciences or physical sciences, the array of careers is as vast as it is varied and the job perspectives are very promising. Scientists work in various economic sectors and they play a primary role in several aspects of our society. Very often, they are called upon to assume an important role in multidisciplinary teams where they work alongside doctors, engineers and other scientists from various fields. These days, it is not uncommon to see chemists, mathematicians, biochemists and physicists work side by side on the same project, or geologists, biologists and experts in environmental science pool their efforts and talents to resolve a problem.

FROM SCIENCE TO MEDICINE
Many students who choose a science program do so in order to pursue graduate and postgraduate studies, or to follow a professional path, whether it is in medicine, health sciences, education or law. A solid training in sciences remains a popular route towards a career in medicine.

FROM GOOGLE, TO ENERGY, TO THE ENVIRONMENT, TO THE HUMAN GENOME
Scientists – they are all around us. Nevertheless, they are not always easy to spot because they often work in positions that are not considered to be strictly scientific, per se. For example, there are many mathematicians who work in the fields of aviation, computers, software design, telecommunications, cryptography, human genome and automobiles.

Physics also covers a vast range of fields of research, from the minuscule (atoms, molecules, nanostructures) to the infinitely immense (structures of the universe). So, it is not surprising that physicists are involved in a massive range of economic sectors: electronics, communications, medical physics, energy and the environment, defence and, obviously, the whole world of space exploration.

Scientists are at the heart of the big questions that concern us. Whether they are biologists, biochemists, geologists or chemists, they constantly deal with current issues and strive to find answers to the burning questions of the day. Why does Earth support life? What is the secret to beating cancer and other major diseases? How is climate changing? How can we better respect our environment?
EXTENDED FRENCH STREAM

The Faculty of Science offers you a chance like no other to maintain your French skills and gain a clear advantage in the workplace. The Extended French Stream (EFS) gives you the opportunity to live it up en français on a bilingual campus in a bilingual region, and be one of over 3,000 Anglophone students at uOttawa taking part of their courses in French. In EFS, one third of your courses are taught in French you choose what you want to do in English and what you want to do in French. You are allowed to submit written work in either French or English in any non-language class you take. The EFS option is available in all our programs, with the exception of Music and Science and Ophthalmic Medical Technology.

Upon graduation, you obtain recognition of your accomplishment on your official University transcript and your diploma – tangible proof of your language skills.

What’s in it for you?
• $1,000 annually for taking 2 courses in French each semester
• Access to campus jobs requiring bilingual skills
• Boost your employability, particularly in the government sector and international jobs
• Bilingual Canadians earn 10% more on average

We have what you need to succeed
• Staff dedicated to you as an immersion student
• Language advisors to improve your written and oral skills
• Language testing to identify your strengths and weaknesses
• Language courses to improve your French skills

Program requirements and regulations
• Admission as an Anglophone student to your program of choice
• Submitting proof of French proficiency (passing our French test, or submitting a DELF B1 certificate or higher)
• Fulfillment of all the requirements of your program to graduate
• Altogether, a minimum of 42 units in courses where the language of instruction is French
  • A minimum of 24 units in courses offered in French within the Faculty of Science
  • A minimum of 6 units in courses offered in French within the Humanities
  • A minimum of 6 units of courses offered in French at the 3000 or 4000 level within the Faculty of Science
• Successful completion of FLS3500, the University’s Second Language Certification Test. This test ensures that you are indeed fluently bilingual.
RECOMMENDED COURSES

According to the different disciplines, the following courses are recommended; a student who is admitted into a program without one of these recommended courses will have to complete a bridging course.

<table>
<thead>
<tr>
<th>DISCIPLINES</th>
<th>BIOCHEMISTRY, BIOLOGY, BIOPHARMACEUTICAL SCIENCE, ENVIRONMENTAL SCIENCE, OPHTHALMIC MEDICAL TECHNOLOGY, BIOMEDICAL SCIENCE</th>
<th>CHEMISTRY, GEOLOGY-PHYSICS</th>
<th>GEOLOGY</th>
<th>PHYSICS, PHYSICS-MATHEMATICS</th>
<th>BIOTECHNOLOGY, PHYSICS AND ELECTRICAL ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONTARIO</td>
<td>Biology 4U Chemistry 4U</td>
<td>Chemistry 4U Physics 4U</td>
<td>Chemistry 4U Earth and Space Science 4U Physics 4U</td>
<td>Chemistry 4U or Biology 4U Physics 4U</td>
<td>Biology 4U Chemistry 4U Physics 4U</td>
</tr>
<tr>
<td>QUEBEC-CEGEP</td>
<td>Biology 101 (General Biology I) Chemistry 202 (General Chemistry or Organic Chemistry)</td>
<td>Chemistry 202 (General Chemistry or Organic Chemistry) Physics 203 (Mechanics or Electricity and Magnetism)</td>
<td>Chemistry 202 (General Chemistry or Organic Chemistry) Physics 203 (Mechanics or Electricity and Magnetism)</td>
<td>Chemistry 202 (General Chemistry or Organic Chemistry) or Biology 101 (General Biology I) Physics 203 (Mechanics or Electricity and Magnetism)</td>
<td>Biology 101 (General Biology I) Chemistry 202 (General Chemistry or Organic Chemistry) Physics 203 (Mechanics or Electricity and Magnetism)</td>
</tr>
<tr>
<td>NEW BRUNSWICK</td>
<td>Biology 122 Chemistry 122</td>
<td>Chemistry 122 Physics 122</td>
<td>Chemistry 122 or Biology 122 Physics 122</td>
<td>Biology 122 Chemistry 122 Physics 122</td>
<td>Biology 122 Chemistry 122 Physics 122</td>
</tr>
<tr>
<td>NOVA SCOTIA</td>
<td>Biology 12 Chemistry 12</td>
<td>Chemistry 12 Physics 12</td>
<td>Chemistry 12 or Biology 12 Physics 12</td>
<td>Biology 12 Chemistry 12 Physics 12</td>
<td>Biology 12 Chemistry 12 Physics 12</td>
</tr>
<tr>
<td>PRINCE EDWARD ISLAND</td>
<td>Biology 621 Chemistry 621</td>
<td>Chemistry 621 Physics 621</td>
<td>Chemistry 621 or Biology 621 Physics 621</td>
<td>Biology 621 Chemistry 621 Physics 621</td>
<td>Biology 621 Chemistry 621 Physics 621</td>
</tr>
<tr>
<td>NEWFOUNDLAND AND LABRADOR</td>
<td>Biology 3201 Chemistry 3202</td>
<td>Chemistry 3202 Physics 3204</td>
<td>Chemistry 3202 or Biology 3201 Physics 3204</td>
<td>Biology 3201 Chemistry 3202 Physics 3204</td>
<td>Biology 3201 Chemistry 3202 Physics 3204</td>
</tr>
<tr>
<td>BRITISH COLUMBIA / YUKON</td>
<td>Biology 12 Chemistry 12</td>
<td>Chemistry 12 Physics 12</td>
<td>Chemistry 12 or Biology 12 Physics 12</td>
<td>Biology 12 Chemistry 12 Physics 12</td>
<td>Biology 12 Chemistry 12 Physics 12</td>
</tr>
<tr>
<td>ALBERTA / NWT / NUNAVUT</td>
<td>Biology 30 Chemistry 30</td>
<td>Chemistry 30 Physics 30</td>
<td>Chemistry 30 or Biology 30 Physics 30</td>
<td>Biology 30 Chemistry 30 Physics 30</td>
<td>Biology 30 Chemistry 30 Physics 30</td>
</tr>
<tr>
<td>SASKATCHEWAN</td>
<td>Biology 30 Chemistry 30</td>
<td>Chemistry 30 Physics 30</td>
<td>Chemistry 30 or Biology 30 Physics 30</td>
<td>Biology 30 Chemistry 30 Physics 30</td>
<td>Biology 30 Chemistry 30 Physics 30</td>
</tr>
<tr>
<td>MANITOBA</td>
<td>Biology 405 Chemistry 405</td>
<td>Chemistry 405 Physics 405</td>
<td>Chemistry 405 or Biology 405 Physics 405</td>
<td>Biology 405 Chemistry 405 Physics 405</td>
<td>Biology 405 Chemistry 405 Physics 405</td>
</tr>
</tbody>
</table>

Past experience indicates that students with the most science prerequisites, including physics, biology and chemistry, have an increased rate of success.
Before submitting an application, be sure you meet or will meet all admissions requirements:

- You have obtained or are in the process of obtaining your secondary school diploma.
- You are registered for at least six courses at the 4U or 4M level.
- You are registered for all 4U-level courses required for the program unless otherwise specified.
- You have the minimum average required and meet any language requirements.

The University of Ottawa reserves the right to reserve the right to guarantee admission. The averages are based on the program, discipline, and language requirements. The language of instruction and the number of places available in the program. The University of Ottawa reserves the right to change minimum admission averages without prior notice. Past experience indicates that students with a strong background in biology, chemistry and physics have an increased rate of success.

Students who have completed Advanced Functions 4U but have not completed Calculus and Vectors 4U can take the replacement course at the University either the summer before or during their first term.

### Disciplines and Prerequisites

<table>
<thead>
<tr>
<th>Disciplines</th>
<th>Prerequisites</th>
<th>Additional Requirements</th>
<th>2016 Average</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biochemistry</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Biochemistry (BSc) and Chemical Engineering (BSc) (Biotechnology)</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>84% - 88%</td>
</tr>
<tr>
<td><strong>Biological Science</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Biopharmaceutical Science</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Chemistry</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Computer Science and Mathematics (BSc)</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Environmental Science</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Financial Mathematics and Economics (BSc)</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Geology</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Geology-Physics</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Mathematics and Economics (BSc)</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Ophthalmic Medical Technology</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>Limited enrolment</td>
</tr>
<tr>
<td><strong>Physics</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Physics-Mathematics</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Two of the following: Biology 4U, Chemistry 4U, Physics 4U, Earth and Space Science 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
<tr>
<td><strong>Physics (BSc) and Electrical Engineering (BSc)</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U • Physics 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>84% - 88%</td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
<td>English 4U or Français 4U • Advanced Functions 4U • Calculus and Vectors 4U</td>
<td>A minimum combined average of 70% is required for all prerequisite courses in science and mathematics.</td>
<td>80% - 84%</td>
</tr>
</tbody>
</table>
### QUEBEC SECONDARY V

#### GENERAL PREREQUISITES AND REQUIREMENTS

Before submitting an application, be sure you meet or will meet all admissions requirements:

- You have obtained or are in the process of obtaining your secondary school diploma.
- You are registered for at least five Secondary V courses.
- You are registered for all courses required for your program unless otherwise specified.
- You will have the minimum average required.
- You meet any language requirements.

#### REQUIRED AVERAGE

Your admission average, which is also used to determine your eligibility for admission scholarships, is based on your five best Secondary V courses, including the prerequisites for your chosen program. A minimum average of 84% is required for most programs at the University of Ottawa. However, it does not guarantee admission.

Please note that the requirements are minimum requirements only and are subject to change. The minimum admission averages are based on 2016 admission requirements and are provided as an example only; admission averages for 2017 have not yet been determined. This means that meeting these minimum admission averages does not guarantee admission.

The averages are based on the program, the language of instruction and the number of places available in the program. The University of Ottawa reserves the right to change the minimum admission averages without prior notice.

Students will be required to take up to two mathematics make-up courses at the University either the summer before or during their first year.

#### DISCIPLINES

<table>
<thead>
<tr>
<th>Disciplines</th>
<th>PREREQUISITES</th>
<th>ADDITIONAL REQUIREMENTS</th>
<th>2016 AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCHEMISTRY</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>BIOCHEMISTRY (BSc) AND CHEMICAL ENGINEERING (BSc) (BIOTECHNOLOGY)</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>BIOLOGY</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>BIOMEDICAL SCIENCE</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>87%</td>
</tr>
<tr>
<td>BIOPHARMACEUTICAL SCIENCE</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>CHEMISTRY</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>COMPUTER SCIENCE AND MATHEMATICS (BSc)</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V)</td>
<td>A minimum average of 84% is required in the prerequisite course in mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>ENVIRONMENTAL SCIENCE</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>FINANCIAL MATHEMATICS AND ECONOMICS (BSc)</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V)</td>
<td>A minimum average of 84% is required in the prerequisite course in mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>GEOLOGY</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>GEOLOGY–PHYSICS</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>MATHEMATICS</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V)</td>
<td>A minimum average of 84% is required in the prerequisite course in mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>MATHEMATICS AND ECONOMICS (BSc)</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V)</td>
<td>A minimum average of 84% is required in the prerequisite course in mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>OPHTHALMIC MEDICAL TECHNOLOGY</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>PHYSICS</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>PHYSICS–MATHEMATICS</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>84%</td>
</tr>
<tr>
<td>PHYSICS (BSc) AND ELECTRICAL ENGINEERING (BSc)</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V) • Science and Technology (with or without option) (Secondary V) • Chemistry 504 • Physics 504</td>
<td>A minimum combined average of 84% is required for all prerequisite courses in science and mathematics.</td>
<td>87%</td>
</tr>
<tr>
<td>STATISTICS</td>
<td>English or Français • Technical and Scientific option or Science option (Secondary V)</td>
<td>A minimum average of 84% is required in the prerequisite course in mathematics.</td>
<td>84%</td>
</tr>
</tbody>
</table>

QUESTIONS ON ADMISSIONS OR PROGRAMS?

Come and meet uOttawa representatives during our information evenings in Gatineau, Quebec City, Sherbrooke, Laval and Montreal in January and February, 2017. Visit uOttawa.ca/events for details.
Your admission average, which is also used to determine your eligibility for admission scholarships, is based on all your completed CEGEP courses, including failed courses, but excluding Physical Education and make-up courses. Please note that all CEGEP courses failed with a final grade lower than 50% are rounded up to 50% for the calculation of your admission average. We do not take the "R" rating into consideration.

If you have successfully completed between 12 and 16 CEGEP courses (excluding Physical Education and make-up courses), the University may require a higher admission average.

Please note that the requirements listed in the tables are minimum requirements only and are subject to change. The minimum admission averages are based on 2016 admission requirements and are provided as an example only; admission averages for 2017 have not yet been determined. This means that meeting these minimum admission averages does not guarantee admission. The averages are based on the program, the language of instruction and the number of places available in the program. The University of Ottawa reserves the right to change minimum admission averages without prior notice.

**Questions on Admissions or Programs?**

Come and meet uOttawa representatives during our information evenings in Gatineau, Quebec City, Sherbrooke, Laval and Montreal in January and February 2017. Visit uOttawa.ca/events for details.
MIX, MATCH AND COMBINE... BUILD YOUR OWN PROGRAM!

How do you choose what to study?
Choose what you’re passionate about and what will lead to your dream job. Take the time to explore the many disciplines offered at uOttawa Science.

When do you choose?
For most programs, when you apply. You must indicate your choice of first discipline on the Ontario Universities’ Application Centre (OUAC) form at www.ouac.on.ca.

Biology and sociology, physics and electrical engineering... How can you combine them?
Are you passionate about many subjects? Some programs allow you to add a second discipline to your bachelor’s. You can even combine disciplines from different faculties.

Major, minor, specialization...
What’s the difference?
Two things are different: the total number of courses you must take in your first discipline and the option or the requirement to add a second discipline. To compare programs, see the diagram on the right.

HONOURS ACADEMIC PATHS

SPECIALIZATION (4 YEARS)

- S SPECIALIZATION + ELECTIVES
- SMn SPECIALIZATION WITH MINOR + Mn MINOR + ELECTIVES
- SO SPECIALIZATION INCLUDING AN OPTION + ELECTIVES
- JH JOINT HONOURS – TWO SPECIALIZATIONS LEADING TO ONE DEGREE + ELECTIVES

DOUBLE MAJOR | MAJOR AND MINOR (4 YEARS)

- M MAJOR + M MAJOR + ELECTIVES
- M MAJOR + Mn MINOR + ELECTIVES

DOUBLE DEGREE – INTEGRATED PATH LEADING TO TWO DEGREES (5 YEARS OR MORE)

- HONOURS BACHELOR + HONOURS BACHELOR
Biochemistry is the chemistry of life. As such, it provides the foundation for understanding all biological processes and for understanding the molecular basis and treatment of human disease.

The biochemistry program, offered through the Department of Chemistry and Biomolecular Sciences, provides you with the training needed to play a leading role in the new and exciting areas of medical research. You will be exposed to cutting-edge research and state-of-the-art knowledge. The undergraduate biochemistry program prepares you for graduate studies and thus for a career in academia or in research in the medical sciences. What’s more, biochemistry provides an excellent foundation for further studies in medicine and other health specialties.

You can enroll in a BSc with specialization or a major or in a minor in biochemistry. Choose the specialization if you want to pursue a career in experimental biochemistry. Opt for the major if you prefer fundamental training in the discipline. Choose the minor if you’re focusing on another discipline but are interested in biochemistry. Additional options in chemical biology, microbiology and immunology and synthetic biology are also available. You can combine studies in biochemistry with training in chemical engineering to obtain both a BSc in biochemistry and a BASc in chemical engineering over five years.

If you choose the specialization program, you have the opportunity to complete a full-year research project under the supervision of a professor. You can pursue work in many areas of modern medical research, including biochemistry, microbiology, immunology, chemical biology, synthetic biology, molecular biology, cell biology, proteomics, genomics, systems biology and bioinformatics.
**HONOURS BSc IN BIOCHEMISTRY (120 UNITS)**

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIO1109 Principles of Biology (register to this course if 4U Biology not completed)</td>
<td>CHM2120 Organic Chemistry II</td>
<td>BCH3170 Molecular Biology</td>
<td>BCH4932 Biochemistry Seminar (Fall and Winter)</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology</td>
<td>CHM2123 Laboratory of Organic Chemistry</td>
<td>BCH3356 Molecular Biology Laboratory</td>
<td>BCH4040 Honours Research - Biochemistry (Fall and Winter)</td>
</tr>
<tr>
<td>CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>CHM2132 Physical Chemistry for the Life Sciences</td>
<td>BIO3153 Cell Biology</td>
<td>3 course units from:</td>
</tr>
<tr>
<td>MAT1330 Calculus for the Life Sciences I</td>
<td>MAT2379 Introduction to Biostatistics</td>
<td>6 elective course units</td>
<td>BPS4104 Bioinformatics Laboratory</td>
</tr>
<tr>
<td>PHY1321 Principles of Physics I or PHY1331 Principles of Physics I (if 4U Physics not completed)</td>
<td>3 elective course units</td>
<td>3 course units from:</td>
<td>BPS4127 Advanced Techniques in Biosciences</td>
</tr>
<tr>
<td>3 optional course units in ENG at the 1000 or 2000 level</td>
<td></td>
<td>Plus 6 course units in science at the 3000 or 4000 level</td>
<td>Plus 6 course units in science at 3000 or 4000 level</td>
</tr>
</tbody>
</table>

**Notes**: BCH4040 is highly recommended. A minimum CGPA of 6.5 is required. This course may not be available every year. BCH4040 is beyond the requirements of the programs in science. Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. Co-operative education and the extended French stream are available with this program.

**HONOURS BSc IN BIOCHEMISTRY - CHEMICAL BIOLOGY OPTION (120 UNITS)**

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIO1109 Principles of Biology (register to this course if 4U Biology not completed)</td>
<td>CHM2120 Organic Chemistry II</td>
<td>BCH3170 Molecular Biology</td>
<td>BCH4932 Biochemistry Seminar (Fall and Winter)</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology</td>
<td>CHM2123 Laboratory of Organic Chemistry</td>
<td>BCH3356 Molecular Biology Laboratory</td>
<td>BCH4040 Honours Research - Biochemistry (Fall and Winter)</td>
</tr>
<tr>
<td>CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>CHM2132 Physical Chemistry for the Life Sciences</td>
<td>BIO3153 Cell Biology</td>
<td>3 course units from:</td>
</tr>
<tr>
<td>MAT1330 Calculus for the Life Sciences I</td>
<td>MAT2379 Introduction to Biostatistics</td>
<td>6 elective course units</td>
<td>BPS4104 Bioinformatics Laboratory</td>
</tr>
<tr>
<td>PHY1321 Principles of Physics I or PHY1331 Principles of Physics I (if 4U Physics not completed)</td>
<td>3 elective course units</td>
<td>3 course units from:</td>
<td>BPS4127 Advanced Techniques in Biosciences</td>
</tr>
<tr>
<td>3 optional course units in ENG at the 1000 or 2000 level</td>
<td></td>
<td>Plus 6 course units in science at the 3000 or 4000 level</td>
<td>Plus 6 course units in science at 3000 or 4000 level</td>
</tr>
</tbody>
</table>

**Notes**: *This course is beyond the requirements of the programs in science. BCH4040 is highly recommended. A minimum CGPA of 6.5 is required. Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. Co-operative education and the extended French stream are available with this program.*
## Honours BSc in Biochemistry - Microbiology and Immunology Option (120 Units)

### 1st Year (30 units)

- **Fall**
  - BIO1109 Principles of Biology
  - MAT1330 Calculus for the Life Sciences I
  - PHY1321 Principles of Physics I
  - 3 elective course units in ENG at the 1000 or 2000 level

- **Winter**
  - BIO1130 Introduction to Organisinal Biology
  - CHM1311 Principles of Chemistry
  - PHY1332 Principles of Physics II
  - 3 optional course units in ENG at the 1000 or 2000 level

### 2nd Year (30 units)

- **Fall**
  - CHM2120 Organic Chemistry II
  - CHM2123 Laboratory of Organic Chemistry II
  - CHM2132 Physical Chemistry for the Life Sciences
  - 3 elective course units

- **Winter**
  - BCH3233 Introduction to Biochemistry
  - BIO2133 Genetics
  - 3 elective units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management

### 3rd Year (30 units)

- **Fall**
  - BCH3170 Molecular Biology
  - BCH3356 Molecular Biology Laboratory
  - BIO3124 General Microbiology Laboratory
  - BIO3153 Cell Biology

- **Winter**
  - BCH4040 Honours Research - Biochemistry (Fall and Winter)
  - BCH4932 Biochemistry Seminar (Fall and Winter)
  - 3 course units from:
    - BPS4104 Bioinformatics Laboratory
    - BPS4127 Advanced Techniques in Biosciences
    - Plus 6 course units in science at the 3000 or 4000 level
    - MIC4125 Immunology
    - 6 elective course units

### Notes
- *This course is beyond the requirements of the programs in science.*
- 1BCH4040 is highly recommended. A minimum CGPA of 6.5 is required.
- Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.
- Co-operative education and the extended French stream are available with this program.

## Honours BSc in Biochemistry - Synthetic Biology Option (120 Units)

### 1st Year (30 units)

- **Fall**
  - BIO1109 Principles of Biology
  - BIO1130 Introduction to Organisinal Biology
  - CHM1311 Principles of Chemistry
  - MAT1330 Calculus for the Life Sciences I
  - PHY1321 Principles of Physics I
  - 3 elective course units in ENG at the 1000 or 2000 level

- **Winter**
  - BIO1140 Introduction to Cell Biology
  - CHM1321 Organic Chemistry I
  - PHY1322 Principles of Physics II
  - 3 optional course units in ENG at the 1000 or 2000 level

### 2nd Year (30 units)

- **Fall**
  - CHM2120 Organic Chemistry II
  - CHM2123 Laboratory of Organic Chemistry II
  - CHM2132 Physical Chemistry for the Life Sciences
  - 3 elective course units

- **Winter**
  - BCH2333 Introduction to Biochemistry
  - BIO2133 Genetics
  - 3 elective units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management

### 3rd Year (30 units)

- **Fall**
  - BCH3170 Molecular Biology
  - BCH3356 Molecular Biology Laboratory
  - BIO3124 General Microbiology Laboratory
  - BIO3153 Cell Biology

- **Winter**
  - BCH4040 Honours Research - Biochemistry (Fall and Winter)
  - BCH4932 Biochemistry Seminar (Fall and Winter)
  - 3 course units from:
    - BPS4104 Bioinformatics Laboratory
    - BPS4127 Advanced Techniques in Biosciences
    - Plus 6 course units in science at the 3000 or 4000 level
    - MIC4124 Pathogenic Bacteriology
    - 3 course units from the list of optional courses below

### Notes
- *This course is beyond the requirements of the programs in science.*
- 1BCH4040 is highly recommended. A minimum CGPA of 6.5 is required.
- Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.
- Co-operative education and the extended French stream are available with this program.

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科学.uOttawa.ca
## MAJOR IN BIOCHEMISTRY (60 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (24 units)</th>
<th>2ND YEAR (15 units)</th>
<th>3RD YEAR (15 units)</th>
<th>4TH YEAR (6 units)</th>
</tr>
</thead>
</table>
| BIO1109* Principles of Biology  
(\text{register to this course if 4U Biology not completed})  
BIO1130 Introduction to Organismal Biology  
CHM1311 Principles of Chemistry  
CHM1301 Principles of Chemistry (if 4U Chemistry not completed)  
MAT1330 Calculus for the Life Sciences I  
PHY1321 Principles of Physics I  
PHY1331 Principles of Physics I (if 4U Physics not completed) | CHM2120 Organic Chemistry II  
CHM2132 Physical Chemistry for the Life Sciences  
MAT2379 Introduction to Biostatistics | BCH3170 Molecular Biology  
BCH3356 Molecular Biology Laboratory | 6 units from (Fall or Winter):  
BCH4101 Human Genome Structure and Function  
BCH4116 Analytical Biochemistry  
BCH4122 Structural Biology of Proteins  
BCH4123 Pathological Chemistry  
BCH4124 Carbohydrates and Glycobiology  
BCH41252 Cellular Regulation and Control  
BCH4172 Topics in Biotechnology  
BCH4188 Nucleic Acids - Structure and Functions  
BCH4300 Selected Topics in Biochemistry  
BPS3101 Genomics  
BPS4129 Advanced Chemical Biology  
CHM4139 Enzyme Chemistry and Biocatalysis |

### Notes
- *This course may not be available every year.*  
- A maximum of 3 course units may be selected amongst these courses.  
- *This course is beyond the requirements of the programs in science.*  
- Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.  
- Co-operative education and the extended French stream are available when taken as part of an honours degree.

## MINOR IN BIOCHEMISTRY (39 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (12 units)</th>
<th>2ND YEAR (9 units)</th>
<th>3RD YEAR (12 units)</th>
<th>4TH YEAR (6 units)</th>
</tr>
</thead>
</table>
| BIO1109* Principles of Biology  
(\text{register to this course if 4U Biology not completed})  
BIO1130 Introduction to Organismal Biology  
CHM1311 Principles of Chemistry  
CHM1301 Principles of Chemistry (if 4U Chemistry not completed) | CHM2120 Organic Chemistry II | BCH3170 Molecular Biology  
3 course units from the list below² | 3 units from the list below² |
| BIO1140 Introduction to Cell Biology  
CHM321 Organic Chemistry I  
MAT1332 Calculus for the Life Sciences II  
PHY1322 Principles of Physics II | BCH2333 Introduction to Biochemistry  
BIO2133 Genetics | BCH3120 General Intermediary Metabolism  
BCH3125 Protein Structure and Function  
BCH3346 Biochemistry Laboratory II | |

### Notes
- *This course may not be available every year.*  
- *This course is beyond the requirements of the programs in science.*  
- Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.  
- Co-operative education and the extended French stream are available when taken as part of an honours degree.

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²A maximum of 3 course units may be selected amongst these courses.
Learn how living organisms grow and develop and how we can use this knowledge to create manufacturing processes, chemical products or life-saving drugs. Did you know that cheese, yogurt and beer are all biotechnology products? So are insulin and the chickenpox vaccine, both of which have saved or improved the lives of millions. The biotechnology program covers the areas of biology, chemistry, mathematics and more. Students in this program, offered through the Departments of Chemistry and Biomolecular Sciences and Chemical and Biological Engineering, obtain two degrees upon graduation, a BSc in biochemistry and a BASc in chemical engineering.

BIOCHEMISTRY AND CHEMICAL ENGINEERING (BIOTECHNOLOGY)

Learn how living organisms grow and develop and how we can use this knowledge to create manufacturing processes, chemical products or life-saving drugs. Did you know that cheese, yogurt and beer are all biotechnology products? So are insulin and the chickenpox vaccine, both of which have saved or improved the lives of millions. The biotechnology program covers the areas of biology, chemistry, mathematics and more. Students in this program, offered through the Departments of Chemistry and Biomolecular Sciences and Chemical and Biological Engineering, obtain two degrees upon graduation, a BSc in biochemistry and a BASc in chemical engineering.

UNDERGRADUATE STUDIES (BACHELOR)
Honours BSc in Biochemistry / BASc in Chemical Engineering (Biotechnology)
- Cooperative education is offered as part of an honours bachelor degree.

GRADUATE PROGRAMS (MASTERS AND PhD)
Master and doctorate in allied disciplines.

CAREER OPPORTUNITIES
Cell biologist • biomedical and biotechnological researcher • patent law specialist • chemical engineer • biochemist...
**HONOURS BSc IN BIOCHEMISTRY / BASc IN CHEMICAL ENGINEERING (BIOTECHNOLOGY) (189 UNITS)**

### 1ST YEAR (30 units)

- **FALL**
  - BIO1109* Principles of Biology (register to this course if 4U Biology not completed)
  - BIO1130 Introduction to Organismal Biology
  - CHM1311 Principles of Chemistry
  - or
  - CHM1301 Principles of Chemistry (if 4U Chemistry not completed)
  - MAT1320 Calculus I
  - MAT1341 Introduction to Linear Algebra
  - PHY1121 Fundamentals of Physics I
  - or
  - PHY1331 Principles of Physics I (if 4U Physics not completed)

- **WINTER**
  - CHM2120 Organic Chemistry II
  - CHM2123 Laboratory of Organic Chemistry II
  - ENG1112 Technical Report Writing (Fall or Winter)
  - GNG1106 Fundamentals of Engineering Computation (Fall or Winter)
  - MAT2377 Probability and Statistics for Engineers
  - MAT2384 Ordinary Differential Equations and Numerical Methods
  - ECO1192 Engineering Economics (Fall or Winter)
  - or
  - GNG2101 Introduction to product development and management for engineers and computer scientists (Fall or Winter)
  - 3 course units of complementary studies electives* (Fall or Winter)

### 2ND YEAR (36 units)

- **FALL**
  - BCH2333 Introduction to Biochemistry
  - BCH2334 Genetics
  - CHM2330 Physical Chemistry: Introduction to the Molecular Properties of Matter
  - CHM2354 Analytical Chemistry

- **WINTER**
  - BCH3120 General Intermediary Metabolism
  - BCH3125 Protein Structure and Function
  - BCH3346 Biochemistry Laboratory II
  - CHG2314 Heat Transfer Operations
  - 3 course units of complementary studies electives* (Fall or Winter)

### 3RD YEAR (39 units)

- **FALL**
  - BCH3170 Molecular Biology
  - BCH3356 Molecular Biology Laboratory
  - BIO3124 General Microbiology
  - CHG2312 Fluid Flow
  - CHG2317 Introduction to Chemical Process Analysis and Design
  - HS2129 Technology, Society and Environment since 1800 (Winter)
  - or
  - PHI2394 Scientific Thought and Social Values (Fall)
  - MAT2322* Calculus III for Engineers (Fall or Winter)

- **WINTER**
  - BCH4040* Honours Research – Biochemistry (Fall and Winter)
  - BCH4172 Topics in Biotechnology
  - BCH4932* Biochemistry Seminar (Fall and Winter)
  - CHG3316 Transport Phenomena
  - CHG3324 Fundamentals and Applications of Chemical Engineering Thermodynamics
  - CHG3331 Application of Mathematical Methods to Chemical Engineering
  - CHG3335 Process Control
  - 6 course units from:
    - BPS3101 Genomics (Fall)
    - or
    - BCH4101 Human Genome Structure and Function (Winter)
    - or
    - BCH4125 Cellular Regulation and Control (Winter)
  - or
  - BCH4116 Analytical Biochemistry (Winter)
  - or
  - BCH4122* Structural Biology of Proteins (Fall)
  - BCH4123 Pathological Chemistry (Winter)
  - BCH4124 Carbohydrates and Glycobiology (Winter)
  - BCH4188* (Fall) Nucleic Acids – Structure and Functions (Fall)
  - BCH4300 Selected Topics in Biochemistry (Winter)
  - BPS4121 Biosynthesis and Natural Product Derived Medicines (Fall)
  - BPS4129 Advanced Chemical Biology (Winter)
  - CHM4139 Enzyme Chemistry and Biocatalysis (Fall)

### 4TH YEAR (48 units)

- **FALL**
  - BCH4040* Honours Research – Biochemistry (Fall and Winter)
  - BCH4172 Topics in Biotechnology
  - BCH4932* Biochemistry Seminar (Fall and Winter)
  - CHG3316 Transport Phenomena
  - CHG3324 Fundamentals and Applications of Chemical Engineering Thermodynamics
  - CHG3331 Application of Mathematical Methods to Chemical Engineering
  - CHG3335 Process Control
  - 6 course units from:
    - BPS3101 Genomics (Fall)
    - or
    - BCH4101 Human Genome Structure and Function (Winter)
    - or
    - BCH4125 Cellular Regulation and Control (Winter)
  - or
  - BCH4116 Analytical Biochemistry (Winter)
  - or
  - BCH4122* Structural Biology of Proteins (Fall)
  - BCH4123 Pathological Chemistry (Winter)
  - BCH4124 Carbohydrates and Glycobiology (Winter)
  - BCH4188* (Fall) Nucleic Acids – Structure and Functions (Fall)
  - BCH4300 Selected Topics in Biochemistry (Winter)
  - BPS4121 Biosynthesis and Natural Product Derived Medicines (Fall)
  - BPS4129 Advanced Chemical Biology (Winter)
  - CHM4139 Enzyme Chemistry and Biocatalysis (Fall)

### 5TH YEAR (36 units)

- **FALL**
  - BCH4172 Topics in Biotechnology
  - BCH4932* Biochemistry Seminar (Fall and Winter)
  - CHG3316 Transport Phenomena
  - CHG3324 Fundamentals and Applications of Chemical Engineering Thermodynamics
  - CHG3331 Application of Mathematical Methods to Chemical Engineering
  - CHG3335 Process Control
  - 6 course units from:
    - BPS3101 Genomics (Fall)
    - or
    - BCH4101 Human Genome Structure and Function (Winter)
    - or
    - BCH4125 Cellular Regulation and Control (Winter)
  - or
  - BCH4116 Analytical Biochemistry (Winter)
  - or
  - BCH4122* Structural Biology of Proteins (Fall)
  - BCH4123 Pathological Chemistry (Winter)
  - BCH4124 Carbohydrates and Glycobiology (Winter)
  - BCH4188* (Fall) Nucleic Acids – Structure and Functions (Fall)
  - BCH4300 Selected Topics in Biochemistry (Winter)
  - BPS4121 Biosynthesis and Natural Product Derived Medicines (Fall)
  - BPS4129 Advanced Chemical Biology (Winter)
  - CHM4139 Enzyme Chemistry and Biocatalysis (Fall)

### Notes
- CHG1125 must be taken during the first or second year; first year is recommended.
- It is recommended that GNG1106 be taken in first or second year.
- For a complete list of complementary studies electives, consult the Faculty of Engineering website.
- During the fourth year, the student must either do a research project (BCH4040), or take nine additional units among the 3000 or 4000 level courses in BCH, BIO, BPS, CMM, CHM, PHA, PHYS or MiC. The research project is highly recommended for students who intend to pursue a career in research, but a GPA of 6.5 is required to be eligible for the project.
- This course runs from September to April.
- This course may not be available every year.
- Consult the list of technical electives in the regular Chemical Engineering program.
- If you wish to take HS2129 during the Winter semester, you would need to take MAT2322 during the Fall semester.
- *This course is beyond the requirements of the programs in science.
- Co-operative education and the extended French stream are available with this program.
Recent discoveries and new technologies are revolutionizing the biological sciences, which increasingly require integrating knowledge across the full range of biological systems, from the gene to entire ecosystems.

Our programs give students both the intellectual tools and the experience they need to generate new knowledge and contribute to debates on issues as diverse as stem cell research, land management, conservation and endangered species, genetically modified organisms as well as disease management and prevention.

The program offers different learning methods: traditional classroom instruction with field trips, innovative laboratory projects using state-of-the-art technologies and a strong basic research program involving close mentoring relationships.

The major in biology introduces students to cell biology, genetics, evolution, ecology, and physiology (both plant and animal) and, in combination with another major or minor, opens the way to graduate studies or to a career in the life sciences.

The specialization in biology involves more in-depth study of the subdisciplines in biology. Students either pursue diverse areas of interest or concentrate in one of the three options (cellular and molecular biology; ecology, evolution and behaviour or physiology) with a compulsory independent research component designed to prepare for graduate studies.

The minor in biology is a flexible program that allows students to select a subset of biology courses.
**HONOURS BSc IN BIOLOGY (120 UNITS)**

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td><strong>Fall</strong></td>
<td><strong>Fall</strong></td>
<td><strong>Fall</strong></td>
</tr>
<tr>
<td>BIO1109** Principles of Biology (register to this course if 4U Biology not completed)</td>
<td>BIO1219 Ecology BIO2137 Introduction to Plant Science: Biodiversity to Biotechnology CHM2120 Organic Chemistry II MAT2379 Introduction to Biostatistics 3 elective course units**</td>
<td>3 optional course units in BIO, BPS, EVS, IT11120, BHS1320, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 6 elective course units**</td>
<td>BIO4920 Seminar I 6 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BCH3336, BCH4122, BCH4125 or BCH4188 9 elective course units**</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>MAT3330 Calculus for the Life Sciences I PHY1321 Principles of Physics I or PHY1331 Principles of Physics I (if 4U Physics not completed) 3 course units in ENG at the 1000 or 2000 level</td>
<td>3 optional course units in BIO, BPS, EVS, IT11120, BHS1320, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 6 elective course units**</td>
<td>BIO4921 Seminar II 9 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BCH3336, BCH4122, BCH4125 or BCH4188 3 elective course units**</td>
</tr>
<tr>
<td>MAT1332 Calculus for the Life Sciences II 3 elective course units**</td>
<td><strong>Winter</strong></td>
<td><strong>Winter</strong></td>
<td><strong>Winter</strong></td>
</tr>
<tr>
<td>BIO1140 Introduction to Cell Biology CHM1321 Organic Chemistry I GEO1111 Introduction to Earth Systems MAT1332 Calculus for the Life Sciences I 3 elective course units**</td>
<td>BCH2333 Introduction to Biochemistry BIO2133 Genetics BIO2135 Animal Form and Function 3 optional course units in BIO, BPS, EVS, IT11120, BHS1320, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 3 elective course units**</td>
<td>3 optional course units in BIO, BPS, EVS, IT11120, BHS1320, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 6 elective course units**</td>
<td>BIO4009 Honours Research (Fall and Winter) BIO4920 Seminar I 3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
</tr>
<tr>
<td>MAT1330 Calculus for the Life Sciences I PHY1321 Principles of Physics I or PHY1331 Principles of Physics I (if 4U Physics not completed) 3 course units in ENG at the 1000 or 2000 level</td>
<td>3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
<td>3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
<td>3 optional course units in BIO, BPS, EVS, IT11120, BHS1320, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 3 elective course units**</td>
</tr>
<tr>
<td>3 course units in ENG at the 1000 or 2000 level</td>
<td>3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
<td>6 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 9 elective course units**</td>
<td>3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
</tr>
<tr>
<td><strong>Notes</strong></td>
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<td><strong>Notes</strong></td>
</tr>
<tr>
<td><em>Minimum of 12 units at the 3000 or 4000 level with a laboratory component. These courses must be selected from the list of optional courses below.</em></td>
<td><em>This course is beyond the requirements of the programs in science.</em></td>
<td><em>Minimum of 9 units must be from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.</em></td>
<td><em>Minimum of 9 units must be from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.</em></td>
</tr>
<tr>
<td>In addition to the regular honours with specialization program, three other honours with specialization options are available: 1) Cellular and Molecular Option; 2) Ecology, Evolution and Behaviour Option; 3) Physiology Option. Please consult the relevant table for each of these options.</td>
<td><em>This course is beyond the requirements of the programs in science.</em></td>
<td>1 Minimum of 12 units at the 3000 or 4000 level with a laboratory component. These courses must be selected from the list of optional courses below.</td>
<td><em>This course is beyond the requirements of the programs in science.</em></td>
</tr>
</tbody>
</table>

**HONOURS BSc IN BIOLOGY - CELLULAR / MOLECULAR OPTION (120 UNITS)**

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
<td><strong>Fall</strong></td>
<td><strong>Fall</strong></td>
<td><strong>Fall</strong></td>
</tr>
<tr>
<td>BIO1109** Principles of Biology (register to this course if 4U Biology not completed)</td>
<td>BIO1219 Ecology BIO2137 Introduction to Plant Science: Biodiversity to Biotechnology CHM2120 Organic Chemistry II MAT2379 Introduction to Biostatistics 3 elective course units**</td>
<td>BIO3153 Cell Biology BIO3170 Molecular Biology 3 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BCH3336, BCH4122, BCH4125 or BCH4188 3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
<td>BIO4009 Honours Research (Fall and Winter) BIO4920 Seminar I 3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>MAT3330 Calculus for the Life Sciences I PHY1321 Principles of Physics I or PHY1331 Principles of Physics I (if 4U Physics not completed) 3 course units in ENG at the 1000 or 2000 level</td>
<td>6 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 9 elective course units**</td>
<td>3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
</tr>
<tr>
<td>MAT1332 Calculus for the Life Sciences I 3 elective course units**</td>
<td><strong>Winter</strong></td>
<td><strong>Winter</strong></td>
<td><strong>Winter</strong></td>
</tr>
<tr>
<td>BIO1140 Introduction to Cell Biology CHM1321 Organic Chemistry I GEO1111 Introduction to Earth Systems MAT1332 Calculus for the Life Sciences II 3 elective course units**</td>
<td>BCH2333 Introduction to Biochemistry BIO2133 Genetics BIO2135 Animal Form and Function 6 elective course units**</td>
<td>BIO3151 Molecular Biology Laboratory or BIO3152 Cell Biology Laboratory 6 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 6 elective course units**</td>
<td>BIO4009 Honours Research (Fall and Winter) BIO4921 Seminar II 9 elective course units**</td>
</tr>
<tr>
<td>MAT1333 Calculus for the Life Sciences II 3 elective course units**</td>
<td>6 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 9 elective course units**</td>
<td>6 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 9 elective course units**</td>
<td>3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
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<tr>
<td>3 course units in ENG at the 1000 or 2000 level</td>
<td>3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
<td>6 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BHS1325, BHS1336, BCH4122, BCH4125 or BCH4188 9 elective course units**</td>
<td>3 course units from the list below** (Fall or Winter) 3 elective course units**</td>
</tr>
<tr>
<td><strong>Notes</strong></td>
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<tr>
<td><em>This course is beyond the requirements of the programs in science.</em></td>
<td><em>Minimum of 15 course units in BIO at the 3000 level or above with a lab component must be completed from this list: BIO3103, BIO3126, BIO3137, BIO3146, BIO3152, BIO3154, BIO3158, BIO3310, BIO3331, BIO3334, BIO3360, BIO3394, BIO4004, BIO4009, BIO4122, BIO4148, BIO4150, BIO4156, BIO4158, BIO4190, BIM4316, BPS4104, BPS4127.</em></td>
<td><em>Minimum of 9 units must be from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.</em></td>
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</tr>
<tr>
<td>In addition to the regular honours with specialization program, three other honours with specialization options are available: 1) Cellular and Molecular Option; 2) Ecology, Evolution and Behaviour Option; 3) Physiology Option. Please consult the relevant table for each of these options.</td>
<td><em>This course is beyond the requirements of the programs in science.</em></td>
<td>1 Minimum of 12 units at the 3000 or 4000 level with a laboratory component. These courses must be selected from the list of optional courses below.</td>
<td><em>This course is beyond the requirements of the programs in science.</em></td>
</tr>
</tbody>
</table>
### HONOURS BSc in Biology - Ecology / Evolution / Behaviour Option (120 Units)

#### 1st Year (30 units)
- **BIO1109** Principles of Biology (register to this course if 4U Biology not completed)
- **BIO1130** Introduction to Organismal Biology
- **CHM1311** Principles of Chemistry or **CHM1301** Principles of Chemistry (if 4U Chemistry not completed)
- **MAT330** Calculus for the Life Sciences I
- **PHY1321** Principles of Physics I or **PHY1331** Principles of Physics I (if 4U Physics not completed)
- 3 course units in ENG at the 1000 or 2000 level

#### 2nd Year (30 units)
- **BIO2129** Ecology
- **BIO2137** Introduction to Plant Science: Biodiversity to Biotechnology
- **CHM2120** Organic Chemistry II
- **MAT2379** Introduction to Biostatistics
  - 3 elective course units**

#### 3rd Year (30 units)
- 6 optional course units from list below (Fall or Winter)
- 3 optional course units in BIO, BPS, EVS, ITI1120, BCH3120, BCH3125, BCH3356, BCH4122, BCH4125 or BCH4188 (Fall or Winter)
- 6 elective course units**

#### 4th Year (30 units)
- **BIO4009** Honours Research (Fall and Winter)
- **BIO4920** Seminar I
- **BIO4158** Applied Biostatistics
  - 3 optional course units in BIO, BPS, EVS, ITI1120, BCH3120, BCH3125, BCH3356, BCH4122, BCH4125 or BCH4188 (Fall or Winter)
  - 3 elective course units**

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### HONOURS BSc in Biology - Physiology Option (120 Units)

#### 1st Year (30 units)
- **BIO1109** Principles of Biology (register to this course if 4U Biology not completed)
- **BIO1130** Introduction to Organismal Biology
- **CHM1311** Principles of Chemistry or **CHM1301** Principles of Chemistry (if 4U Chemistry not completed)
- **MAT330** Calculus for the Life Sciences I
- **PHY1321** Principles of Physics I or **PHY1331** Principles of Physics I (if 4U Physics not completed)
- 3 course units in ENG at the 1000 or 2000 level

#### 2nd Year (30 units)
- **BIO2129** Ecology
- **BIO2137** Introduction to Plant Science: Biodiversity to Biotechnology
- **CHM2120** Organic Chemistry II
- **MAT2379** Introduction to Biostatistics
  - 3 elective course units**

#### 3rd Year (30 units)
- 3 course units from (Fall or Winter; may be taken in 3rd or 4th year):
  - **BIO3147** Developmental Biology
  - **BIO3152** Cell Biology Laboratory
  - **BIO3153** Cell Biology
  - **BIO3170** Molecular Biology
  - 6 or 9 course units, depending on the block chosen (Fall or Winter; may be taken in 3rd or 4th year)
  - **Block 1: Animal Physiology**
    - **BIO3137** Experiments in Animal Physiology
    - Two of the following:
      - **BIO3302** Animal Physiology II
      - **BIO3303** Animal Physiology I
      - **BIO3305** Cellular Physiology
  - **Block 2: Plant Physiology**
    - Two of the following:
      - **BIO3140** Plant Physiology and Biochemistry
      - **BIO3146** Ecophysiology of Plants
      - **BIO4140** Plant Developmental Biology (Winter)
    - 3 elective course units**

#### 4th Year (30 units)
- **BIO4009** Honours Research (Fall and Winter)
- **BIO4920** Seminar I
  - 6 course units from (Fall or Winter; may be taken in 3rd or 4th year):
    - **BCH3120** General Intermediary Metabolism
    - **BIO3140** Plant Physiology and Biochemistry
    - **BIO3146** Ecophysiology of Plants
    - **BIO3302** Animal Physiology II
    - **BIO3303** Animal Physiology I
    - **BIO3305** Cellular Physiology
    - **BIO3310** Plant Systematics and Diversity
    - **BCH3356** Plant Biochemistry and Molecular Biology
    - **BIO4122** Plant Genetics
    - **BIO4125** Plant Developmental Biology (Winter)
    - 3 elective course units**

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Notes:
- Optional courses in Ecology/Evolution/Behaviour - 12 course units from this list must be taken: BIO3102, BIO3103, BIO3115, BIO3117, BIO3119, BIO3122, BIO3146, BIO3154, BIO3176, BIO3178, BIO3360, BIO3424, BIO4010, BIO4111, BIO4122, BIO4146, BIO4148, BIO4150, BIO4156, BIO4159, BIO4162, BIO4537, BIO4551, BIO4910 | Some 3000-4000 level lecture courses are offered in alternating years with the French equivalent. | Within your program of study, you must complete a minimum of 15 course units at the 3000 or 4000 level with a laboratory component. A complete list of courses having a laboratory component can be found below. Please note: if a course listed below has already been used to fulfill a compulsory or optional requirement in your program listed above, these course units count towards this total of 15 units. | List of optional courses with a laboratory component: BIO103, BIO3126, BIO3137, BIO3152, BIO3154, BIO3156, BIO3158, BIO4109. | Some 3000-4000 level lecture courses are offered in French and English in alternating years. | **Minimum of 9 course units must be from the faculties of Arts, Education, Law, Social Science or the Telfer School of Management. | Co-operative education and the extended French stream are available with this program. | 3rd or 4th year):
  - **BIO3170** Molecular Biology
  - 6 course units from (Fall or Winter; may be taken in 3rd or 4th year):
    - **BCH3120** General Intermediary Metabolism
    - **BIO3140** Plant Physiology and Biochemistry
    - **BIO3146** Ecophysiology of Plants
    - **BIO3302** Animal Physiology II
    - **BIO3303** Animal Physiology I
    - **BIO3305** Cellular Physiology
    - **BIO3310** Plant Systematics and Diversity
    - **BCH3356** Plant Biochemistry and Molecular Biology
    - **BIO4122** Plant Genetics
    - **BIO4125** Plant Developmental Biology (Winter)
    - 3 elective course units**
## MAJOR IN BIOLOGY (60 UNITS)

<table>
<thead>
<tr>
<th>Year</th>
<th>Units</th>
<th>Courses</th>
<th>3rd Year</th>
<th>4th Year</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>(21)</td>
<td>BIO1109* Principles of Biology (register to this course if 4U Biology not completed) BIO1130 Introduction to Organismal Biology CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed) MAT1330 Calculus for the Life Sciences I</td>
<td>BIO2129 Ecology BIO2137 Introduction to Plant Science: Biodiversity to Biotechnology CHM2120 Organic Chemistry II MAT1341 Introduction to Linear Algebra or MAT2379 Introduction to Biostatistics</td>
<td>3 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BCH3356, BCH4122, BCH4125 or BCH4188</td>
<td>6 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BCH3356, BCH4122, BCH4125 or BCH4188</td>
</tr>
<tr>
<td>2nd</td>
<td>(21)</td>
<td>BIO1140 Introduction to Cell Biology CHM1321 Organic Chemistry I GEO1111 Introduction to Earth Systems MAT1332 Calculus for the Life Sciences II</td>
<td>BCH2333 Introduction to Biochemistry BIO2133 Genetics BIO2135 Animal Form and Function</td>
<td>6 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BCH3356, BCH4122, BCH4125 or BCH4188</td>
<td>3 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BCH3356, BCH4122, BCH4125 or BCH4188</td>
</tr>
</tbody>
</table>

*This course is beyond the requirements of the programs in science. Co-operative education and the extended French stream are available when taken as part of an honours degree.

## MINOR IN BIOLOGY (30 UNITS)

<table>
<thead>
<tr>
<th>Year</th>
<th>Units</th>
<th>Courses</th>
<th>3rd Year</th>
<th>4th Year</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>(6)</td>
<td>BIO1109* Principles of Biology (register to this course if 4U Biology not completed) BIO1130 Introduction to Organismal Biology</td>
<td>BIO2129 Ecology (Fall) or BIO2133 Genetics (Winter)</td>
<td>3 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BCH3356, BCH4122, BCH4125 or BCH4188</td>
<td>3 optional course units in BIO, BPS, EVS at the 3000 or 4000 level, BCH3120, BCH3125, BCH3356, BCH4122, BCH4125 or BCH4188</td>
</tr>
<tr>
<td>2nd</td>
<td>(6)</td>
<td>BIO1140 Introduction to Cell Biology</td>
<td>BIO2135 Animal Form and Function (Winter) or BIO2137 Introduction to Plant Science: Biodiversity to Biotechnology (Fall)</td>
<td>3 optional course units in BIO, BPS, EVS</td>
<td>3 optional course units in BIO, BPS, EVS</td>
</tr>
</tbody>
</table>

*This course is beyond the requirements of the programs in science.
In the biomedical science program, you have many opportunities to explore both fundamental and applied biology-based sciences. The first two years provide a background in anatomy and psychology in addition to more in-depth knowledge in basic sciences like biology, biochemistry, chemistry and mathematics. After year two, you can choose to combine additional courses in biology and biochemistry with an array of optional courses and obtain a minor in one of many arts or social sciences programs, or you can choose an option in the life sciences, such as neuroscience, cellular and molecular medicine, bioanalytical science, biostatistics and medicinal chemistry. Upon graduation, you have a background suitable for admission to various health-profession programs and to further studies and research in the broad field of health related sciences.

This program requires a higher admission average.

**BIOMEDICAL SCIENCE**

**UNDERGRADUATE STUDIES (BACHELOR)**

Honours BSc in Biomedical Science*

Options: Bioanalytical Science*, Biostatistics**, Cellular and Molecular Medicine*, Medicinal Chemistry*, Neuroscience*

*: There is no direct entry to the Co-operative Education option; however, you may apply in second year.

**GRADUATE PROGRAMS (MASTERS AND PhD)**

Master and Doctorate in allied disciplines.

**CAREER OPPORTUNITIES**

Corporate sales manager • pharmacological chemist • health policy researcher and consultant • toxicologist • microbiology quality control technologist • bioanalytical chemist • health professional programs (medicine, dentistry, pharmacy, etc.)...
**HONOURS BSc IN BIOMEDICAL SCIENCE (120 UNITS)**

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
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<th>4TH YEAR (30 units)</th>
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<tbody>
<tr>
<td>BIO1109* Principles of Biology (register to this course if 4U Biology not completed)</td>
<td>CHM2120 Organic Chemistry II</td>
<td>BIO3124 General Microbiology</td>
<td>3 optional course units at the 3000 or 4000 level offered by the Faculty of Science*</td>
</tr>
<tr>
<td>ANP1105 Human Anatomy and Physiology I</td>
<td>CHM2123 Laboratory of Organic Chemistry II</td>
<td>BIO3170 Molecular Biology</td>
<td>9 elective course units</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology</td>
<td>MAT2379 Introduction to Biostatistics</td>
<td>BCH3356 Molecular Biology Laboratory</td>
<td>3 optional course units offered by the Faculty of Science*</td>
</tr>
<tr>
<td>CHM1311 Principles of Chemistry or</td>
<td>PHH2396 Bioethics</td>
<td>(Fall)</td>
<td>3 elective course units</td>
</tr>
<tr>
<td>CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>PSY1102** Introduction to Psychology: Applications or</td>
<td>or</td>
<td></td>
</tr>
<tr>
<td>MAT1330 Calculus for the Life Sciences I</td>
<td>PSS2114 Lifespan Psychology (Fall or Winter)</td>
<td>PSY1102 Introduction to Biopharmaceutical Sciences (Fall)</td>
<td></td>
</tr>
<tr>
<td>PSY1101 Introduction to Psychology: Foundations</td>
<td>3 optional course units offered from #:</td>
<td>PHY1321 Principles of Physics I (Fall)</td>
<td></td>
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<tr>
<td></td>
<td>or</td>
<td>PHY1322 Principles of Physics II (Winter)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes**
- *This course is beyond the requirements of the programs in science.
- **Students who consider the possibility of joining the Neuroscience Option should choose PSY1102 as this course is a prerequisite for 3rd year courses in Psychology –
- *This course is beyond the requirements of the programs in science.
- **List of optional courses: BCH4123, BCH4172, BIM4103, BIO4158, BPS4102, BPS4103, BPS4127, BPS4129, BPS4131, CHM4139, MAT3377

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**HONOURS BSc IN BIOMEDICAL SCIENCE - BIOANALYTICAL SCIENCE OPTION (120 UNITS)**

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
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<tbody>
<tr>
<td>BIO1109* Principles of Biology (register to this course if 4U Biology not completed)</td>
<td>CHM2120 Organic Chemistry II</td>
<td>BIO3170 Molecular Biology</td>
<td>3 optional course units at the 3000 or 4000 level offered by the Faculty of Science*</td>
</tr>
<tr>
<td>ANP1105 Human Anatomy and Physiology I</td>
<td>CHM2123 Laboratory of Organic Chemistry II</td>
<td>BCH3356 Molecular Biology Laboratory</td>
<td>9 elective course units</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology</td>
<td>MAT2379 Introduction to Biostatistics</td>
<td>(Fall)</td>
<td>3 elective course units</td>
</tr>
<tr>
<td>CHM1311 Principles of Chemistry or</td>
<td>PHH2396 Bioethics</td>
<td>or</td>
<td></td>
</tr>
<tr>
<td>CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>PSY1102** Introduction to Psychology: Applications or</td>
<td>PSY1102 Introduction to Biopharmaceutical Sciences (Fall)</td>
<td></td>
</tr>
<tr>
<td>MAT1330 Calculus for the Life Sciences I</td>
<td>PSS2114 Lifespan Psychology (Fall or Winter)</td>
<td>PHY1321 Principles of Physics I (Fall)</td>
<td></td>
</tr>
<tr>
<td>PSY1101 Introduction to Psychology: Foundations</td>
<td>3 optional course units offered from #:</td>
<td>PHY1322 Principles of Physics II (Winter)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or</td>
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</tbody>
</table>

**Notes**
- *This course is beyond the requirements of the programs in science.
- **List of optional courses: BCH4123, BCH4172, BIM4103, BIO4158, BPS4102, BPS4103, BPS4127, BPS4129, BPS4131, CHM4139, MAT3377

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**Biomedical Science** 25
### HONOURS BSc IN BIOMEDICAL SCIENCE - BIOSTATISTICS OPTION (120 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO1109 Principles of Biology (register to this course if 4U Biology not completed)</td>
<td>CHM2120 Organic Chemistry II</td>
<td>BIO3170 Molecular Biology</td>
<td>BIM4009 Research Project- Biomedical Science (Fall and Winter) or BPS4127 Advanced Techniques in Biosciences and 6 optional course units at the 3000 or 4000 level from the list of optional courses1</td>
</tr>
<tr>
<td>ANP1105 Human Anatomy and Physiology I</td>
<td>MAT2379 Introduction to Biostatistics</td>
<td>BCH3356 Molecular Biology Laboratory (Fall)</td>
<td>BIM4920 Seminar I</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology</td>
<td>PH2396 Bioethics</td>
<td>or BIO3151 Molecular Biology Laboratory (Winter)</td>
<td>BIO4158 Applied Biostatistics or MAT4374 Modern Computational Statistics</td>
</tr>
<tr>
<td>CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>PHY1321 Principles of Physics I or PHY1331 Principles of Physics I (if 4U Physics not completed)</td>
<td>MAT3377** Sampling and Surveys</td>
<td>MAT3375** Regression Analysis</td>
</tr>
<tr>
<td>MAT1330 Calculus for the Life Sciences I</td>
<td>3 elective course units</td>
<td>PSY1102 Introduction to Psychology: Applications or PSY2114 Lifespan Psychology (Fall or Winter)</td>
<td>3 optional course units from the list below1</td>
</tr>
<tr>
<td>PSY1101 Introduction to Psychology: Foundations (Fall or Winter)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes** *This course is beyond the requirements of the programs in science. | **Courses are offered in alternating years with the French equivalent. | 1List of optional courses: BIM4316, BIO3102, BIO3160, BPS3101, BPS4104, BPS4127, CHM2354, MAT4375, MAT4377, MAT4378 | Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. | Co-operative education and the extended French stream are available with this program.

### HONOURS BSc IN BIOMEDICAL SCIENCE - CELLULAR AND MOLECULAR MÉDECINE OPTION (120 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO1109 Principles of Biology (register to this course if 4U Biology not completed)</td>
<td>CHM2120 Organic Chemistry II</td>
<td>BIO3153 Cell Biology</td>
<td>BIM4009 Research Project- Biomedical Science (Fall and Winter) or 9 optional course units at the 3000 or 4000 level from the list of optional courses1</td>
</tr>
<tr>
<td>ANP1105 Human Anatomy and Physiology I</td>
<td>MAT2379 Introduction to Biostatistics</td>
<td>BIO3170 Molecular Biology</td>
<td>BIM4920 Seminar I</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology</td>
<td>PH2396 Bioethics</td>
<td>BCH3356 Molecular Biology Laboratory</td>
<td>BIO3124 General Microbiology</td>
</tr>
<tr>
<td>CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>PHY1321 Principles of Physics I or PHY1331 Principles of Physics II (Fall or Winter)</td>
<td>MAT3377** Sampling and Surveys</td>
<td>3 optional course units from the list below2</td>
</tr>
<tr>
<td>MAT1330 Calculus for the Life Sciences I</td>
<td>3 elective course units</td>
<td>BPS3341 Physiology of Sensation, Regulation, Movement and Reproduction</td>
<td>3 optional course units from: BIO3360 Computational Tools for Biological Sciences (Winter)</td>
</tr>
<tr>
<td>PSY1101 Introduction to Psychology: Foundations (Fall or Winter)</td>
<td></td>
<td>3 elective course units</td>
<td>BIO4158 Applied Biostatistics (Fall)</td>
</tr>
</tbody>
</table>

**Notes** *This course is beyond the requirements of the programs in science. | A student doing an option should choose a course that is not mandatory for their selected option. | 1List of optional courses: BCH3125, BCH/BPS4101, BCH4122, BOC4123, BCH4125, BCH4188, BIM4103, BIM4316, BIO3102, BIO3160, BOC4158, BPS3101, BPS4104, BPS4105, BPS4127, BPS4129, BPS5131, CHM5304, PHS4336 | Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. | Co-operative education and the extended French stream are available with this program.
**HONOURS BSc IN BIOMEDICAL SCIENCE - MEDICINAL CHEMISTRY OPTION (120 UNITS)**

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
</tr>
<tr>
<td>ANP1106 Human Anatomy and Physiology II</td>
<td>BCH2333 Introduction to Biochemistry</td>
<td>BIO3120 General Intermediary Metabolism</td>
<td>BIM4009 Research Project - Biomedical Science (Fall and Winter)</td>
</tr>
<tr>
<td>BIO1109 Principles of Biology</td>
<td>BIO2133 Genetics</td>
<td>BIO2131 Introduction to Structure and Bonding</td>
<td>or 6 optional course units at the 3000 or 4000 level from the list below1 and 3 course units from:</td>
</tr>
<tr>
<td>and Physiology I</td>
<td>PSY1102 Introduction to Psychology: Applications</td>
<td>CHM2111 Introduction to Structure and Bonding</td>
<td>BIM4316 Modern Bioanalytical Chemistry (Winter)</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology</td>
<td>6 elective course units</td>
<td>CHM2354 Analytical Chemistry</td>
<td>BPS4126 Synthetic and Medicinal Chemistry Laboratory (Winter)</td>
</tr>
<tr>
<td>CHM1311 Principles of Chemistry</td>
<td>3 elective course units</td>
<td>CHM3126 Laboratory of Organic Chemistry</td>
<td>BIM4920 Seminar I</td>
</tr>
<tr>
<td>or CHM1301 Principles of Chemistry</td>
<td>3 elective course units</td>
<td>3 optional course units from the list of optional courses at the 3000 or 4000 level</td>
<td>CHM4123 Medicinal Chemistry</td>
</tr>
<tr>
<td>(if 4U Chemistry not completed)</td>
<td>3 elective course units</td>
<td>3 optional course units offered by the Faculty of Science</td>
<td>3 elective course units</td>
</tr>
<tr>
<td>MAT1330 Calculus for the Life Sciences I</td>
<td>6 elective course units</td>
<td>3 elective course units at the 3000 or 4000 level</td>
<td></td>
</tr>
<tr>
<td>PSY1101 Introduction to Psychology: Foundations (Fall or Winter)</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
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<tr>
<td>CHM2120 Organic Chemistry II</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>or PH2396 Bioethics</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>PSY1102** Introduction to Psychology: Applications</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
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<tr>
<td>or PSY2114 Lifespan Psychology (Fall or Winter)</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>3 optional course units in ENG at the 1000 or 2000 level, excluding ENG1112 and ENG1131</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
</tbody>
</table>

**Notes**:  
1. This course is beyond the requirements of the programs in science.  
2. **Students who consider the possibility of joining the Neuroscience Option should choose PSY1102 as this course is a prerequisite for 3rd year courses in Psychology – PSY3128 and PSY3171 - that are mandatory for the option.**  
3. List of optional courses: ANP1107, BCH1312, BCH4101 or BPS4101, B14122, BCH4125, BCH4188, BM1410, BM3140, B132135, B13137, B13147, B13152, B13360, B14158, BP13101, BP14101, BP34105, BP4127, BP4131, PHS3341, PHS342 | Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Science or the Telfer School of Management. | Co-operative education and the extended French stream are available with this program.

**HONOURS BSc IN BIOMEDICAL SCIENCE - NEUROSCIENCE OPTION (120 UNITS)**

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
</tr>
<tr>
<td>BIO1109 Principles of Biology</td>
<td>BCH2333 Introduction to Biochemistry</td>
<td>BCH3120 General Intermediary Metabolism</td>
<td>BIM4009 Research Project - Biomedical Science (Fall and Winter)</td>
</tr>
<tr>
<td>and Physiology I</td>
<td>BIO2133 Genetics</td>
<td>BIO4109 Principles of Neurobiology</td>
<td>or 6 optional course units at the 3000 or 4000 level from the list below1 and 3 course units from:</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology</td>
<td>PSY1102 Introduction to Psychology: Applications</td>
<td>BIO3303 Animal Physiology II</td>
<td>BIM4316 Modern Bioanalytical Chemistry (Winter)</td>
</tr>
<tr>
<td>CHM1311 Principles of Chemistry</td>
<td>3 elective course units</td>
<td>PSY1102 Introduction to Psychology: Applications</td>
<td>BPS4126 Synthetic and Medicinal Chemistry Laboratory (Winter)</td>
</tr>
<tr>
<td>or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td>BIM4921 Seminar II</td>
</tr>
<tr>
<td>MAT1330 Calculus for the Life Sciences I</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td>PHI4107 Introductory Pharmacology - Drugs and Living Systems</td>
</tr>
<tr>
<td>PSY1101 Introduction to Psychology: Foundations (Fall or Winter)</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td>3 optional course units at the 3000 or 4000 level offered by the Faculty of Science</td>
</tr>
<tr>
<td>CHM2120 Organic Chemistry II</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
</tr>
<tr>
<td>or PH2396 Bioethics</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>PSY1102** Introduction to Psychology: Applications</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>or PSY2114 Lifespan Psychology (Fall or Winter)</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>3 optional course units in ENG at the 1000 or 2000 level, excluding ENG1112 and ENG1131</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>BIO1109* Principles of Biology (register to this course if 4U Biology not completed)</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>ANP1106 Human Anatomy and Physiology II</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>BIO1140 Introduction to Cell Biology</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>CHM1321 Organic Chemistry I</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>MAT1332 Calculus for the Life Sciences II</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
<tr>
<td>3 optional course units in ENG at the 1000 or 2000 level, excluding ENG1112 and ENG1131</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
<td></td>
</tr>
</tbody>
</table>

**Notes**:  
1. **This course is beyond the requirements of the programs in science.**  
2. List of optional courses: BCH4123, BM4103, BM4116, BPS3350, BPS4103, BPS4105, BPS4127, BPS4126, BPS4129, BPS4131, CHM4130, CHM4141, CHM4176, CHM4319, CHM4354 | Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Science or the Telfer School of Management. | Co-operative education and the extended French stream are available with this program.

Biomedical Science 27
BIOPHARMACEUTICAL SCIENCE

This interdisciplinary program, offered through the Department of Chemistry and Biomolecular Sciences, combines basic studies from areas such as molecular biology, biochemistry, pharmacology and organic chemistry and adds new courses designed especially for biopharmaceutical science students.

The goal is to prepare students who, with further specialization, will be ready to work in an interdisciplinary environment at the interfaces between biology, chemistry and health-related sciences.

Students must choose among two options: genomics (for students interested in the genetic and biological aspects of the field) and medicinal chemistry (for those fascinated by organic and biological chemistry). Genomics focuses on molecular biology and the function of genes and proteins in the study of diseases. Medicinal chemistry emphasizes organic and biological chemistry and their application to the production of new and better pharmaceuticals.

Graduates from both streams are well positioned to enter all sectors of the growing health sector, from biomedical research and biopharmaceuticals development to drug manufacturing and regulation. They also meet all the requirements for entry into professional programs such as medicine, law, education and administration.

UNDERGRADUATE STUDIES (BACHELOR)

Honours BSc in Biopharmaceutical Science

Options: Genomics, Medicinal Chemistry

*: Cooperative education is offered as part of four-year honours bachelor degrees.

GRADUATE PROGRAMS (MASTERS AND PhD)

Master and Doctorate in allied disciplines.

CAREER OPPORTUNITIES

Pharmaceutical bacteriologist • pharmacological chemist • bioinformatician • toxicologist • pharmaceutical sales representative • bioanalytical chemist...
### HONOURS BSc IN BIOPHARMACEUTICAL SCIENCE - GENOMICS OPTION (120 UNITS)

#### 1ST YEAR (30 units)
- **FALL**
  - BIO1109 Principles of Biology (register for this course if 4U Biology not completed)
  - BIO1130 Introduction to Organismal Biology
  - CHM1311 Principles of Chemistry
  - CHM1301 Principles of Chemistry
  - MAT1330 Calculus for the Life Sciences I
  - PHY1321 Principles of Physics I
  - PHY1331 Principles of Physics II
  - 3 course units in ENG at the 1000 or 2000 level

#### 2ND YEAR (30 units)
- **FALL**
  - BPS2110 Introduction to Biopharmaceutical Sciences
  - CHM2120 Organic Chemistry II
  - CHM2132 Laboratory of Organic Chemistry II
  - CHM2132 Physical Chemistry for the Life Sciences
  - MAT2379 Introduction to Biostatistics

#### 3RD YEAR (30 units)
- **FALL**
  - BIO3119 Population Genetics
  - BIO3170 Molecular Biology
  - BPS3101 Genomics
  - BCH3356 Molecular Biology Laboratory (Fall)
  - or
  - BIO3151 Molecular Biology Laboratory (Winter)
  - 3 optional course units from the Genomics list below

#### 4TH YEAR (30 units)
- **FALL**
  - BPS40062 Honours Project (Fall and Winter)
  - BPS4900 Seminar (Fall and Winter)
  - or
  - BPS4127 Advanced Techniques in Biosciences (Fall) with 6 optional course units at the 3000 or 4000 level offered by the Faculty of Science (Fall or Winter)
  - BPS4101 Human Genome Structure and Function (Winter)
  - BPS4104 Bioinformatics Laboratory (Winter)
  - PHA4107 Introductory Pharmacology — Drugs and Living Systems (Winter)
  - 3 optional course units at the 3000 or 4000 level offered by the Faculty of Science (Fall or Winter)
  - 3 elective course units (Fall or Winter)
  - 3 optional course units from the Genomics list below

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### HONOURS BSc IN BIOPHARMACEUTICAL SCIENCE - MEDICINAL CHEMISTRY OPTION (120 UNITS)

#### 1ST YEAR (30 units)
- **FALL**
  - BIO1109 Principles of Biology (register for this course if 4U Biology not completed)
  - BIO1130 Introduction to Organismal Biology
  - CHM1311 Principles of Chemistry
  - CHM1301 Principles of Chemistry
  - MAT1330 Calculus for the Life Sciences I
  - PHY1321 Principles of Physics I
  - PHY1331 Principles of Physics II
  - GEO1111 Introduction to Earth Systems
  - 3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management

#### 2ND YEAR (30 units)
- **FALL**
  - BCH2333 Introduction to Biochemistry
  - BIO2133 Genetics
  - PH2396 Bioethics
  - 3 elective course units
  - 3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management

#### 3RD YEAR (30 units)
- **FALL**
  - BIO3170 Molecular Biology
  - BCH3356 Molecular Biology Laboratory (Fall)
  - or
  - BIO3151 Molecular Biology Laboratory (Winter)
  - 3 optional course units from the Medicinal Chemistry list below

#### 4TH YEAR (30 units)
- **FALL**
  - BPS40062 Honours Project (Fall and Winter)
  - BPS4900 Seminar (Fall and Winter)
  - or
  - BPS4126 Synthetic and Medicinal Chemistry Laboratory (Winter) with 6 optional course units from the Medicinal Chemistry list below
  - CHM3354 Principles of Instrumental Analysis (Winter)
  - or
  - BIM4316 Modern Bioanalytical Chemistry (Winter)
  - BPS4125 Medicinal Chemistry (Fall)
  - PHA4107 Introductory Pharmacology — Drugs and Living Systems (Winter)
  - 3 optional course units at the 3000 or 4000 level offered by the Faculty of Science
  - 6 optional course units from the Medicinal Chemistry list below (Fall or Winter)

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**Notes**
- *This course is beyond the requirements of the programs in science.*
- *For students intending to pursue graduate studies in Chemistry, it is highly recommended to take 6 course units in CHM from the optional courses list in Medicinal Chemistry.*
- *BPS4006 is highly recommended.*
- *List of optional courses in Medicinal Chemistry — BCH3125, BM4316, BPS3350, BPS4103, BPS4111, BPS4121, BPS4126, BPS4129, BPS4131, CHM3350, CHM4319, CHM4414, CHM4415, CHM4317, CHM4341, CHM4435, CHM4328, CHM4345 | Co-operative education and the extended French stream are available with this program.*

### Biopharmaceutical Science

29
UNDERGRADUATE STUDIES (BACHELOR)

Honours BSc in Chemistry

Options: Advanced Materials, Ecochemistry

Major in Chemistry

Minor in Chemistry

*: Cooperative education is offered as part of four-year honours bachelor degrees.

**: Complementary program offered only as a second discipline. Registration starts in second year.

GRADUATE PROGRAMS (MASTERS AND PhD)

Master of Science (MSc)

Doctorate (PhD)

CAREER OPPORTUNITIES

Medical isotope preparation technician • pharmaceutical chemist • materials chemist • instrument technician (such as mass spectrometrist) • material and chemical reaction modeller • environmental analytical chemist or consultant • police and border services forensic chemist • safety evaluator for food pesticides and additives • patent law • researcher...

CHEMISTRY

Chemistry is a modern, dynamic and diverse field that involves investigating the substances that makes up our physical world and how these substances change. Chemistry touches everything we come into contact with. As a result, it is a field with connections to almost all other areas of science and engineering. For example, chemists play a vital role in developing new drugs and materials for advanced electronic devices. Chemists are also important players in such diverse areas as genetic engineering, forensic science and the oil and gas industry. More recently, chemists have been at the forefront of the nanotechnology field and emerging green technologies, particularly in the development of sustainable energy sources.

The Department of Chemistry and Biomolecular Sciences offers modern programs that provide advanced training in the traditional areas of chemistry, such as organic, inorganic, physical, computational and analytical chemistry. The Department also offers unique options in Advanced Materials and Ecochemistry. In addition to incorporating classroom teaching, programs offer practical laboratory training, with a focus on individual instruction.
### HONOURS BSc IN CHEMISTRY (120 UNITS)

#### 1ST YEAR (30 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM1311</td>
<td>Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
</tr>
<tr>
<td>MAT1320 Calculus I</td>
<td></td>
</tr>
<tr>
<td>PHY1121</td>
<td>Fundamentals of Physics I</td>
</tr>
<tr>
<td>CHM1321</td>
<td>Organic Chemistry I</td>
</tr>
<tr>
<td>MAT1322</td>
<td>Calculus II</td>
</tr>
<tr>
<td>PHY1122</td>
<td>Fundamentals of Physics II</td>
</tr>
<tr>
<td>CHM3123</td>
<td>Organic Chemistry II</td>
</tr>
<tr>
<td>PHY1123</td>
<td>Principles of Physics I (if 4U Physics not completed)</td>
</tr>
<tr>
<td>CHM3124</td>
<td>Organic Chemistry III</td>
</tr>
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</table>

#### 2ND YEAR (30 units)

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM3131</td>
<td>Principles of Chemistry II</td>
</tr>
<tr>
<td>CHM2123</td>
<td>Laboratory of Organic Chemistry II</td>
</tr>
<tr>
<td>CHM2131</td>
<td>Chemical Thermodynamics of Gases and Solutions</td>
</tr>
<tr>
<td>CHM2335</td>
<td>Descriptive Inorganic Chemistry</td>
</tr>
<tr>
<td>BCH2333</td>
<td>Introduction to Biochemistry</td>
</tr>
<tr>
<td>CHM2330</td>
<td>Physical Chemistry: Introduction to the Molecular Properties of Matter</td>
</tr>
<tr>
<td>CHM2354</td>
<td>Analytical Chemistry</td>
</tr>
<tr>
<td>PHY2100</td>
<td>Fundamentals of Applied Physics III</td>
</tr>
<tr>
<td>CHM3133</td>
<td>Molecular Spectroscopy and Statistical Mechanics</td>
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</tbody>
</table>

#### 3RD YEAR (30 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM3134</td>
<td>Principles of Chemistry III</td>
</tr>
<tr>
<td>CHM3132</td>
<td>Applications of Spectroscopy in Chemistry</td>
</tr>
<tr>
<td>CHM3142</td>
<td>Quantum Chemistry and Molecular Modelling</td>
</tr>
<tr>
<td>CHM3350</td>
<td>Transition Metal Chemistry</td>
</tr>
<tr>
<td>CHM3135</td>
<td>Principles of Instrumental Analysis (Fall or Winter)</td>
</tr>
<tr>
<td>CHM3136</td>
<td>Principles of Organic Chemistry (Fall or Winter)</td>
</tr>
</tbody>
</table>

#### 4TH YEAR (30 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM4010</td>
<td>Research Project and Seminar (Fall and Winter)</td>
</tr>
<tr>
<td>CHM4011</td>
<td>Principles of Inorganic Chemistry</td>
</tr>
<tr>
<td>CHM4129</td>
<td>Chemistry of Sustainable Energy</td>
</tr>
<tr>
<td>CHM4130</td>
<td>Principles of Physical – Theoretical Chemistry</td>
</tr>
</tbody>
</table>

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#### Notes

- *Students in the cooperative education option must replace CHM4010 with CHM4016 Research project (6 course units) plus 3 course units in CHM at the 3000 or 4000 level.
- Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.
- Co-operative education and the extended French stream are available with this program.

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### HONOURS BSc IN CHEMISTRY - ADVANCED MATERIALS OPTION (120 UNITS)

#### 1ST YEAR (30 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM1311</td>
<td>Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
</tr>
<tr>
<td>GEO1115</td>
<td>Introduction to Earth Materials</td>
</tr>
<tr>
<td>CHM1321</td>
<td>Organic Chemistry I</td>
</tr>
<tr>
<td>PHY1121</td>
<td>Fundamentals of Physics I</td>
</tr>
<tr>
<td>CHM1322</td>
<td>Principles of Physics II (if 4U Physics not completed)</td>
</tr>
<tr>
<td>CHM1323</td>
<td>Principles of Physics III (if 4U Physics not completed)</td>
</tr>
</tbody>
</table>

#### 2ND YEAR (30 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM2120</td>
<td>Organic Chemistry II</td>
</tr>
<tr>
<td>CHM2123</td>
<td>Laboratory of Organic Chemistry II</td>
</tr>
<tr>
<td>CHM2131</td>
<td>Chemical Thermodynamics of Gases and Solutions</td>
</tr>
<tr>
<td>CHM2335</td>
<td>Descriptive Inorganic Chemistry</td>
</tr>
<tr>
<td>BCH2333</td>
<td>Introduction to Biochemistry</td>
</tr>
<tr>
<td>CHM2330</td>
<td>Physical Chemistry: Introduction to the Molecular Properties of Matter</td>
</tr>
<tr>
<td>CHM2354</td>
<td>Analytical Chemistry</td>
</tr>
<tr>
<td>PHY2100</td>
<td>Fundamentals of Applied Physics III</td>
</tr>
<tr>
<td>CHM3133</td>
<td>Molecular Spectroscopy and Statistical Mechanics</td>
</tr>
</tbody>
</table>

#### 3RD YEAR (30 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM3134</td>
<td>Principles of Chemistry III</td>
</tr>
<tr>
<td>CHM3132</td>
<td>Applications of Spectroscopy in Chemistry</td>
</tr>
<tr>
<td>CHM3142</td>
<td>Quantum Chemistry and Molecular Modelling</td>
</tr>
<tr>
<td>CHM3350</td>
<td>Transition Metal Chemistry</td>
</tr>
<tr>
<td>CHM3135</td>
<td>Principles of Instrumental Analysis (Fall or Winter)</td>
</tr>
<tr>
<td>CHM3136</td>
<td>Principles of Organic Chemistry (Fall or Winter)</td>
</tr>
</tbody>
</table>

#### 4TH YEAR (30 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM4010</td>
<td>Research Project and Seminar (Fall and Winter)</td>
</tr>
<tr>
<td>CHM4011</td>
<td>Principles of Inorganic Chemistry</td>
</tr>
<tr>
<td>CHM4129</td>
<td>Chemistry of Sustainable Energy</td>
</tr>
<tr>
<td>CHM4130</td>
<td>Principles of Physical – Theoretical Chemistry</td>
</tr>
</tbody>
</table>

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#### Notes

- *A project related to Advanced Materials is strongly recommended.
- Although the program is well suited for future graduate work, for students intending to pursue graduate studies in Chemistry, it is highly recommended to take six of their elective units from the list of CHM courses in their area of interest at the 4000 level.
- *12 units from the following list must be completed (a minimum of 6 course units must be in CHM at the 3000 or 4000 level): BCH2333, CHM1326, CHM4123, CHM4141, CHM4143, CHM4155, CHM4182, CHM4111, CHM4133, CHM4327, CHM4325, CHM3440, CHM3881, GEO2164, GEO3167, MAT1341, PHY2100 or PHY2323, PHY2361, PHY3350, PHY4382, PHY4387.
- *Students in the cooperative education option must replace CHM4010 with CHM4016 Research project (6 course units) plus 3 course units in CHM at the 3000 or 4000 level.
- Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.
- Co-operative education and the extended French stream are available with this program.
### MAJOR IN CHEMISTRY (60 UNITS)

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>Courses</th>
</tr>
</thead>
</table>
| 1st | Winter  | CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)  
MAT1320 Calculus I  
PHY1121 Fundamentals of Physics I  
or  
PHY1311 Principles of Physics I (if 4U Physics not completed) |
| 1st | Fall     | BIO1109** Principles of Biology (register to this course if 4U Biology not completed)  
BIO1130 Introduction to Organismal Biology  
CHM1311 Principles of Chemistry  
or  
CHM1301 Principles of Chemistry (if 4U Chemistry not completed) |
| 2nd | Winter   | CHM2120 Organic Chemistry II  
CHM2123 Laboratory of Organic Chemistry II  
CHM2131 Chemical Thermodynamics of Gases and Solutions  
CHM2335 Descriptive Inorganic Chemistry |
| 2nd | Fall     | BIO2129 Ecology  
CHM2120 Organic Chemistry II  
CHM2123 Laboratory of Organic Chemistry II  
CHM2131 Chemical Thermodynamics of Gases and Solutions  
CHM2335 Descriptive Inorganic Chemistry |
| 3rd | Winter   | CHM2333 Environmental Chemistry  
CHM2330 Physical Chemistry: Introduction to the Molecular Properties of Matter  
CHM2354 Analytical Chemistry  
6 elective course units |
| 3rd | Fall     | CHM2120 Intermediate Organic Chemistry  
CHM3122 Applications of Spectroscopy in Chemistry  
CHM3350 Transition Metal Chemistry  
3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. Some of them may come from those listed below.  
3 optional course units of CHM at the 2000, 3000 or 4000 level |
| 4th | Winter   | CHM3129 Catalysis and Sustainable Synthesis  
3 optional course units in CHM at the 3000 or 4000 level from the list below  
3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. Some of them may come from those listed below.  
3 elective course units |
| 4th | Fall     | CHM4129 Chemistry of Sustainable Energy  
CHM3354 Principles of Instrumental Analysis  
3 optional course units from the list below  
3 elective course units |

**Notes:**  
1. A project related to ecochemistry is strongly recommended.  
2. Although the program is well suited for future graduate work, for students intending to pursue graduate studies in Chemistry, it is highly recommended to take six of their elective units from the list of CHM courses in their area of interest at the 4000 level.  
3. 12 units from the following list must be completed (minimum of 6 units must be CHM at the 3000 or 4000 level): BCH2333, BIO1140, BIO1317, BIO4101, BIO4146, BPS412, BPS4122, CHM1340, CHM1337, CHM1412, CHM1439, CHM4106, CHM4107, CHM4108, CHM4111, CHM4117, CHM4125, CHM4350, CHM4380, CHM4413, CHM4512, CHM1232, CHM205, CHM2125, DH1191, DVM101, ENS101, GSC301, GSC302, GSC4116, GSC4116, GSC4117, GSC412, GSC4156, GSC4166, GSC4176, GSC4186, GSC4196, GSC4212, GSC4312, GSC4334, GSC4334, GSC4342, GSC4342, HS2319, HS2379, PL1102, SOC4310  
4. Students in the cooperative education option must replace CHM4010 with: CHM4016 Research Project (6 course units) plus 3 course units in CHM at the 3000 or 4000 level.  
5. **This course is beyond the requirements of the programs in science.** Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.  
6. A co-operative education option and the extended French stream are available when taken as part of an honours degree.
ENVIRONMENTAL SCIENCE

Environmental science (EVS) is the interdisciplinary study of the environment, its functioning and its relationship to human activities. Society has a growing need for specialists able to recognize, understand, solve and prevent environmental problems.

The environmental science program, offered through the Department of Earth and Environmental Sciences, focuses on the integration of traditional science disciplines (e.g. biology, earth sciences, chemistry, physics) to study the natural environment and the impact of human activities. The program consists of a core of basic science courses complemented by courses in various disciplines that address the scientific and societal aspects of environmental problems. Within this program, you must select among three areas of specialization: conservation and biodiversity; global change; and environmental geochemistry and ecotoxicology. The final year entails an independent research project or equivalent units in advanced courses in the student’s specialization.

The EVS program is accredited by ECO Canada, the national organization whose mission is to promote the competence and the excellence of academic programs, the environmental careers, and recognition of the professional expertise of environment workers. “ECO Canada provides resources to help individuals learn about, train for, and find environmental careers.” This additional asset to the EVS program will help you plan an exciting career after your graduation.

UNDERGRADUATE STUDIES (BACHELOR)
Honours BSc in Environmental Science
Options: Conservation and Biodiversity, Environmental Geochemistry and Ecotoxicology, Global Change

GRADUATE PROGRAMS (MASTERS AND PhD)
Master and Doctorate in allied disciplines.

CAREER OPPORTUNITIES
Environmental consultant or impact analyst • environmental program development supervisor • researcher • natural resource planner or policy analyst • conservation biologist • water quality specialist...
## Honours BSc in Environmental Science - Conservation and Biodiversity Option (120 Units)

### 1st Year (30 units)
- **Fall**
  - BIOS109 Principles of Biology (register for this course if 4U Biology not completed)
  - BIOS110 Introduction to Organismal Biology
  - CHM131I Principles of Chemistry
  - CHM130I Principles of Chemistry (if 4U Chemistry not completed)
  - GEO1115 Introduction to Earth Materials
  - MAT1330 Calculus for the Life Sciences I
  - PHY1321 Principles of Physics I or PHY1331 Principles of Physics II (if 4U Physics not completed)

### 2nd Year (30 units)
- **Fall**
  - BIOS2129 Ecology
  - CHM2353 Descriptive Inorganic Chemistry
  - MAT2379 Introduction to Biostatistics

### 3rd Year (30 units)
- **Fall**
  - EVS3101 Environmental Issues
  - EVS3120 Environmental Microbiology
  - GEO3342** Introduction to Hydrogeology (to be taken in 3rd or 4th year)

### 4th Year (30 units)
- **Fall**
  - EVS4904 Seminar (Fall or Winter)

### Notes
- *This course is beyond the requirements of the programs in science.*
- Optional courses offered by the faculties of Science, Engineering, or the Department of Geography (GEG): BCH2333, BIO3124, BIO3154, BIO3158, BIO3176, BIO3333, BIO3354, BIO3924, BIO4101, BIO4162, BPS3502, CHG4811, CHM2121, CHM2123, CHM3120, CHM3126, CMH4155, CMH4156, CVG2121, DMN2105, DMN3125, DMN3135, GEE3306, GEO4104, GEO4118, GEO4120, GEO4121, GEO2166*, GEO4141, GEO4142, GEO4154, GEO4152, MAT3177
- **These courses are offered in alternating years with the French equivalent.**

## Honours BSc in Environmental Science - Environmental Geochemistry and Ecotoxicology Option (120 Units)

### 1st Year (30 units)
- **Fall**
  - BIOS109 Principles of Biology (register for this course if 4U Biology not completed)
  - BIOS110 Introduction to Organismal Biology
  - CHM131I Principles of Chemistry
  - CHM130I Principles of Chemistry (if 4U Chemistry not completed)
  - GEO1115 Introduction to Earth Materials
  - MAT1330 Calculus for the Life Sciences I
  - PHY1321 Principles of Physics I or PHY1331 Principles of Physics II (if 4U Physics not completed)

### 2nd Year (30 units)
- **Fall**
  - CHM2313** Environmental Chemistry (to be taken in 2nd or 3rd year)
  - CHM2354 Analytical Chemistry
  - GEO1111 Introduction to Earth Systems
  - MAT1332 Calculus for the Life Sciences II

### 3rd Year (30 units)
- **Fall**
  - BIOS2129 Ecology
  - CHM2353 Descriptive Inorganic Chemistry
  - MAT2379 Introduction to Biostatistics

### 4th Year (30 units)
- **Fall**
  - BIO4158 Applied Biostatistics (Fall) or GEO3352** Geological Data Analysis (Winter) (to be taken in 3rd or 4th year)

### Notes
- *This course is beyond the requirements of the programs in science.*
- **These courses are offered in alternating years with the French equivalent.**
- Optional courses offered by the Faculty of Science, the Faculty of Engineering, or the Department of Geography (GEG): BCH2333, BIO3124, BIO3154, BIO3158, BIO3176, BIO3333, BIO3354, BIO3924, BIO4101, BIO4162, BPS3502, CHG4811, CHM2121, CHM2123, CHM3120, CHM3126, CMH4155, CMH4156, CVG2121, DMN2105, DMN3125, DMN3135, GEE3306, GEO4104, GEO4118, GEO4120, GEO4121, GEO2166*, GEO4141, GEO4142, GEO4154, GEO4152, MAT3177
- Co-operative education and the extended French stream are available with this program.
# HONOURS BSc in Environmental Science - Global Change Option (120 units)

<table>
<thead>
<tr>
<th>1st Year (30 units)</th>
<th>2nd Year (30 units)</th>
<th>3rd Year (30 units)</th>
<th>4th Year (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1ST YEAR</strong></td>
<td><strong>2ND YEAR</strong></td>
<td></td>
<td><strong>3RD YEAR</strong></td>
</tr>
<tr>
<td><strong>3rd Year</strong></td>
<td><strong>4TH YEAR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIO1109* Principles of Biology (register for this course if 4U Biology not completed)</td>
<td><strong>BIO2129</strong> Ecology CHM2353 Descriptive Inorganic Chemistry</td>
<td><strong>EVS3101</strong> Environmental Issues EVS3120 Environmental Microbiology GEO3342** Introduction to Hydrogeology (to be taken in 3rd or 4th year)</td>
<td><strong>EVS4904</strong> Seminar (Fall or Winter) EVS4009 Research Project (Fall and Winter)</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology</td>
<td><strong>CHM1311 Principles of Chemistry</strong></td>
<td><strong>GEO1115</strong> Introduction to Earth Materials MAT1330 Calculus for the Life Sciences I PHY1321 Principles of Physics I</td>
<td>9 optional course units at the 3000 level or above from the list of optional courses offered by the faculties of Science, Engineering, the Department of Geography (GEG) or from one of the options in EVS (see list below)</td>
</tr>
<tr>
<td>CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td><strong>PHY1332 Principles of Physics I</strong> (if 4U Physics not completed)</td>
<td><strong>GEO1111</strong> Introduction to Earth Systems</td>
<td>3 course units from: BIO4150 Spatial Ecology ENV3321 Human and Policy Dimensions of Environmental Change GEG3102 Hydrogeology</td>
</tr>
<tr>
<td>GEO1115 Introduction to Earth Materials</td>
<td><strong>MAT1332 Calculus for the Life Sciences II</strong></td>
<td><strong>GEG1302 Places and Spaces of Human Activity</strong></td>
<td><strong>GEG4101</strong> Permafrost Environments</td>
</tr>
<tr>
<td>MAT1332 Calculus for the Life Sciences II</td>
<td><strong>GEG3102 Introduction to Geomatics (Fall or Winter)</strong></td>
<td><strong>GEG3102</strong> Ecosystem Ecology EVS3102 The Practice of Environmental Science EVS4010 Field Course in Environmental Science</td>
<td><strong>GEG4112 Quaternary Paleoenvironments</strong></td>
</tr>
<tr>
<td>6 optional course units at the 2000 level or above from the list of optional courses offered by the faculties of Science, Engineering, the Department of Geography (GEG) or from one of the options in EVS (see list below)</td>
<td><strong>6 course units from:</strong> BIO4150 Spatial Ecology ENV3321 Human and Policy Dimensions of Environmental Change GEG3102 Hydrology</td>
<td><strong>6 course units from:</strong> BIO4150 Spatial Ecology ENV3321 Human and Policy Dimensions of Environmental Change GEG3102 Hydrology</td>
<td>3 elective course units from the faculties of Science or Engineering</td>
</tr>
<tr>
<td>3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
<td><strong>GEG3105 Remote Sensing</strong></td>
<td><strong>GEG4118 Environmental Impact Assessment</strong></td>
<td>9 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td><strong>GEG3107 Geography of Polar Regions</strong></td>
<td><strong>GEG4129 Global Climate Change</strong></td>
<td>Co-operative education and the extended French stream are available with this program.</td>
</tr>
</tbody>
</table>

*This course is beyond the requirements of the programs in science. **These courses are offered in alternating years with the French equivalent. Optional courses offered by the Faculty of Science, the Faculty of Engineering, or the Department of Geography (GEG): BCH2333, BIO3103, BIO3124, BIO3136, BIO3158, BIO3176, BIO3333, BIO3334, BIO3354, BIO3357, BIO4101, BIO4162, BPS3102, CHG4381, CHM2120, CHM2123, CHM3120, CHM3126, CHM4155, CHM4354, CVG2132, DM2105, DVM1125, DVM1135, GEG1106, GEG3303, GEG3306, GEG3312, GEG4104, GEG4118, GEG4120, GEG4121, GEO1266, GEO3138, GEO4341, GEO4342, GEO4354, GEO4382, MAT3377 |
GEOLOGY

The Department of Earth and Environmental Sciences offers degree programs in geology as well as in geology-physics in partnership with the Department of Physics. Research strengths at the Department of Earth and Environmental Sciences include environmental geosciences, sedimentary systems, natural resources, earth materials and geodynamics.

Geology involves the study of the composition, structure and evolution of the Earth and other planetary bodies. The discipline builds from a basic understanding of physics, chemistry, and often biology, and extends into many specialties like mineralogy, petrology, paleontology, sedimentary systems, environmental geology, economic geology, geochemistry, structural geology and geophysics.

As a result, geologists study natural materials and geological processes across a range of spatial and temporal scales—from isotopes and crystals to mountain ranges and planetary dynamics. Geologists spend their time in both the field and a laboratory setting applying scientific methods to unravel the Earth’s puzzles. Training to be a geologist involves developing analytical and critical thinking skills.

Enrolling in the BSc Honours with a specialization in either geology or geology-physics will allow students to meet the accreditation requirements of professional bodies and practise as geoscientists. In their first year, students increase their knowledge of mathematics, physics, chemistry and biology. Later in the program, students focus on the geology aspect of the program, which consists of lecture-laboratory courses and abundant opportunities for field excursions.
# HONOURS BSc IN GEOLOGY (120 UNITS)

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
</tr>
</thead>
</table>
| 1ST YEAR (30 units) | BIO1109* Principles of Biology (register to this course if 4U Biology not completed)  
CHM1311 Principles of Chemistry  
CHM1301 Principles of Chemistry (if 4U Chemistry not completed)  
GEO1115 Introduction to Earth Materials  
PHY1121 Fundamentals of Physics I or PHY1331 Principles of Physics I (if 4U Physics not completed) |
| 2ND YEAR (30 units) | CHM2330 Physical Chemistry: Introduction to the Molecular Properties of Matter  
CHM2353 Descriptive Inorganic Chemistry (Fall or Winter)  
GEO2163 Introduction to Mineralogy  
GEO2165 Stratigraphy and Sedimentation  
MAT2377 Probability and Statistics for Engineers or MAT2379 Introduction to Biostatistics  
3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management* |
| 3RD YEAR (30 units) | GEO3164 Metamorphic Petrology  
GEO3165* Carbonate Sedimentology or GEO3166 Siliciclastic Sedimentology  
GEO3342** Introduction to Hydrogeology  
3 optional course units in BIO, CHM, MAT or PHY at the 2000, 3000 or 4000 level  
3 elective course units |
| 4TH YEAR (30 units) | GEO3920 Field Studies II  
GEO4010 Honours Project (Fall and Winter)  
6 optional course units in GEO at the 3000 or 4000 level  
3 elective course units |

**Notes:**  
* A language course at the 1000 or 2000 level is strongly recommended.  
** This course is beyond the requirements of the programs in science.  
*** This course is offered in alternating years with the French equivalent.  
| This program can satisfy the academic requirements of the Association of Professional Geoscientists of Ontario. Check APGO website for current eligible courses which can be used for accreditation.  
| Please note that all programs in the Faculty of Science require a minimum of 12 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.  
| Co-operative education and the extended French stream are available with this program.  

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# HONOURS BSc IN GEOLOGY-PHYSICS (120 UNITS)

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
</tr>
</thead>
</table>
| 1ST YEAR (30 units) | BIO1109* Principles of Biology (register to this course if 4U Biology not completed)  
BI0130 Introduction to Organismal Biology  
CHM1311 Principles of Chemistry  
CHM1301 Principles of Chemistry (if 4U Chemistry not completed)  
GEO1115 Introduction to Earth Materials  
PHY1121 Fundamentals of Physics I or PHY1331 Principles of Physics I (if 4U Physics not completed) |
| 2ND YEAR (30 units) | CHM2330 Physical Chemistry: Introduction to the Molecular Properties of Matter  
CHM2353 Descriptive Inorganic Chemistry (Fall or Winter)  
GEO2163 Introduction to Mineralogy  
GEO2165 Stratigraphy and Sedimentation  
MAT2322 Calculus II for Engineers (Fall or Winter)  
MAT2384 Ordinary Differential Equations and Numerical Methods (Fall or Winter)  
PHY2311 Waves and Optics |
| 3RD YEAR (30 units) | GEO3191 Applied Geophysics  
6 optional course units in GEO at the 3000 or 4000 level  
3 optional course units from (Fall or Winter):  
PHY2104 Introduction to Circuit Theory and Electronics  
PHY2323 Electricity and Magnetism  
PHY2333 Mechanics  
3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management* |
| 4TH YEAR (30 units) | GEO4010 Honours Project (Fall and Winter)  
3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management  
6 elective course units |

**Notes:**  
* A language course at the 1000 or 2000 level is strongly recommended.  
** This course is beyond the requirements of the programs in science.  
*** This course is offered in alternating years with the French equivalent.  
| Students who take the Geology-Physics program and wish to become registered members of the Association of Professional Geoscientists of Ontario must take 21 units in Geology from among the optional courses in order to satisfy the requirements of the professional association.  
| The required 3000-4000 level lecture courses are offered in alternating years with the French equivalent.  
| Please note that all programs in the Faculty of Science require a minimum of 12 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.  
| Co-operative education and the extended French stream are available with this program.  
|
## MAJOR IN GEOLOGY (60 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (24 units)</th>
<th>2ND YEAR (18 units)</th>
<th>3RD YEAR (12 units)</th>
<th>4TH YEAR (6 units)</th>
</tr>
</thead>
</table>
| BIO1109* Principles of Biology  
(registered to this course if 4U Biology not completed)  
BIO1130 Introduction to Organismal Biology  
CHM1311 Principles of Chemistry  
or  
CHM1301 Principles of Chemistry  
(if 4U Chemistry not completed)  
GEO1115 Introduction to Earth Materials  
MAT1330 Calculus for the Life Sciences I  
PHY1121 Fundamentals of Physics I  
or  
PHY1331 Principles of Physics I (if 4U Physics not completed)  
| GEO2163 Introduction to Mineralogy  
GEO2165 Stratigraphy and Sedimentation  
6 course units from (Fall or Winter):  
GEO2020 Field studies I  
GEO2113 Palaeontology  
GEO2166 Oceanography  
GEO2334 Quaternary Geology and Climate Change  
| 6 optional course units in GEO at the 3000 or 4000 level  
| 3 optional course units in GEO at the 4000 level  

### FALL

| BIO1111 Introduction to Earth Systems  
MAT1332 Calculus for the Life Sciences II  
PHY1122 Fundamentals of Physics II  
or  
PHY1322 Principles of Physics II (if 4U Physics not completed)  
| GEO2164 Analytical Methods in Mineralogy  
GEO2321 Structural Geology and Tectonics  
| 6 optional course units in GEO at the 3000 or 4000 level  
| 3 optional course units in GEO at the 4000 level  

### WINTER

Notes: *This course is beyond the requirements of the programs in science. This program does not satisfy the requirements of the Association of Professional Geoscientists of Ontario. Some 3rd and 4th year courses are offered in alternating years with the French equivalent. Please note that all programs in the Faculty of Science require a minimum of 12 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. Co-operative education and the extended French stream are available when taken as part of an honours degree.

## MINOR IN GEOLOGY (30 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (15 units)</th>
<th>2ND YEAR (9 units)</th>
<th>3RD YEAR (3 units)</th>
<th>4TH YEAR (3 units)</th>
</tr>
</thead>
</table>
| CHM1311 Principles of Chemistry  
or  
CHM1301 Principles of Chemistry (if 4U Chemistry not completed)  
GEO1115 Introduction to Earth Materials  
MAT1330 Calculus for the Life Sciences I  
PHY1121 Fundamentals of Physics I  
or  
PHY1331 Principles of Physics I (if 4U Physics not completed)  
| GEO2163 Introduction to Mineralogy  
6 course units from (Fall or Winter):  
GEO2020 Field studies I  
GEO2113 Palaeontology  
GEO2164 Analytical Methods in Mineralogy  
GEO2165 Stratigraphy and Sedimentation  
GEO2321 Structural Geology and Tectonics  
GEO2334 Quaternary Geology and Climate Change  
| 3 optional course units in GEO at the 3000 or 4000 level (Fall or Winter)  
| 3 optional course units in GEO at the 3000 or 4000 level (Fall or Winter)  

### FALL

| GEO1111 Introduction to Earth Systems  
|  

### WINTER

Notes: This program does not satisfy the requirements of the Association of Professional Geoscientists of Ontario. Some 3rd and 4th year courses are offered in alternating years with the French equivalent.
MATHEMATICS AND STATISTICS

Mathematics and statistics are not only powerful problem-solving tools, but also highly creative fields of study that combine imagination with logic, and precision with intuition.

Mathematics is much more than numbers! Its basic goal is to reveal and model general patterns to help explain our world, whether these patterns are found in electrical impulses in the human nervous system, the evolution of animal populations in their habitats, fluctuations in stockmarket prices, or electronic communications.

Mathematics reaches far beyond science and engineering into medicine, business and the social sciences.

Advances in mathematics and statistics lie behind many discoveries that are now part of our daily lives, such as MRI scanners, digital compression of music and video, secure electronic communications, data mining, genomic algorithms, futures pricing, and many other innovations.

The Department of Mathematics and Statistics offers honours with specializations as well as majors and minors, in both mathematics and in statistics. Our honours program with specialization in statistics is accredited by the Statistical Society of Canada, allowing graduates to earn the A.Stat. professional designation. Moreover, the Department offers a joint honours program in mathematics and economics, a joint honours program in computer science and mathematics and a multidisciplinary program in financial mathematics and economics.
# HONOURS BSc IN MATHEMATICS (120 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FALL</strong></td>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
<td><strong>WINTER</strong></td>
</tr>
<tr>
<td>MAT1320 Calculus I</td>
<td>MAT2122 Multivariable Calculus</td>
<td>MAT3120* Real Analysis</td>
<td>3 optional course units in MAT at the 4000 level</td>
</tr>
<tr>
<td>MAT1341 Introduction to Linear Algebra</td>
<td>MAT2141 Linear Algebra I</td>
<td>MAT3141* Linear Algebra II</td>
<td>3 optional course units in MAT at the 3000 or 4000 level</td>
</tr>
<tr>
<td>(Fall or Winter)</td>
<td>or MAT2362 Foundations of Mathematics</td>
<td>or MAT3341* Applied Linear Algebra (Fall or Winter)</td>
<td>3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
</tr>
<tr>
<td>MAT1362 Mathematical Reasoning and Proofs</td>
<td>3 course units from: (Fall or Winter)</td>
<td>6 optional course units in MAT at the 3000 or 4000 level</td>
<td>6 elective course units</td>
</tr>
<tr>
<td>3 course units in ENG at the 1000 or 2000 level</td>
<td>MAT2355 Introduction to Geometry</td>
<td>3 elective course units</td>
<td>3 elective course units</td>
</tr>
<tr>
<td>3 elective course units</td>
<td>MAT2371 Introduction to Probability</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>MAT2375 Introduction to Statistics</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>3 elective course units</td>
<td></td>
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</tr>
<tr>
<td><strong>WINTER</strong></td>
<td><strong>WINTER</strong></td>
<td><strong>FALL</strong></td>
<td><strong>FALL</strong></td>
</tr>
<tr>
<td>MAT1322 Calculus II</td>
<td>MAT2125 Elementary Real Analysis</td>
<td>MAT3121* Complex Analysis I</td>
<td>3 optional course units in MAT at the 4000 level</td>
</tr>
<tr>
<td>3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
<td>MAT2143 Algebraic Structures</td>
<td>MAT3143* Ring Theory</td>
<td>3 optional course units in MAT at the 3000 or 4000 level</td>
</tr>
<tr>
<td>9 elective course units</td>
<td>MAT2348 Ordinary Differential Equations and the Laplace Transform</td>
<td>3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
<td>9 elective course units</td>
</tr>
<tr>
<td>3 course units from: (Fall or Winter)</td>
<td>3 course units from: (Fall or Winter)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAT2348* Discrete Mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAT2355 Introduction to Geometry</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAT2371 Introduction to Probability</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAT2375 Introduction to Statistics</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>3 elective course units</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes**
- *Students interested in applied mathematics should take MAT3341.*
- *Students interested in discrete mathematics should take MAT2348.*
- *Some 3rd and 4th year courses are offered in alternating years with the French equivalent.*
- The course MAT3153 cannot be counted for credit if you have previously passed MAT4153. You may however take MAT3153 and then subsequently take MAT 4153, and count both for credit.
- Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. Co-operative education and the extended French stream are available with this program.

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# HONOURS BSc IN STATISTICS (120 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FALL</strong></td>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
<td><strong>WINTER</strong></td>
</tr>
<tr>
<td>ITI1120 Introduction to Computing I (Fall or Winter)</td>
<td>MAT2122 Multivariable Calculus</td>
<td>MAT3172 Foundations of Probability</td>
<td>6 course units from: (Fall or Winter)</td>
</tr>
<tr>
<td>MAT1320 Calculus I</td>
<td>MAT2141 Linear Algebra I</td>
<td>MAT3375 Regression Analysis</td>
<td>MAT3379 Introduction to Time Series Analysis</td>
</tr>
<tr>
<td>MAT1341 Introduction to Linear Algebra</td>
<td>or MAT2342 Introduction to Applied Linear Algebra</td>
<td>MAT3377* Sampling and Surveys</td>
<td>MAT4371 Applied Probability</td>
</tr>
<tr>
<td>(Fall or Winter)</td>
<td>or MAT2371 Introduction to Probability</td>
<td>6 elective course units</td>
<td>MAT4374 Modern Computational Statistics</td>
</tr>
<tr>
<td>MAT1362 Mathematical Reasoning and Proofs</td>
<td>3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
<td></td>
<td>MAT4375 Multivariate Statistical Methods</td>
</tr>
<tr>
<td>3 course units in ENG at the 1000 or 2000 level</td>
<td>3 elective course units</td>
<td></td>
<td>MAT4376 Topics in Statistics</td>
</tr>
<tr>
<td></td>
<td>3 optional course units in MAT at the 3000 or 4000 level</td>
<td></td>
<td>MAT4377 Topics in Applied Probability</td>
</tr>
<tr>
<td><strong>WINTER</strong></td>
<td><strong>WINTER</strong></td>
<td><strong>FALL</strong></td>
<td><strong>FALL</strong></td>
</tr>
<tr>
<td>MAT1322 Calculus II</td>
<td>MAT2125 Elementary Real Analysis</td>
<td>MAT3341* Applied Linear Algebra</td>
<td>15 optional course units in MAT at the 3000 or 4000 level</td>
</tr>
<tr>
<td>12 elective course units</td>
<td>MAT2342 Ordinary Differential Equations and the Laplace Transform</td>
<td>MAT3378* Analysis of experimental designs</td>
<td>9 elective course units (Fall or Winter)</td>
</tr>
<tr>
<td></td>
<td>or MAT2375 Introduction to Statistics</td>
<td>or MAT4175 Introduction to Mathematical Statistics</td>
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</tr>
<tr>
<td></td>
<td>6 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
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</tr>
<tr>
<td></td>
<td>6 elective course units</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAT2379* Analysis of experimental designs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAT2375 Introduction to Statistics</td>
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</tr>
<tr>
<td></td>
<td>6 elective course units</td>
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</tr>
</tbody>
</table>

**Notes**
- *This course is offered in alternating years with the French equivalent.*
- This program is accredited by the Statistical Society of Canada. To satisfy the requirements for the professional title of A. Stat. from the Statistical Society of Canada, students must add to the Honours in statistics the equivalent of a minor in a field other than MAT. Contact the Department of Mathematics and Statistics for details.
- The following courses are recommended for the students interested in pursuing graduate studies in probability or statistics: MAT3120 and MAT3121. Other courses in probability and statistics which may be of interest include: MAT4170, MAT4171 and MAT4172.
- *Some 3rd and 4th year courses are offered in alternating years with the French equivalent.*
- Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. Co-operative education and the extended French stream are available with this program.
### HONOURS BSc IN FINANCIAL MATHEMATICS AND ECONOMICS (120 UNITS)

<table>
<thead>
<tr>
<th>Year</th>
<th>Semesters</th>
<th>Courses</th>
</tr>
</thead>
</table>
| 1ST YEAR (30 units) | FALL | ADM1100 Introduction to Business Management  
ECO1102 Introduction to Macroeconomics  
MAT1320 Calculus I  
MAT1341 Introduction to Linear Algebra (Fall or Winter)  
MAT1362 Mathematical Reasoning and Proofs |
| | WINTER | ADM1340 Financial Accounting  
ECO1104 Introduction to Microeconomics  
MAT1322 Calculus II  
3 optional course units in ENG at the 1000 level  
3 elective course units (Fall or Winter) |
| 2ND YEAR (30 units) | FALL | ECO2142 Macroeconomic Theory I  
ECO2144 Microeconomic Theory I  
MAT2122 Multivariable Calculus  
MAT2141 Linear Algebra I  
MAT2342 Introduction to Applied Linear Algebra  
MAT2371 Introduction to Probability |
| | WINTER | ADM2352 Finance Theory  
ADM3350 Corporate Finance  
MAT3172 Foundations of Probability  
3 optional course units in MAT at the 3000 or 4000 level |
| 3RD YEAR (30 units) | FALL | ECO3153 Microeconomic Theory III  
MAT2324 Ordinary Differential Equations and the Laplace Transform  
PH2397 Business Ethics  
3 optional course units in MAT at the 3000 or 4000 level |
| | WINTER | ADM4351 Options and Futures  
ECO4185 Financial Econometrics  
3 optional course units in ADM at the 4000 level  
3 optional course units in MAT at the 4000 level  
3 course units from (Fall or Winter):  
ECO3152 Macroeconomic Theory III  
ECO4115 Monetary Theory  
EC04139 Industrial Finance  
ECO4145 Mathematical Economics II  
ECO4170 Game Theory with Applications in Corporate Finance  
ECO4186 Applied Econometrics |
| 4TH YEAR (30 units) | FALL | ECO4185 Financial Econometrics  
3 optional course units in ADM at the 4000 level  
3 optional course units in MAT at the 4000 level  
3 course units from (Fall or Winter):  
ECO3152 Macroeconomic Theory III  
ECO4115 Monetary Theory  
EC04139 Industrial Finance  
ECO4145 Mathematical Economics II  
ECO4170 Game Theory with Applications in Corporate Finance  
ECO4186 Applied Econometrics |

**Notes:** Many mathematics (MAT) compulsory lecture courses at the 3000 and 4000 levels are offered in alternating years with the French equivalent. You can choose optional courses from the 4th year if needed to select the language of your choice. (Consult the timetable) Students intending to pursue graduate studies in statistics should select MAT3177, MAT3378 and MAT4175 among their elective units in mathematics (MAT). | Recommended courses: MAT4372, MAT4374, MAT4387 | Co-operative education and the extended French stream are available with this program.

### JOINT HONOURS BSc IN COMPUTER SCIENCE AND MATHEMATICS (120 UNITS)

<table>
<thead>
<tr>
<th>Year</th>
<th>Semesters</th>
<th>Courses</th>
</tr>
</thead>
</table>
| 1ST YEAR (30 units) | FALL | ENG1112 Technical Report Writing  
ITI1120 Introduction to Computing I  
MAT1320 Calculus I  
MAT1341 Introduction to Linear Algebra  
3 elective course units |
| | WINTER | ITI1100 Digital Systems I  
ITI1121 Introduction to Computing II  
MAT1322 Calculus II  
MAT1348 Discrete Mathematics for Computing  
3 elective course units |
| 2ND YEAR (30 units) | FALL | CEG2136 Computer Architecture I  
CS2110 Data Structures and Algorithms  
MAT2122 Multivariable Calculus  
MAT2141 Linear Algebra I  
MAT2371 Introduction to Probability |
| | WINTER | CEG2136 Computer Architecture I  
CS2110 Data Structures and Algorithms  
MAT2122 Multivariable Calculus  
MAT2141 Linear Algebra I  
MAT2371 Introduction to Probability |
| 3RD YEAR (30 units) | FALL | CSI3105 Design and Analysis of Algorithms I  
SEG2105 Introduction to Software Engineering  
3 course units from:  
MAT2324 Ordinary Differential Equations and the Laplace Transform (Winter)  
MAT2355 Introduction to Geometry  
MAT2362 Foundations of Mathematics  
3 elective course units  
3 optional course units in MAT at the 3000 or 4000 level |
| | WINTER | CS2101 Discrete Structures  
CS2120 Programming Paradigms  
CS2132 Databases I  
CS2911 Professional Practice in Computing (co-op)  
MAT2125 Elementary Real Analysis  
MAT2143 Algebraic Structures |
| 4TH YEAR (30 units) | FALL | CS2911 Professional Practice in Computing (non co-op)  
CS1304 Introduction to Formal Languages  
CS1311 Operating Systems  
MAT2375 Introduction to Statistics  
3 course units from: (Fall or Winter)  
CEG3185 Introduction to Data Communications and Networking  
CS1310 Databases II  
CS1314 WWW Structures, Techniques and Standards |
| | WINTER | CSI3105 Design and Analysis of Algorithms I  
SEG2105 Introduction to Software Engineering  
3 course units from:  
MAT2324 Ordinary Differential Equations and the Laplace Transform (Winter)  
MAT2355 Introduction to Geometry  
MAT2362 Foundations of Mathematics  
3 elective course units in MAT at the 3000 or 4000 level  
3 optional course units in CSI at the 4000 level  
3 optional course units in MAT at the 3000 or 4000 level  
3 optional course units in MAT at the 4000 level  
3 optional course units in CSI or SEG at the 3000 or 4000 level (Fall or Winter)  
3 elective course units |

**Notes:** To be admissible to graduate studies in Computer Science, students must have successfully completed MAT2371 and MAT2375. Students planning to go to graduate studies in mathematics or statistics must consult the Department of Mathematics and Statistics for their choices of optional courses. | Some 3rd and 4th year courses are offered in alternating years with the French equivalent. | Co-operative education and the extended French stream are available with this program.
### JOINT HONOURS BSc IN MATHEMATICS AND ECONOMICS (120 UNITS)

**1ST YEAR** (30 units)
- **FALL**
  - ECO1104 Introduction to Microeconomics
  - ENG1100 Workshop in Essay Writing
  - MAT1320 Calculus I
  - MAT1341 Introduction to Linear Algebra
  - MAT1362 Mathematical Reasoning and Proofs
- **WINTER**
  - ECO1102 Introduction to Macroeconomics
  - ENGL10 Literature and Composition I: Prose Fiction
  - MAT1322 Calculus II

**2ND YEAR** (30 units)
- **FALL**
  - ECO2142 Macroeconomic Theory I
  - ENG1100 Workshop in Essay Writing
  - MAT1322 Calculus I
  - MAT2122 Multivariable Calculus
  - MAT2141 Linear Algebra I
  - MAT2342 Introduction to Applied Linear Algebra
  - MAT2371 Introduction to Probability
- **WINTER**
  - ECO2143 Macroeconomic Theory II
  - ENGL121 Literature and Composition II: Drama and Poetry
  - MAT2125 Elementary Real Analysis

**3RD YEAR** (30 units)
- **FALL**
  - ECO3152 Macroeconomic Theory III
  - 6 optional course units in ECO at the 3000 or 4000 level
- **WINTER**
  - ECO3151 Introduction to Econometrics
  - 3 course units from (Fall or Winter):
    - MAT2143 Algebraic Structures
    - MAT2324 Ordinary Differential Equations and the Laplace Transform
    - MAT2348 Discrete Mathematics

**4TH YEAR** (30 units)
- **FALL**
  - 3 optional course units in ECO at the 4000 level
- **WINTER**
  - 3 optional course units in MAT at the 4000 level

### MAJOR IN MATHEMATICS (54 UNITS)

**1ST YEAR** (12 units)
- **FALL**
  - MAT1320 Calculus I
  - MAT1341 Introduction to Linear Algebra (Fall or Winter)
  - MAT1362 Mathematical Reasoning and Proofs
- **WINTER**
  - MAT1322 Calculus II

**2ND YEAR** (24 units)
- **FALL**
  - MAT2122 Multivariable Calculus
  - MAT2141 Linear Algebra I
  - 12 course units from: (Fall or Winter):
    - MAT2348 Discrete Mathematics
    - MAT2355 Introduction to Geometry
  - 6 optional course units in MAT at the 3000 or 4000 level
- **WINTER**
  - MAT2125 Elementary Real Analysis
  - MAT2143 Algebraic Structures

**3RD YEAR** (12 units)
- **FALL**
  - 6 optional course units in MAT at the 3000 or 4000 level
- **WINTER**
  - 3 optional course units in MAT at the 4000 level

**4TH YEAR** (6 units)
- **FALL**
  - 3 optional course units in MAT at the 4000 level

**Notes**
- Students interested in graduate studies in mathematics should choose MAT2141.
- MAT2362 is strongly recommended and is required for further study of logic.
- Students planning to go to graduate studies in mathematics and statistics must consult the Department of Mathematics and Statistics for their choices of optional courses.
- Some 3rd and 4th year courses are offered in alternating years with the French equivalent.
- Co-operative education and the extended French stream are available with this program.
## MAJOR IN STATISTICS (54 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (12 units)</th>
<th>2ND YEAR (15 units)</th>
<th>3RD YEAR (18 units)</th>
<th>4TH YEAR (9 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT1320 Calculus I or MAT1341 Introduction to Linear Algebra (Fall or Winter)</td>
<td>MAT2122 Multivariable Calculus MAT2141 Linear Algebra I or MAT2342 Introduction to Applied Linear Algebra MAT2371 Introduction to Probability</td>
<td>MAT3375 Regression Analysis MAT3377* Sampling and Surveys 3 optional course units from the list below</td>
<td>6 optional course units in MAT at the 3000 or 4000 level</td>
</tr>
<tr>
<td>MAT1322 Calculus II or MAT1332 Calculus for the Life Sciences II</td>
<td>MAT2125 Elementary Real Analysis MAT2375 Introduction to Statistics</td>
<td>MAT3378** Analysis of Experimental Designs 6 optional course units from the list below</td>
<td>3 optional course units from the list below</td>
</tr>
</tbody>
</table>

Notes 12 course units from the following list must be taken: MAT3172, MAT3379, MAT4175, MAT4371, MAT4374, MAT4375, MAT4376, MAT4377, MAT4378 | *This is a required course for A. Stat. accreditation. | *Courses accredited by the Statistical Society of Canada (SSC) and which may be used to satisfy the requirements for the professional title of A. Stat. from the SSC. Contact the Department of Mathematics and Statistics for more details. | **This course is offered in alternating years with the French equivalent. | The course MAT3153 cannot be counted for credit if you have previously passed MAT4153. You may however take MAT3153 and then subsequently take MAT4153, and count both for credit. | Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. | Co-operative education and the extended French stream are available when taken as part of an honours degree. |

## MINOR IN MATHEMATICS (30 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (9 units)</th>
<th>2ND YEAR (15 units)</th>
<th>3RD YEAR (6 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT1320 Calculus I or MAT1330 Calculus for the Life Sciences I MAT1341 Introduction to Linear Algebra (Fall or Winter)</td>
<td>MAT2342 Introduction to Applied Linear Algebra or MAT2141 Linear Algebra I MAT2322* Calculus III for Engineers MAT2324 Ordinary Differential Equations and the Laplace Transform or MAT2325 Ordinary Differential Equations and Numerical Methods MAT2348 Discrete Mathematics MAT2355 Introduction to Geometry MAT2362 Foundations of Mathematics MAT2371 Introduction to Probability MAT2375 Introduction to Statistics or MAT2379* Introduction to Biostatistics</td>
<td>3 optional course units in MAT at the 3000 level</td>
</tr>
<tr>
<td>MAT1322 Calculus II or MAT1332 Calculus for the Life Sciences II</td>
<td></td>
<td>3 optional course units in MAT at the 3000 level</td>
</tr>
</tbody>
</table>

Notes *MAT2322 cannot count for credits in the major or Honours in mathematics or statistics. Students interested in the major or Honours in mathematics or statistics must take MAT2122 and MAT2125 instead of MAT2322. | *This course cannot count for credits in the major or Honours in mathematics or statistics. | Some 3rd and 4th year courses are offered in alternating years with the French equivalent. | Some 3rd and 4th year courses are offered in alternating years with the French equivalent. |

## MINOR IN STATISTICS (30 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (9 units)</th>
<th>2ND YEAR (9 units)</th>
<th>3RD YEAR (9 units)</th>
<th>4TH YEAR (3 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT1320 Calculus I or MAT1330 Calculus for the Life Sciences I MAT1341 Introduction to Linear Algebra or MAT1302 Mathematical Methods II (Fall or Winter)</td>
<td>MAT2342 Introduction to Applied Linear Algebra or MAT2141 Linear Algebra I MAT2371 Introduction to Probability</td>
<td>9 course units from: (Fall or Winter) MAT3172* Foundations of Probability MAT3375 Regression Analysis MAT3377 Sampling and Surveys MAT3378 Analysis of experimental designs MAT3379 Introduction to Time Series Analysis MAT4175* Introduction to Mathematical Statistics MAT4371 Applied Probability MAT4374 Modern Computational Statistics MAT4375 Multivariate Statistical Methods MAT4376 Topics in Statistics MAT4377 Topics in Applied Probability MAT4378 Categorical Data Analysis in Biostatistics</td>
<td>3 optional course units in MAT at the 2000, 3000 or 4000 level or from among the following courses (Fall or Winter): ADM4306* Statistical Modeling BIDA4358 Applied Biostatistics ECO4186* Applied Econometrics GEG4120* GIS and Numerical Spatial Analysis GEO4354* Quantitative Analysis in Geology</td>
</tr>
<tr>
<td>MAT1322 Calculus II or MAT1332 Calculus for the Life Sciences II</td>
<td>MAT2375 Introduction to Statistics or MAT2379* Introduction to Biostatistics (Fall)</td>
<td></td>
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</tr>
</tbody>
</table>

Notes *This course cannot count for credits in the major or Honours in mathematics or statistics. | *The courses in this list are accredited by the Statistical Society of Canada for the A. Stat. professional designation. Contact the Department of Mathematics and Statistics for more details. | *These courses require prerequisites which are not part of the minor. | Some 3rd and 4th year courses are offered in alternating years with the French equivalent. |
Do you love music and science? Would you like to develop your musical abilities to their full potential while doing advanced studies in the sciences? Now you can do so, thanks to a bachelor’s program offered jointly by the University of Ottawa’s faculties of Arts, Science and Engineering. Acquire in-depth knowledge and pursue rigorous training in science and music, the first of its kind in Canada!

The Integrated Bachelor of Music and Science program was created for students who would like to be able to work in either field and are interested in developing their skills in both disciplines. This five-year integrated program leads to a degree in science (BSc) and in music (BMus) and opens the door to graduate studies. To be admitted to the program, students must meet the Bachelor of Science admission criteria and be accepted into the performance profile of the Bachelor of Music program, by successfully completing an instrument or voice audition demonstrating outstanding ability.

Admission to this program is through the Faculty of Arts.

MUSIC AND SCIENCE

Do you love music and science? Would you like to develop your musical abilities to their full potential while doing advanced studies in the sciences? Now you can do so, thanks to a bachelor’s program offered jointly by the University of Ottawa’s faculties of Arts, Science and Engineering. Acquire in-depth knowledge and pursue rigorous training in science and music, the first of its kind in Canada!

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Admission to this program is through the Faculty of Arts.

MUSIC AND SCIENCE
OPHTHALMIC MEDICAL TECHNOLOGY

The complexity of ophthalmic medicine has been growing steadily, and with it, the demand for well-trained allied health specialists in this critical area of eye care.

Students in the ophthalmic medical technology program work with the latest technologies and as part of the health care team at the University of Ottawa Eye Institute. This integrated education prepares graduates for a challenging and rewarding career as an ophthalmic medical technologist (OMT). After successful completion of the program, students are eligible to sit for the certification exams given by the International Joint Commission on Allied Health Personnel in Ophthalmology. Graduates from the OMT program are sought after across the country and internationally.

The ophthalmic medical technology program begins with two years of core sciences, followed by two years of studies dealing specifically with ophthalmology and visual science. Courses in years three and four are delivered at the University of Ottawa Eye Institute at The Ottawa Hospital. They integrate didactic learning with hands-on training in the health care environment. Students work alongside and learn from other health care providers and ophthalmologists.

Admission to the third and fourth years of this program is limited. To qualify, a student must have successfully completed the compulsory 1000- and 2000-level courses with a minimum grade point average of 6.0. Applicants meeting these requirements will be interviewed by the admission committee to determine which candidates are most likely to succeed in the field.

Applicants are advised and encouraged, early in the program, to visit the Eye Institute for a tour and to meet with ophthalmic personnel in order to gain an understanding of the profession. Students that are not accepted into the third and fourth years of the program can transfer into another program within the Faculty of Science. The first two years are similar to the first two years in biology, biochemistry and biopharmaceutical science. They should meet with an academic advisor to establish the list of courses that will be credited to the new program.

HONOURS BSc IN OPHTHALMIC MEDICAL TECHNOLOGY (120 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FALL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIO1109 Principles of Biology (register to this course if 4U Biology not completed)</td>
<td>CHM2120 Organic Chemistry II</td>
<td>HSS3101 Health Research: Quantitative and Qualitative Approaches</td>
<td>OMT4122 Advanced Diagnostics</td>
</tr>
<tr>
<td>BIO1130 Introduction to Organismal Biology</td>
<td>CHM2123 Laboratory of Organic Chemistry II</td>
<td>OMT4123 Ocular Anatomy and Physiology</td>
<td>OMT4123 Ophthalmic Pharmacology</td>
</tr>
<tr>
<td>CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>MAT2379 Introduction to Biostatistics</td>
<td>OMT3124 Basic Diagnostics I</td>
<td>OMT4125 Ophthalmic Basic Science Seminars</td>
</tr>
<tr>
<td>MAT1330 Calculus for the Life Sciences I or PHY1321 Principles of Physics I</td>
<td>6 optional course units at the 2000, 3000 or 4000 level offered by the Faculty of Science</td>
<td>OMT3125 Clinical Application I</td>
<td>OMT4201 Basic Skills II</td>
</tr>
<tr>
<td>PHY1331 Principles of Physics I (if 4U Physics not completed)</td>
<td></td>
<td>OMT3126 Ophthalmic Basic Science Seminars</td>
<td>OMT4224 Clinical Application-II</td>
</tr>
<tr>
<td>HSS1101 Determinants of Health or PSY1102 Introduction to Psychology: Applications (Fall or Winter)</td>
<td></td>
<td>OMT3231 Introduction to Ophthalmic Technology: Basic Skills-I</td>
<td></td>
</tr>
<tr>
<td>WINTER</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>BIO1140 Introduction to Cell Biology</td>
<td>BCH2333 Introduction to Biochemistry</td>
<td>OMT3126 Ophthalmic Subspecialties</td>
<td>OMT4126 Specialized Diagnostic Evaluations</td>
</tr>
<tr>
<td>CHM1321 Organic Chemistry I</td>
<td>BIO2133 Genetics</td>
<td>OMT3127 Basics Diagnostics I</td>
<td>OMT4127 Advanced Perimetry</td>
</tr>
<tr>
<td>MAT1332 Calculus for the Life Sciences II</td>
<td>PH2396 Bioethics</td>
<td></td>
<td>OMT4128 Abnormalities of the Eye and Common Ocular Complaints</td>
</tr>
<tr>
<td>PHY1322 Principles of Physics II</td>
<td>6 optional course units at the 2000, 3000 or 4000 level offered by the Faculty of Science</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENGT100 Workshop in Essay Writing (Fall or Winter)</td>
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</tbody>
</table>

Notes: *This course runs from September to April. | **This course is beyond the requirements of the programs in science.
Why is our world the way it is? How can we understand and explain what we observe around us, from the smallest sub-atomic particles to the largest galaxies? How can we apply this understanding to manipulate our world? Of course studying physics gives insight into the fundamental laws of nature.

But an education in physics gives so much more. The rigorous training our students receive in analyzing and understanding complex problems is of considerable value to many future career directions. While many of our graduates have found careers in universities and in the high-tech sector as research and development scientists, others have used their physics degrees as a springboard for careers in finance, administration, medicine, management and education. The range of career opportunities is perhaps wider than for any other scientifically trained group.

From original ground breaking discoveries, to the development of new and revolutionary technologies, to the decoding of the stock market, physicists have revolutionized the way we live our lives. Our professors and our graduates are an important part of this chain. Many of our professors have also been recognized as superb teachers and have been widely recognized as world-class researchers in their respective fields of expertise.

The research conducted by the professors in the Department of Physics is concentrated in several sub-specialties, including the physics of biological and complex systems, condensed matter physics, photonics, and the physics of geomaterials. Depending upon their choice of program, undergraduate students will have the opportunity to take courses and participate in research projects in these specialized areas.

The Department of Physics offers an honours BSc with a specialization in physics as well as three other honours BSc programs. The specialization in physics-mathematics provides enriched mathematics training within a physics program. The specialization in physics with biological physics option prepares the student for cutting edge research in biophysics and physical phenomena in the life sciences. The specialization in physics with photonics option combines a well-rounded training in fundamental physics with a state-of-the-art training in the technology driven area of photonics. The Department also offers a major in physics, which may form the core of an honours BSc when combined with a major or a minor in another discipline.

The Department of Physics also has a strong graduate program, leading to a MSc or PhD degree. BSc graduates who qualify for the accelerated stream can obtain a MSc degree in only one year.
## HONOURS BSc IN PHYSICS (120 UNITS)

### 1ST YEAR (30 units)

<table>
<thead>
<tr>
<th>FALL</th>
<th>WINTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT1320 Calculus I or MAT1341 Introduction to Linear Algebra (Fall or Winter)</td>
<td>PHY1121 Fundamentals of Physics I or PHY1131 Principles of Physics I (if 4U Physics not completed)</td>
</tr>
<tr>
<td>3 elective course units²</td>
<td>3 elective course units³</td>
</tr>
</tbody>
</table>

### 2ND YEAR (30 units)

<table>
<thead>
<tr>
<th>FALL</th>
<th>WINTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY1322 Calculus II or PHY1122 Fundamentals of Physics II or PHY1322 Principles of Physics II (if 4U Physics not completed)</td>
<td>3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
</tr>
<tr>
<td>6 elective course units² (Fall or Winter)</td>
<td>3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
</tr>
</tbody>
</table>

### 3RD YEAR (30 units)

<table>
<thead>
<tr>
<th>FALL</th>
<th>WINTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT2122 Multivariable Calculus or MAT2322 Calculus III for Engineers or MAT2324 Ordinary Differential Equations and the Laplace Transform (Winter) or MAT2384 Ordinary Differential Equations and Numerical Methods (Fall or Winter)</td>
<td>PHY2311 Waves and Optics PHY2333 Mechanics</td>
</tr>
<tr>
<td>3 optional course units in MAT at the 2000, 3000 or 4000 level, excluding MAT2379⁹</td>
<td>3 elective course units¹</td>
</tr>
</tbody>
</table>

### 4TH YEAR (30 units)

<table>
<thead>
<tr>
<th>FALL</th>
<th>WINTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY3341 Theoretical Physics or PHY3350 Thermodynamics or PHY3370 Introductory Quantum Mechanics</td>
<td>PHY3902 Physics and Applied Physics Laboratory I</td>
</tr>
<tr>
<td>3 elective course units¹</td>
<td>3 elective course units²</td>
</tr>
</tbody>
</table>

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### Notes

- ITI1120 is a prerequisite for most further courses in computer science (CSI). GNG1106 is recommended for students not taking further computer science courses (CSI).
- Of the 24 elective units, some breadth in other sciences is recommended and the following courses are recommended in particular: CHM1311 (see also note 3). MAT2121 or MAT2342 or (MAT1321 or MAT2377) is recommended.
- May be taken in 3rd year if prerequisites satisfied. Specialization programs are also offered in Physics with Biological Physics option, Photonics Option and in Physics-Mathematics; please consult the relevant tables for details. Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management.

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## HONOURS BSc IN PHYSICS - BIOLOGICAL PHYSICS OPTION (120 UNITS)

### 1ST YEAR (30 units)

<table>
<thead>
<tr>
<th>FALL</th>
<th>WINTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM1311 Principles of Chemistry or CHM1301 Principles of Chemistry (if 4U Chemistry not completed)</td>
<td>MAT1320 Calculus I or MAT1341 Introduction to Linear Algebra (Fall or Winter)</td>
</tr>
<tr>
<td>3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
<td>PHY1121 Fundamentals of Physics I or PHY1131 Principles of Physics I (if 4U Physics not completed)</td>
</tr>
</tbody>
</table>

### 2ND YEAR (30 units)

<table>
<thead>
<tr>
<th>FALL</th>
<th>WINTER</th>
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</thead>
<tbody>
<tr>
<td>BIO3153 Cell Biology or MAT2122 Multivariable Calculus or MAT2322 Calculus III for Engineers</td>
<td>PHY2311 Waves and Optics</td>
</tr>
<tr>
<td>PHY2333 Mechanics</td>
<td>PHY2325 Physics in Biology</td>
</tr>
</tbody>
</table>

### 3RD YEAR (30 units)

<table>
<thead>
<tr>
<th>FALL</th>
<th>WINTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY3325 Introduction to Circuit Theory and Electronics or PHY3236 Electricity and Magnetism</td>
<td>PHY2361 Modern Physics</td>
</tr>
<tr>
<td>PHY3370 Introductory Quantum Mechanics</td>
<td>PHY3355 Statistical Thermodynamics</td>
</tr>
<tr>
<td>PHY3902 Physics and Applied Physics Laboratory I</td>
<td>PHY3904 Physics and Applied Physics Laboratory II</td>
</tr>
<tr>
<td>3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
<td>3 elective course units²</td>
</tr>
</tbody>
</table>

### 4TH YEAR (30 units)

<table>
<thead>
<tr>
<th>FALL</th>
<th>WINTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY3322 Biological Physics</td>
<td>PHY4906 Physics Research Project (Fall and Winter)</td>
</tr>
<tr>
<td>3 elective course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
<td>9 elective course units¹</td>
</tr>
</tbody>
</table>

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### Notes

- Of the 18 elective units, some breadth in other sciences is recommended and the following courses are recommended in particular: CHM1321, GNG1106 or ITI1120 (see also note 2 and 3). ITI1120 is a prerequisite for most further courses in computer science. GNG1106 is recommended for students not taking further computer science courses.
- MAT2141 or MAT2342 or (MAT2371 or MAT2377) is recommended. Co-operative education and the extended French stream are available with this program.

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Physics 47
### HONOURS BSc IN PHYSICS - PHOTONICS OPTION (120 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
</tr>
<tr>
<td>GNG1106* Fundamentals of Engineering Computation or ITI1120* Introduction to Computing I (Fall or Winter)</td>
<td>MAT1322 Calculus I MAT1341 Introduction to Linear Algebra (Fall or Winter) PHY1121 Fundamentals of Physics I or PHY1331 Principles of Physics I (if 4U Physics not completed) 3 elective course units offered by the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
<td>PHY2332 Ordinary Differential Equations and the Laplace Transform or PHY2384 Ordinary Differential Equations and Numerical Methods (Fall or Winter) PHY2104 Introduction to Circuit Theory and Electronics PHY2323 Electricity and Magnetism PHY2361 Modern Physics 3 elective course units*</td>
<td>PHY3310, PHY4311, PHY4320 and PHY4375 are offered in alternating years in English. Take Group A in 3rd year and Group B in 4th year, or vice versa, ensure they are taken when offered.</td>
</tr>
<tr>
<td>MAT1322 Calculus II PHY1122 Fundamentals of Physics II or PHY1322 Principles of Physics II (if 4U Physics not completed) 6 elective course units* 3 elective course units offered by the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
<td>MAT2324 Ordinary Differential Equations and the Laplace Transform or PHY2384 Ordinary Differential Equations and Numerical Methods (Fall or Winter) PHY2104 Introduction to Circuit Theory and Electronics PHY2323 Electricity and Magnetism PHY2361 Modern Physics 3 elective course units*</td>
<td>PHY3320 Electromagnetic Theory PHY3355 Statistical Thermodynamics 6 elective course units*</td>
<td>ELG4178 Optical Communications and Networking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PHY3380 Physics and Applied Physics Laboratory I Group A PHY4311 Introduction to Photonics - Lasers</td>
<td>PHY4006 Physics Research Project (Fall and Winter) or PHY4906 Physics Project (Fall and Winter) plus 3 optional course units at the 2000, 3000 or 4000 level from the faculties of Science or Engineering</td>
</tr>
</tbody>
</table>

#### Notes
- ITI1120 is a prerequisite for most further courses in computer science (CSI). MAT130 is recommended for students not taking further computer science courses (CSI).
- **Out of the 24 elective course units, some breadth in other sciences is recommended and particularly CHM1311.**
- **May be taken anytime in 3rd or 4th year if prerequisites satisfied.**
- Telfer School of Management Education and the extended French stream are available with this program.

### HONOURS BSc IN PHYSICS-MATHEMATICS (120 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (30 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (30 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
</tr>
<tr>
<td>MAT1320 Calculus I MAT1341 Introduction to Linear Algebra (Fall or Winter) PHY1121 Fundamentals of Physics I or PHY1331 Principles of Physics I (if 4U Physics not completed) GNG1106* Fundamentals of Engineering Computation or ITI120* Introduction to Computing I (Fall or Winter) MAT1362 Mathematical Reasoning and Proofs (Fall) or MAT1348* Discrete Mathematics for Computing (Winter)</td>
<td>MAT2122 Multivariable Calculus MAT2141 Linear Algebra I MAT2371* Introduction to Probability or MAT2377 Probability and Statistics for Engineers (Fall or Winter) PHY2311 Waves and Optics PHY2333 Mechanics</td>
<td>PHY3341 Theoretical Physics PHY3350 Thermodynamics PHY3370 Introductory Quantum Mechanics PHY3902 Physics and Applied Physics Laboratory I Group A PHY4320 Introduction to Quantum Optics</td>
<td>PHY4370 Quantum Mechanics PHY4382 Introduction to Solid State Physics or PHY4906 Physics Project (Fall or Winter) plus 3 optional course units at the 2000, 3000 or 4000 level</td>
</tr>
<tr>
<td>MAT1322 Calculus II PHY1122 Fundamentals of Physics II or PHY1322 Principles of Physics II (if 4U Physics not completed) 6 elective course units* 3 elective course units offered by the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management</td>
<td>MAT2324 Ordinary Differential Equations and the Laplace Transform or PHY2384 Ordinary Differential Equations and Numerical Methods (Fall or Winter) PHY2104 Introduction to Circuit Theory and Electronics PHY2323 Electricity and Magnetism PHY2361 Modern Physics 3 elective course units*</td>
<td>PHY3380 Physics and Applied Physics Laboratory I 3 elective course units*</td>
<td>PHY4320 Introduction to Solid State Physics 3 elective course units*</td>
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</tbody>
</table>

#### Notes
- ITI120 is a prerequisite for most further courses in computer science (CSI). GNG1106 is recommended for students not taking further computer science courses (CSI).
- **Out of the 24 elective course units, some breadth in other sciences is recommended and particularly CHM1311.**
- **May be taken anytime in 3rd or 4th year if prerequisites satisfied.**
- Telfer School of Management Education and the extended French stream are available with this program.
## MAJOR IN PHYSICS (54 UNITS)

### 1ST YEAR (15 units)
- **Fall**
  - MAT1320 Calculus I
  - MAT1341 Introduction to Linear Algebra (Fall or Winter)
  - PHY1121 Fundamentals of Physics I (if 4U Physics not completed)

### 2ND YEAR (21 units)
- **Fall**
  - MAT2122 Multivariable Calculus
  - PHY2332 Calculus III for Engineers
  - PHY2333 Mechanics

### 3RD YEAR (9 units)
- **Fall**
  - PHY3350 Thermodynamics (Fall of 3rd or 4th year)
  - PHY3902 Physics and Applied Physics Laboratory I (Fall of 3rd or 4th year)

### 4TH YEAR (9 units)
- **Fall**
  - PHY3902 Physics and Applied Physics Laboratory I (Fall of 3rd or 4th year)

### Notes
- 1. Some physics courses are offered in alternating years with the French equivalent. Please note that all programs in the Faculty of Science require a minimum of 12 course units from the faculties of Arts, Education, Law, Social Sciences or the Telfer School of Management. Co-operative education and the extended French stream are available when taken as part of an honours degree.
- 2. MAT1321 is a prerequisite to some second year physics courses; check the university calendar. Students interested in applying for graduate studies in biological physics in the Department of Physics at uOttawa are recommended to take some of the following courses: PHY2161, PHY3350, PHY3355, MAT2324 or MAT2384. For more details the interested student should consult with the potential research supervisor of the Department of Physics.

## MINOR IN PHYSICS (30 UNITS)

### 1ST YEAR (15 units)
- **Fall**
  - MAT1320 Calculus I
  - MAT1330 Calculus for the Life Sciences I
  - PHY1121 Fundamentals of Physics I (if 4U Physics not completed)

### 2ND YEAR (12 units)
- **Fall**
  - 6 optional course units from:
    - PHY2311 Waves and Optics (Fall)
    - PHY2333 Mechanics (Fall)
    - PHY2100 Fundamentals of Applied Physics III (Fall)
    - PHY2332 Electricity and Magnetism (Winter)

### 3RD YEAR (3 units)
- **Fall**
  - A minimum of 3 optional course units in PHY at the 3000 or 4000 level (Fall or Winter; may be taken in 3rd or 4th year)

### Notes
- 1. PHY2100 and PHY2101 cannot be combined for credit.
- 2. Excluding PHY3902, PHY3903, PHY3904, PHY4006, PHY4327, PHY4903 and PHY4906.

## MINOR IN BIOPHYSICS (33 UNITS)

### 1ST YEAR (18 units)
- **Fall**
  - CHM1311 Principles of Chemistry
  - CHM1301 Principles of Chemistry (if 4U Chemistry not completed)
  - MAT1320 Calculus I
  - MAT1330 Calculus for the Life Sciences I
  - PHY1121 Fundamentals of Physics I (if 4U Physics not completed)

### 2ND YEAR (6 units)
- **Fall**
  - PHY2325 Physics in Biology

### 3RD YEAR (9 units)
- **Fall**
  - BIO3153 Cell Biology
  - PHY3325 Introduction to Molecular Biophysics

### Notes
- 1. PHY3141 is a prerequisite to some second year physics courses; check the university calendar. Students interested in applying for graduate studies in biological physics in the Department of Physics at uOttawa are recommended to take some of the following courses: PHY2161, PHY3350, PHY3355, MAT2324 or MAT2384. For more details the interested student should consult with the potential research supervisor of the Department of Physics.
PHYSICS AND ELECTRICAL ENGINEERING

Discover the fundamental laws of nature, and then apply this knowledge in the design of breakthrough technologies that will transform our society. While physics probes big questions, from the origin of the universe to the workings of the quantum world, electrical engineering underlies the technologies that are ubiquitous in our modern world, from power generation to the computer chip.

By teaching you the foundations of how nature works, and then how to innovate with this knowledge, this integrated program will uniquely equip you to tackle societal and technological problems facing us and future generations. In five years you will earn two degrees, one in physics and one in electrical engineering, and will be truly challenged to defy the conventional.

HONOURS BSc IN PHYSICS / BASc IN ELECTRICAL ENGINEERING (159 UNITS)

<table>
<thead>
<tr>
<th>1ST YEAR (30 units)</th>
<th>2ND YEAR (33 units)</th>
<th>3RD YEAR (30 units)</th>
<th>4TH YEAR (33 units)</th>
<th>5TH YEAR (33 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM131 Principles of Chemistry</td>
<td>CEG2136 Computer Architecture I</td>
<td>CEG3136 Computer Architecture II</td>
<td>ELG4912 Electrical Engineering Design Project: Part I</td>
<td>PHY4006 Physics Research Project (Fall and Winter)</td>
</tr>
<tr>
<td>GNG1106 Fundamentals of Engineering Computation (Fall or Winter)</td>
<td>ELEC2138 Circuit Theory I</td>
<td>ELG3106 Electromagnetic Engineering</td>
<td>PHY3341 Theoretical Physics</td>
<td>PHY4370 Quantum Mechanics</td>
</tr>
<tr>
<td>MAT1320 Calculus I</td>
<td>MAT2322 Calculus III for Engineers (Fall or Winter)</td>
<td>ELG3125 Signal and System Analysis</td>
<td>PHY3350 Thermodynamics</td>
<td>PHY4382 Introduction to Solid State Physics</td>
</tr>
<tr>
<td>MAT1341 Introduction to Linear Algebra (Fall or Winter)</td>
<td>MAT2384 Ordinary Differential Equations and Numerical Methods (Fall or Winter)</td>
<td>ELG3136 Electronics II</td>
<td>PHY3370 Introductory Quantum Mechanics</td>
<td></td>
</tr>
<tr>
<td>PHY1121 Fundamentals of Physics I</td>
<td>PHY2311 Waves and Optics</td>
<td>ELG3316 Electric Machines and Power Systems</td>
<td>HIS2129 Technology, Society and Environment since 1800 (Winter)</td>
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<td></td>
<td>PHYS2333 Mechanics</td>
<td></td>
<td>or PHI2394 Scientific Thought and Social Values (Fall)</td>
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</tr>
</tbody>
</table>

Notes: 1(MAT2141 or MAT2342) or (MAT2371 or MAT2377) is recommended  | 2Students in the Power and Sustainability Option must take PHY4324 Energy Technologies, which may need to be taken in the winter of the fourth year  | 3Compulsory electrical engineering/computer engineering (ELG/CEG) 4000 level courses (students must choose one of the following options): a) Communications option: ELG4118, ELG4139, ELG4156, ELG4176, ELG4177, ELG4178 b) Systems Engineering option: CMG4158, ELG4137, ELG4156, ELG4176, ELG4177  c) Electronic option: ELG4115, ELG4117, ELG4137, ELG4159, ELG4176, ELG4177  d) Microwave and Photonic Engineering option: ELG4115, ELG4117, ELG4159, ELG4176, ELG4177  e) Power and Sustainable Energy option: ELG4125, ELG4126, ELG4139, ELG4157, ELG4159, ELG4179 | The extended French stream is available with this program. |
**LIFE SCIENCES**

The Minor in Life Sciences gives students who carefully choose their optional courses the prerequisites to apply to schools of medicine, dentistry or pharmacy. Students are strongly urged to carefully check the admission requirements of schools they are considering. This minor cannot be combined with other life sciences programs (Biochemistry, Biology, Biomedical Science) as they already cover the material of the minor and more fully prepare students thinking of entering life science-based professions.

**MINOR IN LIFE SCIENCES (30 UNITS)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Units</th>
<th>Courses</th>
</tr>
</thead>
</table>
| **1st Year** | 9 | BIO1109* (register to this course if 4U Biology not completed)  
BIO1130 Introduction to Organismal Biology |
| **2nd Year** | 9 | CHM2120 Organic Chemistry II  
CHM2123 Laboratory of Organic Chemistry II |
| **3rd Year** | 6 | 3 optional course units in BCH, BIO, BPS, CHM, EVS, MIC or PHA at the 3000 or 4000 level (Fall or Winter)¹,² |
| **4th Year** | 6 | 3 optional course units in BCH, BIO, BPS, CHM, EVS, MIC or PHA at the 3000 or 4000 level (Fall or Winter)¹,² |

**Notes** ¹Students can register in 3000 or 4000 level courses having a laboratory component only with permission from the Faculty. ²Students who wishes to meet the entrance requirements for the Faculty of Medicine should choose BCH3120 or CHM1311 plus CHM2353 as part of their optional courses. ³This course is beyond the requirements of the programs in science.