Program Updates for the Faculty of Science

New changes have been approved in the Faculty of Science.

New concentrations are available in the Bachelor of Science (Honours), Psychology program. These concentrations are Cognitive Psychology, Developmental Psychology, Forensic Psychology, Health Psychology, Organizational Psychology, and Social and Personality Psychology. These concentrations are also available in the Bachelor of Arts (Honours), Psychology program.


Co-operative Education options have been added in the Bachelor of Science (Honours) programs in Food Science and Nutrition, Physical Geography, and Geomatics.

The Bachelor of Computer Science (Honours) has added a new work experience opportunity to its long standing Co-operative Education program. There is a now an Industrial Application Internship option as well.

Admission Changes: The Bachelor of Science (Honours) programs in Biology and Physics, and Chemistry and Physics no longer require the Calculus (MCV4U) for admission.

Note: Biostatistics is no longer offered in the Bachelor of Mathematics.
Explore Science @ Carleton

The Faculty of Science consists of:

6 DEPARTMENTS
• Biology
• Chemistry
• Earth Sciences
• Health Sciences
• Neuroscience
• Physics

2 INSTITUTES
• Biochemistry
• Environmental Science

2 SCHOOLS
• Computer Science
• Mathematics and Statistics

Students can choose to study one of:

4 DEGREE PROGRAMS
• Bachelor of Computer Science
• Bachelor of Health Sciences
• Bachelor of Mathematics
• Bachelor of Science

*Co-op is available in most Honours programs.
Welcome to the Faculty of Science

Carleton University’s Faculty of Science is home to internationally renowned researchers who have a passion for sharing their expertise with students. At Carleton, you will have the opportunity to work with these world-class researchers as soon as you get here, for many of our research stars shine just as brightly in our first-year classrooms as they do in sophisticated laboratories and on international research projects.

We also believe that the best way to learn science is to do science. From the start of your first year, you will be engaged in hands-on learning in state-of-the-art labs. Learning through discovery will continue throughout your program, with opportunities for summer internships, co-op placements and field courses.

You will find that we are committed to your success. We are proud to offer you access to our Science Student Success Centre (SSSC) to help you make the most of your Carleton experience. The SSSC offers science-specific advice on a variety of topics, including how to get the most out of your lectures, how to study more effectively, how to get involved in research and how to apply to graduate programs or medical school.

We are a dynamic community of researchers/teachers who thoroughly enjoy interacting with students. We hope you will join us!
At Carleton, we believe that science is fundamental to understanding the world around us. A Carleton science education is comprehensive, challenging and designed to equip you to work, teach and conduct research effectively in a scientific and technologically advanced environment.

Carleton offers you a comprehensive range of rigorous, innovative programs in all the main areas of computer science, mathematics and statistics, and the natural sciences. You can choose from over 50 different programs, specialize within specific areas of concentration, complete a combined degree in two areas or complement your main subject of interest with a minor in another. All of our programs are offered as four-year Honours programs. We also offer some four-year Major programs and some three-year General programs. Students considering graduate studies should enrol in the Honours program as they will complete a fourth-year research project which is excellent preparation for graduate studies.

Research intensive
Carleton’s Faculty of Science is highly active in fundamental and applied research. Our students participate in this successful research enterprise and are encouraged to learn through discovery by engaging in a wide variety of research opportunities in our well-equipped laboratories and classrooms.
Supportive environment

Our students are taught by many leading scientific researchers and award-winning professors. As a Carleton student, you will benefit directly from their knowledge and expertise. You will take part in stimulating team projects, present your work at specially designated research days on campus, be inspired by guest speakers and have plenty of opportunities to expand your studies beyond the classroom.

Cohesive community

As a first-year science student, consider joining a Science Learning Community and:

- be part of a small group of students who take the same lectures, labs and tutorials
- be offered a timetable with all your mandatory courses already included
- meet other students in your program
- easily form lab partnerships and study groups
- participate in skills-development workshops
- be matched with an upper-year student mentor

If you are interested in this unique opportunity, visit the Science Learning Community website at slc.carleton.ca for all the details.

Ideal location

Carleton’s location in Ottawa, the nation’s capital, means that we can offer our students access to resources not readily available elsewhere. These resources include:

- federal government departments and agencies
- government and industry labs specializing in health, the environment, agriculture and natural resources
- an extensive diplomatic community
- national libraries and museums
- a vibrant high-tech and bio-tech sector
- teaching and research hospitals
- national and international associations and organizations

All of these provide Carleton students with a wealth of possibilities for resources, co-op placements and work opportunities.

Many research-intensive government departments and agencies, including the National Research Council Canada, are located in the National Capital Region.

National museums, such as the Canadian Museum of Nature, provide research opportunities for students.

The city offers our students a wealth of potential science employers, in a variety of fields:

HIGH-TECH
- high-tech firms such as IBM Canada, Mitel and Mxi Technologies
- biotechnology firms including Exova and Abbott Point of Care

HEALTH SCIENCES
- clinical, medical and life sciences research organizations (including the Ottawa Hospital Cancer Centre)

RESEARCH
- national museums (including the Canadian Museum of History, the Canada Science and Technology Museum, and the Canadian Museum of Civilization)
- research-intensive federal government departments and agencies such as Environment Canada, Health Canada, Agriculture and Agri-Food Canada, the National Research Council Canada, Natural Resources Canada, Statistics Canada and the Canadian Food Inspection Agency
Our faculty aim to prepare you for an exciting future in a competitive and evolving world. They constantly search for ways to enhance your learning experience through innovative course, lab and field work. As part of your program at Carleton, we ensure that you have many opportunities to pursue research interests alongside award-winning teachers and leading scientific researchers.

You will be taught by renowned researchers, published authors and expert teachers sought out by media and government for their knowledge, expertise and commentary. They will teach you how to probe a variety of sources for information, apply the latest in research techniques and make critical assessments of your findings—as well as provide the support and guidance you need as you become increasingly sophisticated as a scientist yourself.

At Carleton, we make high quality laboratory experiences and field trips a key feature of our programs.

FIRST-YEAR SEMINAR
First-year science students are encouraged to enrol in our unique seminar course Seminar in Science (NSCI 1000). This course is designed specifically to introduce you to the latest scientific developments and technical, methodological, teamwork and communication skills immediately.
issues and help you develop the kind of communication, analytical and research skills needed for science studies. If you choose this elective, you will attend several special lectures given by prominent Canadian researchers, as well as small group seminars led by a professor who acts as both your mentor and teacher. This limited-enrolment course exposes you to different concepts, teaching styles and research opportunities and allows you to participate directly in workshops, discussions and debates.

**FOURTH-YEAR PROJECT**

By the time you reach the fourth year of your Honours program, you will be ready to undertake a major research project in a group setting. Your professors will provide direction and supervision, as well as a choice of interesting topics. Your fourth-year project will give you an area of special expertise as well as experience in following a research problem through, from start to finish.

**Science cafés**

Carleton professors share their expertise not only with their students but also with members of the Ottawa community. Twice a month during the academic year, a neighbourhood café becomes the venue for a Carleton science professor to address an issue of the day through their area of study. These popular evenings have attracted audiences from across the city and subject matter has ranged from “The Mysterious World of Fungi” to “The 100th Anniversary of World War I: How Chemical Weapons Led to Cancer Chemotherapy.” Check out what was discussed in the past and what’s upcoming at sciencecafe.carleton.ca.

**Work opportunities**

**CO-OPERATIVE EDUCATION**

Most of our Honours degree programs offer 12 months or more of co-operative education in local and provincial businesses and industries. This opportunity to put theory into practice helps hone your skills and prepare you for a scientific career in areas such as research, health or the environment. Co-op education is available in many of the Bachelor of Science (Honours), Bachelor of Mathematics and Bachelor of Computer Science programs. carleton.ca/cc

**SUMMER RESEARCH INTERNSHIPS**

After your first year, you could be eligible to participate in a Dean’s Summer Research Internship (DSRI), giving you the opportunity to work in a research group headed by a Carleton professor.

After completion of your second year, you could be eligible for the Natural Sciences and Engineering Research Council of Canada (NSERC) Undergraduate Student Research Award (USRA) Program, allowing you to work in a research group made up of professors, undergraduate students and graduate students. These teams work on innovative solutions to real-world problems in all the natural sciences.

**TEACHING ASSISTANTSHIPS**

Senior students may work in their departments as research assistants or teaching assistants. You could also be chosen to work in a Carleton research lab for the summer, supported by one of our faculty members’ research grants.

**World-class research**

Carleton science professors and students are part of an extensive network of scientists from around the world who work together. As a science student, you could become part of these exciting collaborations and have the opportunity to engage in some of the world-class research carried out by Carleton professors. Here are some examples of these research projects:

**SNOLAB**

Carleton is one of three Ontario universities that participate in SNOLAB, an international research facility based in Sudbury and located at the bottom of a mineshaft in the Vale Inco Creighton Mine. Expanding upon the already successful scientific program at the Sudbury Neutrino Observatory, SNOLAB hosts research facilities designed to capitalize on the low-noise radiation background experienced in the mine.

**NATIONAL WILDLIFE RESEARCH CENTRE**

Located right on campus, the National Wildlife Research Centre is headquarters for a network of wildlife researchers throughout Canada and the world. Government scientists, faculty researchers and students benefit from close collaboration on shared projects. Carleton students have the opportunity to work directly with government-funded researchers from the Centre.

Mathematics professor Brett Stevens (right) sometimes turns to popular puzzles and games to demonstrate mathematical concepts, as he did here at one of our Science cafés.
Carleton’s Computer Science program teaches you the principles of solving computational problems, while giving you up-to-date applied skills for working in the information technology, biotech and multimedia industries.

THE PROGRAM
- Several program options, including the four-year Honours and Major degree programs, and a Combined Honours program with Mathematics
- Six specialty streams and three multidisciplinary streams in the Honours program. You may also choose to take the Honours degree without a stream, or to start without a stream and add one later.
- Complementary study in minor areas such as business, history, music, psychology and the natural sciences
- Honours program accredited by the Canadian Computer Science Accreditation Council
- Co-operative education options

SPECIALTY STREAMS
Computer Game Development
This stream is ideal for those with a strong interest in the design and implementation of computer games. Topics of study include basic architecture, animated scenes, game character development, special effects, networked games and large, multi-player online games.

Algorithms
If you have strong mathematical abilities and wish to pursue an advanced degree or a career in cutting-edge research after your bachelor’s degree, this stream is designed for you. In addition to core courses in computer science, this stream includes foundational courses on
algorithms that will teach you to design, analyze, experiment with and reason about the algorithms that arise in modern applications.

**Mobile Computing**
We are in the midst of a long-term shift of computing applications from desktop machines to mobile platforms such as smartphones and tablet computers. In the Mobile Computing stream you will study some of the fundamental problems related to computing on mobile devices, and at the same time develop the practical skills needed to develop sophisticated mobile applications. Students in the stream must have their own laptop computer.

**Software Engineering**
Software Engineering is concerned with correct, timely, reliable and secure operations on information. It covers communication, storage and presentation of information; rapid, economical and correct development of software; and understanding and satisfying user requirements. The stream is accredited as both a computer science program and a software engineering program.

**Computer and Internet Security**
The Computer and Internet Security stream is for those interested in security issues for computing and communication networks. Computer and Internet Security provides a strong background in computer science and software engineering, as well as depth in both the foundations and the practice of information systems security.

**Network Computing**
In Network Computing, you will learn about the specific challenges of computing in a networked environment. Your studies will range from the design and implementation of parallel and distributed algorithms to the architecture and workings of client/server systems.

**MULTIDISCIPLINARY STREAMS**

**Management and Business Systems**
For as long as they have existed, computers have been applied to commercial enterprise. Today, they are used in practically every application affecting our daily lives—from the stock exchange to the grocery store. This stream combines courses in computer science with courses offered by Carleton’s Sprott School of Business.

You can learn from Computer Science faculty who are engaged in cutting-edge research, such as Professor Sonia Chiasson, who is a Canada Research Chair in Human-oriented Computer Security and deputy scientific director of the Smart cybERsEcurity Network – Réseau intégré sur la cybersécurité (SERENE-RISC).

**Psychology**
This stream focuses on the relationship between computer science and psychology, including areas such as cognitive science, human factors, product-design methodology and social aspects of computer use.

**Biomedical Computing**
This stream is geared toward students who wish to work as computer scientists or software engineers in biotechnology, medical computing or the life sciences.

**Honours versus Major program**
Both programs teach you the fundamentals in computer science and give you the opportunity to explore and experiment with the latest computer systems and applications. The Major program is ideal for those desiring a somewhat less rigorous program and the chance to take a variety of courses of their own choosing.

**Minor program**
Students interested in combining their skills in computer science with knowledge of another area of study can opt to take a four-credit minor in another discipline. Visit the Carleton University Undergraduate Calendar for a complete list of minors available. carleton.ca/cuuc
Bachelor of Health Sciences

Carleton’s Bachelor of Health Sciences (BHSc) is a wide-ranging and career-focused program that will provide you with the skills required to succeed in the rapidly changing worlds of medicine, biomedical research and healthcare research. You will gain a strong foundation in the scientific knowledge and methods involved in the study of human health, along with the capacity to engage in broader multidisciplinary, multi-sector, and multicultural approaches to finding solutions to some of the most crucial health issues of our time.

Program of study
The BHSc program offers a broad-based foundation in health science that can prepare you for postgraduate education in biomedical research and professional fields like medicine, dentistry or veterinary medicine, as well as for careers in health-related fields like public health, global and environmental health law and policy, and health services and community healthcare.

The BHSc program offers five concentrations, which can be combined in unique and informative ways:

BIOMEDICAL SCIENCES
This concentration provides a strong foundation in the biomedical sciences and allows you to explore the genetic, biochemical, immunological, physiological and developmental aspects of human health. In addition, a broader view of health sciences is gained by addressing current issues from cultural, psychological, technological and environmental perspectives. Training in the dynamic field of biomedical sciences will provide you with the skills needed to be part of the exciting and rapidly changing world of biomedical research and medicine.

GLOBAL HEALTH
This concentration provides you with the knowledge required to address current and developing international health issues. It focuses on real-world issues of increasing relevance in
our interconnected global community—such as infectious diseases and pandemics—in the context of the social and political factors that influence healthcare practices and policies. You will explore such topics as the interaction between pathogens and our immune system, the way that therapeutics and vaccines work, and why it is harder to develop treatments or vaccines for some diseases than for others.

ENVIRONMENT AND HEALTH

This concentration explores the influence of our environment on our health, from toxins we are exposed to in our daily lives to the effect of climate change on global patterns of infectious disease. You will learn about the chemistry of environmental toxins, their effect on our cells and DNA, and our immune responses to them, including how multiple factors can make individuals either more vulnerable or more resilient to illness. You will also study issues related to the prevention and treatment of environmentally linked illnesses such as cancer, asthma, and neurodegenerative disorders like Parkinson’s disease and dementia.

HEALTH THROUGHOUT THE LIFESPAN

This concentration focuses on health and illness through the stages of human life. There are few health sciences programs in Canada that include lifespan studies, and Carleton’s program is unique in featuring courses that explore the entire lifespan, from neonatal development to old age. You will learn about the biological aging process, including how events occurring early in life can have effects that appear much later, in the form of medical conditions like diabetes, cardiovascular disease and depression. In addition, you will explore the biomedical basis of health and disease, and have the opportunity to learn how factors such as gender and social conditions can influence health.

DISABILITY AND CHRONIC ILLNESS

This concentration is unique to Carleton. It introduces you to the biomedical, social and psychological basis of chronic illnesses and explores treatment strategies to enable productive and healthy lives. Chronic illnesses and disabilities affect the quality of life of a large number of people and include heart disease, cancer, chronic pain conditions, mental health problems and physical disabilities. You will learn about biomedical, cognitive and technological advances, as well as the ethical dilemmas affecting intervention and treatment.

Hands-on approach

All concentrations in the BHSc program provide a hands-on approach that includes laboratories, workshops and seminars, beginning in first year. Students can take advantage of programs offered at Carleton that include summer research internships, the co-curricular volunteer program and international alternative break opportunities. The fourth year of the program provides a capstone experience with various options and hands-on experiences to choose from (pending satisfaction of academic requirements) that can advance your personal and professional goals.

Double concentration option

For those who would like to fuse two areas of study, it is possible to take a double concentration. For example, Biomedical Sciences can be combined with Global Health, if you wish to address new and emerging diseases. Likewise, you might wish to combine the concentrations in Health Throughout the Lifespan and in Disability and Chronic Illness to focus on issues relating to healthy aging. Taking a double concentration can add value to your degree for when you enter the job market or when you apply to professional or post-graduate programs.

The Carleton advantage

The BHSc program reflects Carleton’s strengths in such fields as global and international studies, journalism and evidence-based practices and policy, and architecture and the built environment. This emphasis on interdisciplinarity will provide you with the breadth of knowledge and experience that medical schools and employers look for.

The capital advantage

Carleton’s location in the nation’s capital has enabled the university to forge partnerships in the area of health with both the public and private sectors. There are numerous organizations, agencies, research institutes and hospitals in the region that together provide a knowledge base unique to Ottawa.

Careers

There is great demand for highly-skilled workers in the health sector in Canada. The concentrations in the BHSc program are designed to prepare you for a diverse array of health careers but also provide excellent preparation for medical school and other professional training.
Mathematics is a driving force behind many of today’s advancements in medicine, economics, business, science and technology. As a Bachelor of Mathematics student you can choose from a broad range of program options according to your interests and career goals. You will graduate with a BMath instead of a BSc degree, and this designation, in combination with the skills gained from our programs, will provide you with a competitive edge in many careers and prepare you to contribute to the next generation of innovations.

Carleton provides focused training in both mathematics and statistics. You will be taught by leading researchers with specialized areas of expertise that cover a diverse range of mathematical and statistical disciplines.

Mathematics (HONOURS AND GENERAL)
Mathematical ideas and reasoning provide the foundation with which powerful and broad ranging theories may be devised.

Mathematical theories have been utilized to provide secure computer storage and transmission of data. They also help forecast complex systems such as disease spread, financial markets and weather patterns. Carleton mathematics programs are built around a strong core of fundamental pure mathematics. This allows you to branch out into many different areas of modern mathematics and applications, including a specialization in Stochastics. Graduates are well equipped to pursue a broad range of career paths or further graduate study.

Statistics (HONOURS AND GENERAL)
Statistics applies mathematical methods to the search for useful information in the face of uncertain data. From planning data collection methods, to monitoring the processing of data and advising on the interpretation and limitations of results,
statisticians are involved at many levels of government, business and research. The Statistics programs are designed to provide all the fundamental tools used in statistical analysis. Graduates can pursue careers in a wide array of fields, including actuarial science, business, finance, communications, health science and environmental science.

**ACTUARIAL SCIENCE CONCENTRATION**
A concentration in Actuarial Science is now offered in the Statistics Honours program. This concentration incorporates a targeted sequence of courses in Business and Economics that provides students with the necessary background to satisfy all six undergraduate requirements set out by the Society of Actuaries for professional designation.

**Biostatistics (COMBINED HONOURS)**
Biostatistics brings mathematical and statistical reasoning to bear on the complex problems presented in research areas such as genetics, medicine and environmental science. The Biostatistics program combines comprehensive statistical training with substantial exposure to relevant topics in biology so graduates are well prepared to enter this rapidly emerging field.

**Computational and Applied Mathematics and Statistics (HONOURS)**
More than ever, computers play a crucial role in an increasing range of careers. As a student in Honours Computational and Applied Mathematics and Statistics or General Computer Mathematics, you will acquire the training and experience you need to harness the power of computers to solve critical problems in business, government and science. You will gain valuable experience in the use of versatile and widely used software packages. The program provides a broad background in computing, statistics and mathematics, ensuring graduates emerge with the necessary knowledge and skills for any number of computer oriented careers.

**Computer Science and Mathematics (COMBINED HONOURS)**
The combined Bachelor of Mathematics degree in Computer Science and Mathematics is a challenging but rewarding mix of these complementary subjects. Students receive comprehensive training in mathematical and statistical methods related to computing, combined with exposure to advanced computer science topics such as the design of operating systems and software engineering. With two concentrations—Computing Theory and Numerical Methods, and Statistics and Computing—this program is an excellent choice for students who wish to combine practical computer knowledge with a strong theoretical foundation.

**Economics and Mathematics; Economics and Statistics (COMBINED HONOURS)**
The combined Bachelor of Mathematics degrees with Economics bring together fundamental courses in economics with related courses in mathematics and statistics. These programs are designed for those interested in career paths in fields such as econometrics, or business forecasting. The programs share many common elements, but have different emphases on either mathematics or statistics.

**Mathematics and Physics (DOUBLE HONOURS BSC)**
The Double Honours in Mathematics and Physics is a demanding program which incorporates the full requirements of the Honours Mathematics and Honours Physics degrees. As such, it requires 1.5 additional credits, but affords the full advantage of the theoretical foundation found in mathematics to help students appreciate more fully the motivations and applications found in physics. This ensures that students graduating from this program are in a strong position to pursue careers or further graduate study in either discipline.

**Fast-track program**
Carleton offers an elite fast-track program in which high-achieving students can complete both a bachelor’s and master’s degree in just four years.

**Graduate with work experience**
The co-op option is available to qualified students in our Honours programs and gives you the opportunity to put theory into practice. You may graduate with 16 to 20 months of professional work experience and a valuable network of job contacts while earning money to fund your university education.

**Tutorial Centre**
The Mathematics Tutorial Centre provides a free drop-in service where you can access one-on-one tutorial assistance with mathematics problems.

**Math Matters**
At Carleton, we want you to experience success. That’s why we’ve introduced Math Matters, a program run in August specifically designed for first-year students who are entering programs at Carleton with a math component. It is a great opportunity for students to revisit key math components and to prepare for university-level courses. Visit [carleton.ca/mathmatters](http://carleton.ca/mathmatters) for details.
Studying science gives you the skills you need to join an ever-changing workforce and to become a valuable resource for employers in government, industry or education or in fields such as medicine, dentistry or pharmaceutical sciences.

As a Bachelor of Science graduate, you will have a unique blend of skills that will enable you to tackle problems with initiative and resourcefulness, plan and execute projects, and work as part of a team.

**THE PROGRAM**
- Honours, Combined Honours and three-year General programs
- Four-year Major programs available in Biochemistry, Biology, Earth Sciences, Environmental Science, Neuroscience and Mental Health, and Physics
- First-year Seminar in Science
- Experimental sciences laboratory work starting in the first year
- Top-notch resources, including new laboratories, laboratory equipment, classrooms and computer labs
- Complementary minors in other areas of interest, such as business, law, psychology, philosophy or a second area of science
- Co-operative education options in most Honours programs

**Biochemistry**
The science of biochemistry seeks to understand how organisms function by investigating enzyme reactions, mechanisms of gene regulation, chemical signaling pathways, and cellular structure at the molecular level. Biochemists study how animals, plants and bacteria make use of energy to grow, compete with other organisms and reproduce. Many of the biochemist’s findings are of direct relevance to humanity—they help us understand and treat disease, improve food production and find new techniques to produce valuable products such as vitamins and antibiotics.

Biochemistry programs are excellent training options for entry into medicine and other health sciences professional programs.

Honours programs in Computational Biochemistry and in Biotechnology and Biochemistry are also offered.

**CAREER PATHS**
- environmental and toxicology consulting
- forensic sciences
Biology and Biotechnology, and several interdisciplinary joint programs with other departments and with the College of the Humanities. Students in the BSc (Honours) program in Biology will have extensive opportunities to learn in lab-based environments and may choose to specialize in one of four concentrations: Ecology, Evolution and Behaviour; Health Science; Molecular and Cellular Biology; and Physiology.

CAREER PATHS
- agriculture and horticulture sciences
- applications in biotechnology
- environmental consulting
- genomics
- medicine and health sciences research
- wildlife management

Biotechnology
Biotechnology applies the principles of biochemistry and biology to the study and manipulation of living organisms for industrial, medical, agricultural and environmental applications.

Some areas of biotechnology include genetic engineering, metabolic engineering, personalized medicine, drug development, applied microbiology and fermentation techniques, and biological control of insect pests. In the Ottawa area, local companies and government agencies are involved in projects such as biofuel production from agricultural waste, the development of medical diagnostic screening devices, and the development of new anti-cancer and antimicrobial therapies.

The extensive laboratory training provided in this program will give you the experience you need to work in a laboratory environment. Biotechnology is offered as a specialized Honours program in conjunction with Biology or Biochemistry.

CAREER PATHS
- agricultural research
- biotechnology consulting
- environmental biotechnology consulting
- forensic sciences

Chemistry
As a student interested in chemistry, you can enrol in programs and courses in all the main areas of chemistry, including analytical, inorganic, organic, physical and environmental chemistry. If you wish, you can choose to pursue a concentration in Nanotechnology where you will study the atoms and molecules used to create computer chips and other devices that are the smallest permitted by current technologies. Extensive lab experience is offered, helping you to round out your studies with practical experience.

“Before starting at Carleton I decided to take Math Matters, a pre-university math course at Carleton that gets students ready for university math. This is where I learned about the Science Student Success Centre (SSSC). In first year I had a chance to be involved with the SSSC as a first-year rep and in upper years I continued as a mentor. While at the SSSC I learned to improve my time management, study and note-taking skills thanks to their training. This year I have been able to take all those skills and become their training coordinator.

While at Carleton I have had a chance to get involved with the Carleton University Student Emergency Response Team (CUSERT)—the medical response team on campus. Some of the best friends that I have made during my university experience are on this team. Being part of CUSERT has taught me a lot about the medical field and about myself.”

Owen Hovey, Biology student
and a solid foundation in training in computer science and in biochemistry program was The Computational development of tools to analyze and manage this flood of data. One of our biggest challenges is the embeddedness of the recent application to biochemistry has been transformed by the recent development of instruments and technologies. Additionally, applications using nanotechnology are already evident in the electronics and aerospace industries. Nanotechnology is set to revolutionize science and technology.

CAREER PATHS
- biomedical, environmental and communication technology
- microelectronics and aerospace

Computational Biochemistry
The modern era of biochemistry has been transformed by the recent development of instruments which can generate vast amounts of information about entire genomes or thousands of proteins or metabolites. One of our biggest challenges in biochemistry is the development of tools to analyze and manage this flood of data.

The Computational Biochemistry program was developed to provide both training in computer science and a solid foundation in biochemistry. Students are exposed to the core areas of biology and chemistry, including genetics, cell biology, organic chemistry and analytical chemistry, as well as general and experimental biochemistry, bioinformatics and molecular modelling. Optional courses allow you to focus on areas such as molecular genetics, pharmaceutical drug design, functional genomics and protein structure and function.

CAREER PATHS
- biomedical and genetic data analysis
- biomedical data management
- biomedical research and development
- biotechnology research and development
- combinatorial drug and enzyme design
- forensic sciences/data analysis
- industrial research and development
- pharmaceutical research
- science illustration and communications
- teaching and instructional innovation
- technical sales for biotechnology companies

Earth Sciences
The Earth Sciences program at Carleton offers you the opportunity to study the Earth’s systems, incorporating knowledge from other sciences including physics, biology and chemistry. You will learn about processes (such as evolution, earthquakes, volcanic eruptions, plate tectonics and mountain building, formation of hydrocarbon reservoirs and mineral deposits) and influence the Earth’s geologic past that establish our present and future global development. The program offers the opportunity to participate in hands-on field courses that can take you to sites throughout Ontario, across Canada and around the world.

Honours students may enroll in concentrations such as Finance: Resource Valuation; Geophysics, Resource Economics; or Vertebrate Paleontology and Paleobiology; or in Combined programs with Biology, Chemistry or Physical Geography that provide a broader understanding of fields related to Earth Sciences. Honours and Major graduates are eligible to apply for Professional Geoscientist registration in Canada—an important designation in the job market. Some Earth Sciences students may be interested in taking a minor in Business or Geomatics.

CAREER PATHS
- natural resources exploration
- research in government, industry or university laboratories
- resource and investment valuation in business
- water resources, environmental assessment or remediation

Environmental Science
The Environmental Science program brings together the study of biology, chemistry, earth sciences and geography to enable its graduates to address complex and multidisciplinary environmental and conservation problems. Through lecture and seminar courses, hands-on laboratory work and field camps, students become proficient in topics such as water resource management, fish and wildlife ecology, ecological restoration, sustainable resource extraction, environmental monitoring, and environmental policy. In the upper years, students take courses in chosen areas of study and hone their skills in preparing research and thesis projects, working in teams and individually on current problems facing environmental science.

Concentrations are available in Biology, Chemistry and Earth Sciences. The Environmental Science honours program is accredited by ECO Canada (www.eco.ca), which aids the graduates of our program in following their own interests and paths to tackle a wide range of environmental issues.

CAREER PATHS
- environmental impact assessment and monitoring
- environmental policy analysis
- graduate studies, research and education
- industrial and environmental consulting
- natural resource management
- wildlife and habitat conservation

Food Science and Nutrition
Knowledge of food and nutritional science is required in order to make decisions on such issues as food irradiation, the genetic modification of
foods, food contamination by micro-organisms and toxic compounds, and food preservation. Carleton’s program in Food Science and Nutrition is unique in that it combines a solid science base with the study of the assessment, management, and communication of risk in food safety. No other food or nutritional science program in Canada offers such depth of study in food science as well as food economics, risk assessment, policy and regulation.

The modern job market for food professionals demands people that have technical skills as well as an understanding of regulatory and policy issues. People with both sets of skills are in demand by all levels of government and by the private sector.

**CAREER PATHS**
- analytical chemist
- food microbiologist
- food safety and nutrition evaluator
- quality assurance and regulatory oversight
- research and development

**Geomatics**
From Google Maps to GPS navigation to global vegetation and water monitoring, geomatics deals with the acquisition, management, analysis and display of geographic information. In our Geomatics BSc program, you will obtain intensive science-based training in geographic information systems (GIS), remote sensing (imaging from satellites and aircraft) and cartography, including web-based applications. You will apply advanced computer software and techniques to the challenge of understanding the Earth’s physical and natural systems, addressing environmental problems and planning human interventions. Our program combines hands-on learning using the latest in laboratory facilities with opportunities to gain field experience and do work placements. Science-based geomatics applications include the modeling and mapping of the physical and natural environment, resource planning, land cover and vegetation mapping, and hazards mapping, amongst many others. The BSc in Geomatics includes training in associated physical or natural sciences and computer sciences. Geomatics can also be taken as a BA Honours degree.

**CAREER PATHS**
- environmental consulting
- GIS/remote sensing analysis, in applications such as mapping and monitoring of forests, water, ice, agriculture, or land use development
- natural resources management
- regional land use evaluation and environmental assessment
- web based geomatics, including design and programming

**Nanoscience**
Nanoscience is concerned with the study of matter at a scale on the order of 10 to thousands of atoms. At Carleton, you will examine nanoscience through the disciplines of physical chemistry and electrical engineering to understand the physical, chemical and electronic characteristics of matter in this size regime. The combination of these two areas of study will equip you to fully understand nanoscience in photonic, electronic, energy and communication technologies. The focus of the program will be on materials—their use in electronic devices, their scalability and the control of their properties. Further required courses in mathematics, physics and statistics will round out the program, and advanced courses in bionanoscience and nanoelectronics are available. A concentration in Nanotechnology is also available within the Honours program in Chemistry.

**CAREER PATHS**
- communications technology
- micro (nano) electronics
- research and development in aerospace technologies
- research and development in green technologies
- solar cell technology

**Neuroscience/Neuroscience and Mental Health**
Neuroscience is a new, exciting, and rapidly expanding scientific discipline that aims to understand how physical processes in our brains underlie complex functions such as movement, sensation, memory, emotion, consciousness and thought. Faculty and students in Neuroscience are particularly interested in how diseases that affect the brain lead to mental health problems, with the focus of our research including depression, Parkinson’s disease, obesity, Alzheimer’s disease and concussion. Our research, like our academic programs, integrates information from many disciplines including medicine, molecular biology, psychology, immunology, genetics, chemistry and epidemiology.

Neuroscience and Mental Health is Canada’s first undergraduate degree program to be run by a
Neuroscience Department.
The program offers flexibility of course selection for students, including opportunities for students to pursue a wide range of minors. Neuroscience (Combined Honours) is also available for students wanting more emphasis on advanced biology courses.

**CAREER PATHS**
- human genetics
- medicine
- neurology
- neuroscience
- pharmacy
- psychiatry
- research
- science journalism
- veterinary medicine

**Physical Geography**
Physical Geographers study the natural environment as a product of the interaction of the atmosphere, the hydrosphere (water in all its forms), the biosphere (all living things), the lithosphere (the solid earth) and human activity. Physical Geography is the science of the natural environment at all scales, from the smallest grain of sand to the entire planet. In the Physical Geography BSc program, you can choose from a range of courses that cover topics such as climate change, water resources and land degradation. Both fieldwork and laboratory techniques are emphasized. Physical Geography at Carleton is also offered as a concentration in the BA Honours program.

**CAREER PATHS**
- environmental consulting
- environmental management
- impacts of climate change
- natural hazard risk management
- water resource monitoring

**Psychology**
Psychologists study the mechanisms that underlie our thoughts, emotions and behaviours. They examine a diverse range of topics, such as how we think and learn, how we interact with others and how we can promote healthy development and wellness. This is accomplished by conducting research so that the knowledge gained can help us to better understand the human mind, enhance well-being and performance and generate additional research questions.

At Carleton, you will explore psychology’s major areas including cognitive, developmental, forensic, health, organizational and social/personality psychology. Specialized topics include abnormal behaviour, human neuropsychology, perception, criminal behaviour, positive psychology, and social and cognitive development.

The insights you will gain from studying psychology will serve you throughout your life, in virtually any career. Psychology is also offered as Bachelor of Arts Honours, General and Combined Honours programs.

**CAREER PATHS**
- corrections, probation, parole counselling
- early childhood education
- health and social services
- human resource management
- marketing and public relations
- mental health services
- research
Carleton offers a wide range of support services to help you make a successful transition to post-secondary studies. As you begin to interact with staff and faculty, you will find that this commitment to your success is shared by the entire campus.

**Science Student Success Centre**
The Science Student Success Centre (SSSC) was created specifically to address the needs of students in the Faculty of Science. The centre offers information sessions and workshops covering such topics as how to manage your workload, prepare for class, take good notes and study for exams and tests. Staff from the centre are available to meet with you to help you draft an individual study plan and to act as an on-going resource so you can reach your academic goals. The SSSC is also concerned with what happens to you after you finish your undergraduate studies. They can talk to you about summer jobs, career options, how to get involved in research and how to prepare for medical school. Make a plan to visit their offices and see how they can help you. [carleton.ca/sssc](http://carleton.ca/sssc)

**Carleton Complete**
As a Carleton student you can access Carleton Complete—our unparalleled package of academic and extra-curricular initiatives designed to support your complete university experience and promote a culture of success. You can take advantage of our study skills workshops, leadership-development programs, orientation sessions, weekly e-newsletter and more. Our support staff can help you understand the university’s academic regulations and find answers to your questions. [carleton.ca/students](http://carleton.ca/students).

**Student Experience Office**
The Student Experience Office (SEO) helps new students adjust to university life and continues to support students throughout their time at Carleton. The office oversees a wide variety of programs, such as:
- Summer, Fall and Winter Orientation sessions
- Community Service Learning initiatives
- Leadership Development programs
- Parent and Family Outreach publications and events [carleton.ca/seo](http://carleton.ca/seo)

**Student Academic Success Centre**
The Student Academic Success Centre (SASC) is Carleton’s centralized academic advising and learning support centre. [carleton.ca/sasc](http://carleton.ca/sasc)

For more services offered for students throughout their complete Carleton experience, check out [carleton.ca/students/services](http://carleton.ca/students/services).
A Carleton degree is an excellent investment in your future. You will have gained a strong foundation in your area of specialty and solid communication, research and analytical skills—skills that will be invaluable as you begin your career, go on to graduate studies or enter a professional program such as medical school.

**The workplace**
Carleton’s Computer Science, Mathematics and Science graduates can be found working in many local and national organizations, such as private corporations, medical facilities, educational institutions, research laboratories and federal/provincial departments and laboratories. Co-op and Career Services at Carleton provides free career planning and advice, and helps connect students with potential employers through networking events, job postings and career fairs. carleton.ca/cc

CARLETON BACHELOR OF COMPUTER SCIENCE GRADUATES AT WORK:

**Sample positions:**
Audio Artist, Field Implementation Specialist, Financial Analyst, IT Security Analyst, Programmer, Systems Analyst

**Sample organizations:**
Adobe Systems, Apple, Canada Post, Environment Canada, IBM Canada, Mitel Networks, Quest Software, Travelocity

CARLETON BACHELOR OF MATHEMATICS GRADUATES AT WORK:

**Sample positions:**
Actuary, Consultant, Data Analyst, Fraud Analyst, Math Teacher, Statistician, Tax Analyst

**Sample organizations:**
Bank of Montreal, Canada Revenue Agency, Health Canada, Rogers Communications, United Nations

CARLETON BACHELOR OF SCIENCE GRADUATES AT WORK:

**Sample positions:**
Chemical Technician, Entrepreneur, Fisheries Consultant, Genetic Counselor, Legal Metrologist, Radon Technologist

**Sample organizations:**
Aeroquest Airborne, Canadian Nuclear Safety Commission, Gamma-Dynacare, Johnson & Johnson, IMS Health, Kraft Canada, Stantec

The positions and organizations listed above for each degree are samples only, and the lists are not meant to correspond. Some positions may require further education and/or certification.
Graduate studies

Many of our Honours students pursue graduate studies either in Canada or abroad. Carleton’s Faculty of Science offers an extensive array of graduate programs in:

**Master of Computer Science**
- Human-Computer Interaction
- Bioinformatics
  (collaborative specialization)

**Master of Science**
- Bioinformatics
  (collaborative specialization)
- Biology*
- Chemical and Environmental Toxicology
- Chemistry*
- Earth Sciences*
- Geography
  (Physical Geography)
- Health: Science, Technology and Policy
- Mathematics*
- Neuroscience
- Physics*

**Doctor of Philosophy**
- Biology*
- Chemical and Environmental Toxicology
- Chemistry*
- Computer Science*
- Earth Sciences*
- Mathematics*
- Neuroscience
- Physics*

**Collaborative Programs**
- Data Science (Collaborative Master’s)

+Co-operative education is available.
*Joint program between Carleton University and the University of Ottawa

[graduate.carleton.ca](http://graduate.carleton.ca)

Thinking of applying to medical school or other professional programs?

Many professional programs, including medicine, law, teaching, and business, attract well-rounded applicants from a variety of educational backgrounds. Carleton’s undergraduate programs in science are excellent preparation for such professional programs. If you are considering a career in medicine you should familiarize yourself early with all your options. Your first step is to check out the different medical schools for admission requirements, MCAT requirements, program information and important deadlines. If you are interested in one of the six medical schools in Ontario, start by visiting the Ontario Medical Schools Application Service (OMSAS) at [www.ouac.on.ca/omsas](http://www.ouac.on.ca/omsas) for application information.

Admission requirements such as mandatory courses, CGPA and MCAT scores vary between medical schools, but generally students must show a history of academic excellence, involvement in volunteer or work placements, and letters of reference. Most medical schools also require Medical College Admission Test (MCAT) scores be included in the application for admission.

Carleton students who want to pursue medical school can study in a variety of programs including Biochemistry, Biology, Health Sciences, Neuroscience, Psychology or Biomedical and Electrical Engineering.

Applying to medical school is just one option as far as careers in healthcare are concerned. Many Carleton graduates go on to study veterinary medicine, pharmacology, dentistry or optometry. Any of these programs can help prepare you for an exciting and fulfilling career path.

**CARLETON’S SCIENCE STUDENT SUCCESS CENTRE** is available to help those students who are interested in applying to medical school. Specific activities provided by the Centre include offering information and advice; assisting with the application process and forming MCAT study groups. They also invite doctors, industry professionals, medical school faculty and current medical school students to Carleton to speak to potential applicants as well as provide information to help students find work and volunteer positions that could assist them in acquiring valuable health services-related experience.

Carleton also has an active Pre-Med Society which students are encouraged to join to meet other students considering the medical profession.

Both the Science Student Success Centre and the Carleton Pre-Med Society allow students to talk to someone who has undergone the application process (and possibly the interview process as well), so that they can receive advice based on firsthand experience.
All students must apply online through the Ontario Universities’ Application Centre at [www.ouac.on.ca](http://www.ouac.on.ca). If you are currently finishing your last year of high school, you must obtain log-in information from your school’s guidance office before applying online. Visit [admissions.carleton.ca/apply](http://admissions.carleton.ca/apply) for details.

## Ontario Admission Requirements

For admission to undergraduate programs, Ontario students must have the Ontario Secondary School Diploma (OSSD) with six 4U/M courses. 4U English is recommended and 4U/M credits for co-op work experience will not be considered as part of the six courses. Higher averages are required for admission to programs for which the demand for places by qualified applicants exceeds the number of places available.

The overall average required for admission is determined each year on a program by program basis. All programs have limited enrolment. Admission is not guaranteed and all requirements are subject to change.

### Degree Program

<table>
<thead>
<tr>
<th>Degree program</th>
<th>Areas of Study</th>
<th>Required prerequisite courses</th>
<th>Minimum cut-off range</th>
<th>Notes</th>
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</table>
| Bachelor of Computer Science Honours Major | * Algorithms*  
  * Biomedical Computing*  
  * Computer Game Development*  
  * Computer and Internet Security* | * Management and Business Systems*  
    * Mobile Computing*  
    * Network Computing*  
  * Psychology*  
  * Software Engineering* | Advanced Functions or Calculus (MHF4U or MCV4U)  
  BCS Biomedical Computing stream:  
    * Advanced Functions or Calculus (MHF4U or MCV4U)  
    * Chemistry (SCH4U) | 78-82% Honours  
  * Co-operative education available.  
  Streams (areas of study) are part of Honours programs only. |
| Bachelor of Health Sciences Honours | * Biomedical Sciences  
  * Disability and Chronic Illness*  
  * Environment and Health Global Health  
  * Health Throughout the Lifespan | Advanced Functions (MHF4U)  
  Two credits from Biology (SBI4U), Chemistry (SCH4U), Earth and Space Science (SES4U) or Physics (SHP4U) (Calculus [MCV4U] strongly recommended) | 85-88% | |
| Bachelor of Mathematics Honours General | * Biostatistics*  
  * Computational and Applied Mathematics and Statistics*  
  * Computer Mathematics*  
  * Computer Science and Mathematics*  
  * Mathematics* | * Mathematics and Economics*  
    * Mathematics/ Master of Science Statistics*  
  * Statistics and Economics*  
  * Statistics/ Master of Science Statistics*  
  * Statistics with concentration in Actuarial Science* | Advanced Functions (MHF4U)  
  Calculus (MCV4U)  
  Biostatistics (Honours):  
    * Advanced Functions (MHF4U)  
    * Calculus (MCV4U)  
    * Advanced Functions (MHF4U), Calculus (MCV4U), Biology (SBI4U), and Chemistry (SCH4U) (Calculus [MCV4U] strongly recommended) | 78-82% Honours  
  74-76% General | *Co-operative education available in Honours programs.  
  Not all areas of study are offered under both the General and the Honours programs. |
| Bachelor of Science Honours | * Biochemistry*  
  * Bioinformatics*  
  * Biology*  
  * Biotechnology* | * Chemistry*  
    * Computational Biochemistry*  
    * Food Science and Nutrition*  
  * Nanoscience*  
  * Neuroscience*  
  * Neuroscience and Mental Health*  
  * Psychology* | Advanced Functions (MHF4U)  
  Two credits from Biology (SBI4U), Chemistry (SCH4U), Earth and Space Science (SES4U) or Physics (SHP4U) (Calculus [MCV4U] strongly recommended) | 78-82% | For Honours Psychology, 4U English is recommended.  
  *Co-operative education available. |
| Bachelor of Science Honours | * Earth Sciences*  
  * Environmental Science* | * Geography*  
  * Physical Geography* | Advanced Functions (MHF4U) or Calculus (MCV4U)  
  Two credits from Biology (SBI4U), Chemistry (SCH4U), Earth and Space Science (SES4U) or Physics (SHP4U) | 78-82% | For Honours Environmental Science, both 4U Chemistry and 4U Biology are recommended.  
  *Co-operative education available. |
| Bachelor of Science Honours | * Physics* | * Applied Physics*  
    * Biology & Physics*  
    * Mathematics & Physics* | Advanced Functions (MHF4U) and Calculus (MCV4U)  
  One credit from Biology (SBI4U), Chemistry (SCH4U), Earth and Space Science (SES4U) or Physics (SHP4U) | 78-82% | For all programs in Physics, 4U Physics is strongly recommended.  
  *Co-operative education available. |
| Major General | * Biochemistry*  
  * Biology*  
  * Earth Sciences* | * Environmental Science*  
    * Neuroscience and Mental Health*  
    * Physics* | Advanced Functions (MHF4U)  
  Two credits from Biology (SBI4U), Calculus (MCV4U), Chemistry (SCH4U), Earth and Space Science (SES4U) or Physics (SHP4U) | 74-76% | For the BSc Major in Physics, Calculus (MCV4U) may be substituted for Advanced Functions (MHF4U). For all programs in Physics, 4U Physics is strongly recommended. |
Connect with Carleton
You can also get more information about Carleton—our programs, facilities and services—through the following:

UNDERGRADUATE ADMISSIONS WEBSITE
Everything a prospective student needs to know about Carleton University, including programs, campus life, co-op, scholarships and awards can be found here.
admissions.carleton.ca

STUDENT BLOGS
Get an inside look at life at Carleton. Students share their thoughts about campus life, their professors and programs, and the transition from high school to university.
carleton.ca/blogs

ASK CARLETON
You have questions and we have the answers. Visit our online databank of frequently asked questions anytime, day or night.
admissions.carleton.ca/ask

Watch our videos
Visit our ever-expanding video gallery where you can view short videos on our campus, our residences, our co-op programs and more at: admissions.carleton.ca/videos

If you have any questions or wish further information, do not hesitate to contact us. Please see the back cover for our contact information.

Take a tour
We encourage all prospective students and their families to visit our beautiful riverside campus. Book a tour online at carleton.ca/tours, by email at tours@carleton.ca or by phone at the Undergraduate Recruitment Office number listed on the back cover. If you can’t visit us in person, you can take one of our program-specific virtual tours at admissions.carleton.ca/virtual-tours.

INSIGHT NEWSLETTER
Receive up-to-date news about Carleton University’s undergraduate academic programs, upcoming on- and off-campus recruitment events and more. Register for our monthly newsletter.
carleton.ca/insight

Check out our Facebook page to learn more about future-student news and events, or to view photos from around the Carleton campus.
facebook.com/carletonfuture

Follow us on Twitter @carleton_future. You’ll get all the latest news and announcements for future students.
twitter.com

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