Biotechnology

This section presents the requirements for programs in:

- **Biotechnology B.Sc. Honours**
- **Biology and Biotechnology B.Sc. Honours**

Program Requirements

Biotechnology
B.Sc. Honours (20.0 credits)

A. Credits Included in the Major CGPA (11.0 credits)		
1. 2.0 credits in:		2.0
BTEC 2301 [0.5]	Biotechnology I	
BTEC 3301 [0.5]	Biotechnology II	
BTEC 3302 [0.5]	Regulations and Intellectual Property	
BTEC 3303 [0.5]	Quality Control and Quality Assurance	
2. 1.0 credit from:		1.0
BTEC 4908 [1.0]	Research Thesis	
BTEC 4909 [1.0]	Practicum	
BTEC 4910 [1.0]	Consulting Project	
3. 2.0 credits from:		2.0
BTEC 3501 [0.5]	Agrifood Technologies	
BTEC 4501 [0.5]	Food Bio-Innovation	
BTEC 4601 [0.5]	Regenerative Medicine	
BTEC 4602 [0.5]	Biotherapeutics and Vaccines	
BTEC 4701 [0.5]	Environmental Bioremediation	
BTEC 4702 [0.5]	Industrial Microbiology	
4. 1.5 credits from:		1.5
BIOL 2001 [0.5]	Animals: Form and Function	
BIOL 2002 [0.5]	Plants: Form and Function	
CHEM 2204 [0.5]	Organic Chemistry II	
CHEM 2501 [0.5]	Introduction to Inorganic and Bioinorganic Chemistry	
CHEM 2800 [0.5]	Foundations for Environmental Chemistry	
FOOD 2002 [0.5]	Food Processing	
5. 1.5 credits from		1.5
BIOC 3103 [0.5]	Experimental Biochemistry I: Principles and Practices	
BIOC 3104 [0.5]	Experimental Biochemistry II: Research Experience	
BIOC 3203 [0.5]	Biochemical Pharmacology	
BIOL 3201 [0.5]	Cell Biology	
BIOL 3205 [0.5]	Plant Biochemistry and Physiology	
BIOL 3303 [0.5]	Experimental Microbiology	
CHEM 3201 [0.5]	Structure Elucidation	
CHEM 3205 [0.5]	Experimental Organic Chemistry	
CHEM 3800 [0.5]	The Chemistry of Environmental Pollutants	
FOOD 3001 [0.5]	Food Chemistry	
FOOD 3002 [0.5]	Food Analysis	
FOOD 3003 [0.5]	Food Packaging and Shelf Life	
FOOD 3005 [0.5]	Food Microbiology	
FOOD 3006 [0.5]	Upcycling and Sustainable Food Systems	
6. 1.0 credit in BIOC, BIOL, BTEC CHEM, FOOD at 4000 level		1.0
7. 1.5 credits in:		1.5
BUSI 1800 [0.5]	Introduction to Business	
BUSI 2800 [0.5]	Entrepreneurship	
PHIL 2408 [0.5]	Bioethics	
8. 0.5 credit from:		0.5
BUSI 2301 [0.5]	Introduction to Supply and Operations Management	
BUSI 3119 [0.5]	Business and Environmental Sustainability	
BUSI 3600 [0.5]	Entrepreneurial Strategies	
BUSI 3810 [0.5]	Business Development	
B. Credits Not Included in the Major CGPA (9.0 credits)		
9. 2.5 credits in:		2.5
BIOL 1103 [0.5]	Foundations of Biology I	
BIOL 1104 [0.5]	Foundations of Biology II	
BIOL 2104 [0.5]	Introductory Genetics	
BIOL 2303 [0.5]	Microbiology	
BIOL 3104 [0.5]	Molecular Genetics	
10. 2.0 credits in:		2.0
BIOC 1500 [0.5]	Biochemistry in a Modern Society	
BIOC 2200 [0.5]	Cellular Biochemistry	
BIOC 3101 [0.5]	Unlocking Metabolism: Pathways, Enzymes, and Control	
BIOC 3102 [0.5]	Biochemical Signals and Structures: The Molecular Language of Cells	
11. 2.0 credits in:		2.0
CHEM 1001 [0.5]	General Chemistry I	
CHEM 1002 [0.5]	General Chemistry II	
CHEM 2203 [0.5]	Organic Chemistry I	
CHEM 2303 [0.5]	Analytical Chemistry II	
12. 1.5 credits in:		1.5
MATH 1007 [0.5]	Elementary Calculus I	
MATH 1107 [0.5]	Linear Algebra I	
PHYS 1007 [0.5]	Elementary University Physics I	
13. 0.5 credit from:		0.5
BIOL 1105 [0.5]	Introduction to Biological Data	
BIOC 2500 [0.5]	Research Methods and Skills in Biochemistry	
STAT 2507 [0.5]	Introduction to Statistical Modeling I	
14. 0.5 credit in free electives		0.5
Total Credits		**20.0**

Biology and Biotechnology
B.Sc. Honours (20.0 credits)

A. Credits Included in the Major CGPA (13 credits)		
1. 6.5 credits in:		6.5
BIOL 1103 [0.5]	Foundations of Biology I	
BIOL 1104 [0.5]	Foundations of Biology II	
BIOL 1105 [0.5]	Introduction to Biological Data	
BIOL 2001 [0.5]	Animals: Form and Function	
BIOL 2002 [0.5]	Plants: Form and Function	
BIOL 2104 [0.5]	Introductory Genetics	
BIOL 2200 [0.5]	Cellular Biochemistry	
BIOL 2301 [0.5]	Biotechnology I	
BIOL 2303 [0.5]	Microbiology	

BIOL 3104 [0.5]	Molecular Genetics	
BIOL 3201 [0.5]	Cell Biology	
BIOL 3301 [0.5]	Biotechnology II	
BIOL 4301 [0.5]	Current Topics in Biotechnology	
2. 1.5 credit in:		1.5
BUSI 2800 [0.5]	Entrepreneurship	
BIOC 3101 [0.5]	Unlocking Metabolism: Pathways, Enzymes, and Control	
BIOC 3102 [0.5]	Biochemical Signals and Structures: The Molecular Language of Cells	
3. 4.0 credits from:		4.0
BIOC 2300 [0.5]	Physical Biochemistry	
or CHEM 2103 [0.5]	Physical Chemistry I	
BIOC 3103 [0.5]	Experimental Biochemistry I: Principles and Practices	
BIOC 3104 [0.5]	Experimental Biochemistry II: Research Experience	
BIOL 3004 [0.5]	Insect Diversity	
BIOL 3102 [0.5]	Mycology	
BIOL 3205 [0.5]	Plant Biochemistry and Physiology	
BIOL 3303 [0.5]	Experimental Microbiology	
BIOL 3305 [0.5]	Human and Comparative Physiology	
BIOL 3501 [0.5]	Biomechanics	
BIOL 3901 [0.5]	Research Proposal	
CHEM 3800 [0.5]	The Chemistry of Environmental Pollutants	
FOOD 3005 [0.5]	Food Microbiology	
BIOC 4001 [0.5]	Methods in Biochemistry	
BIOC 4004 [0.5]	Industrial Biochemistry	
BIOC 4005 [0.5]	Biochemical Regulation	
BIOC 4007 [0.5]	Membrane Biochemistry	
BIOC 4009 [0.5]	Biochemistry of Disease	
BIOC 4203 [0.5]	Secondary Metabolism and Natural Products Biochemistry	
BIOC 4708 [0.5]	Principles of Toxicology	
BIOL 4106 [0.5]	Advances in Molecular Biology	
BIOL 4109 [0.5]	Laboratory Techniques in Molecular Genetics	
BIOL 4200 [0.5]	Immunology	
BIOL 4201 [0.5]	Advanced Cell Culture and Tissue Engineering	
BIOL 4202 [0.5]	Mutagenesis and DNA Repair	
BIOL 4206 [0.5]	Human Genetics	
BIOL 4304 [0.5]	Forensic Biology	
BIOL 4901 [0.5]	Directed Special Studies	
TSES 4001 [0.5]	Technology and Society: Risk	
TSES 4002 [0.5]	Technology and Society: Forecasting	
4. 1.0 credit in:		1.0
BIOL 4905 [1.0]	Honours Workshop	
or BIOL 4907 [1.0]	Honours Essay and Research Proposal	
or BIOL 4908 [1.0]	Honours Research Thesis	
B. Credits Not Included in the Major CGPA (7.0 credits)		
5. 2.0 credits in:		2.0
CHEM 1001 [0.5] & CHEM 1002 [0.5]	General Chemistry I General Chemistry II	
CHEM 2203 [0.5] & CHEM 2204 [0.5]	Organic Chemistry I Organic Chemistry II (See Note, below)	
6. 0.5 credit in:		0.5
MATH 1007 [0.5]	Elementary Calculus I	
7. 1.5 credits from:		1.5
COMP 1005 [0.5]	Introduction to Computer Science I	
COMP 1006 [0.5]	Introduction to Computer Science II	
MATH 1107 [0.5]	Linear Algebra I	
PHYS 1007 [0.5]	Elementary University Physics I	
or PHYS 1003 [0.5]	Introductory Mechanics and Thermodynamics	
PHYS 1008 [0.5]	Elementary University Physics II	
or PHYS 1004 [0.5]	Introductory Electromagnetism and Wave Motion	
STAT 2507 [0.5]	Introduction to Statistical Modeling I	
8. 2.0 credits in Approved Courses Outside the Faculties of Science and Engineering and Design (may include ISAP 1000)		2.0
9. 1.0 credit in free electives.		1.0
Total Credits		**20.0**

B.Sc. Regulations

The regulations presented in this section apply to all Bachelor of Science programs. In addition to the requirements presented here, students must satisfy the University regulations common to all undergraduate students including the process of Academic Continuation Evaluation (see the *Academic Regulations of the University* section of this Calendar).

Breadth Requirement for the B.Sc.

Students in a Bachelor of Science program must present the following credits at graduation:

1. 2.0 credits in Science Continuation courses not in the major discipline; **students completing a double major are considered to have completed this requirement providing they have 2.0 credits in Science Continuation courses in each of the two majors;**
2. 2.0 credits in courses outside of the faculties of Science and Engineering and Design (may include ISAP 1000)

In most cases, the requirements for individual B.Sc. programs, as stated in this Calendar, contain these requirements, explicitly or implicitly.

Students admitted to B.Sc. programs by transfer from another institution must present at graduation (whether taken at Carleton or elsewhere):

1. 2.0 credits in courses outside of the faculties of Science and Engineering and Design (may include ISAP 1000) if the student received fewer than 10.0 transfer credits; or,
2. 1.0 credit in courses outside of the faculties of Science and Engineering and Design (may include ISAP 1000) if the student received 10.0 or more transfer credits.

Declared and Undeclared Students

Degree students are considered "Undeclared" if they have been admitted to a degree, but have not yet selected and been accepted into a program within that degree. The status "Undeclared" is available only in the B.A. and B.Sc. degrees. Undeclared students must apply to enter a program upon or before completing 3.5 credits.

Change of Program within the B.Sc. Degree

To transfer to a program within the B.Sc. degree, applicants must normally be *Eligible to Continue* (EC) in the new program, by meeting the CGPA thresholds described in Section 3.1.9 of the *Academic Regulations of the University.*

Applications to declare or change programs within the B.Sc. degree must be made online through Carleton Central by completing a Change of Program Elements (COPE) application form within the published deadlines. Acceptance into a program, or into a program element or option, is subject to any enrolment limitations, and/or specific program, program element or option requirements as published in the relevant Calendar entry.

Minors, Concentrations, and Specializations

Students may add a Minor, Concentration, or Specialization by completing a Change of Program Elements (COPE) application form online through Carleton Central. Acceptance into a Minor, Concentration, or Specialization normally requires that the student be *Eligible to Continue* (EC) and is meeting the minimum CGPAs described in Section 3.1.9 of the *Academic Regulations of the University*, as well as being subject to any specific requirements of the intended Minor, Concentration, or Specialization as published in the relevant Calendar entry.

Experimental Science Requirement

Students in a B.Sc. degree program must present at graduation at least two full credits of Experimental Science chosen from two different departments or institutes from the list below:

Approved Experimental Science Courses

Biochemistry	
BIOC 2200 [0.5]	Cellular Biochemistry
BIOC 3103 [0.5]	Experimental Biochemistry I: Principles and Practices
BIOC 3104 [0.5]	Experimental Biochemistry II: Research Experience
BIOC 4001 [0.5]	Methods in Biochemistry
BIOC 4201 [0.5]	Advanced Cell Culture and Tissue Engineering
Biology	
BIOL 1103 [0.5]	Foundations of Biology I
BIOL 1104 [0.5]	Foundations of Biology II
BIOL 2001 [0.5]	Animals: Form and Function
BIOL 2002 [0.5]	Plants: Form and Function
BIOL 2104 [0.5]	Introductory Genetics
BIOL 2200 [0.5]	Cellular Biochemistry
BIOL 2600 [0.5]	Ecology
Chemistry	
CHEM 1001 [0.5]	General Chemistry I
CHEM 1002 [0.5]	General Chemistry II
CHEM 2103 [0.5]	Physical Chemistry I
CHEM 2203 [0.5]	Organic Chemistry I
CHEM 2204 [0.5]	Organic Chemistry II
CHEM 2302 [0.5]	Analytical Chemistry I
CHEM 2303 [0.5]	Analytical Chemistry II
CHEM 2800 [0.5]	Foundations for Environmental Chemistry
Earth Sciences	
ERTH 1002 [0.5]	The Earth and Life Odyssey: A Journey Through Billions of Years
ERTH 2102 [0.5]	Mineralogy to Petrology
ERTH 2404 [0.5]	Engineering Geoscience
ERTH 2802 [0.5]	Field Geology I
ERTH 3111 [0.5]	Vertebrate Evolution: Mammals, Reptiles, and Birds
ERTH 3112 [0.5]	Vertebrate Evolution: Fish and Amphibians
ERTH 3204 [0.5]	Mineral Deposits
ERTH 3205 [0.5]	Physical Hydrogeology
Food Sciences	
FOOD 3001 [0.5]	Food Chemistry
FOOD 3002 [0.5]	Food Analysis
FOOD 3005 [0.5]	Food Microbiology
Geography	
GEOG 1010 [0.5]	Global Environmental Systems
GEOG 3108 [0.5]	Soil Properties
Neuroscience	
NEUR 3206 [0.5]	Sensory and Motor Neuroscience
NEUR 3207 [0.5]	Systems Neuroscience
NEUR 4600 [0.5]	Advanced Lab in Neuroanatomy
Physics	
PHYS 1001 [0.5]	Foundations of Physics I
PHYS 1002 [0.5]	Foundations of Physics II
PHYS 1003 [0.5]	Introductory Mechanics and Thermodynamics
PHYS 1004 [0.5]	Introductory Electromagnetism and Wave Motion
PHYS 1007 [0.5]	Elementary University Physics I
PHYS 1008 [0.5]	Elementary University Physics II
PHYS 2007 [0.5]	Second Year Physics Laboratory: Selected Experiments and Seminars
PHYS 3007 [0.5]	Third Year Physics Laboratory: Selected Experiments and Seminars
PHYS 3606 [0.5]	Modern Physics II
PHYS 3608 [0.5]	Modern Applied Physics

Course Categories for B.Sc. Programs

Science Geography Courses

GEOG 1010 [0.5]	Global Environmental Systems
GEOG 2006 [0.5]	Introduction to Quantitative Research
GEOG 2013 [0.5]	Weather and Water
GEOG 2014 [0.5]	The Earth's Surface
GEOG 3003 [0.5]	Quantitative Geography

GEOG 3010 [0.5]	Field Methods in Physical Geography
GEOG 3102 [0.5]	Geomorphology
GEOG 3103 [0.5]	Watershed Hydrology
GEOG 3104 [0.5]	Principles of Biogeography
GEOG 3105 [0.5]	Climate and Atmospheric Change
GEOG 3106 [0.5]	Aquatic Science and Management
GEOG 3108 [0.5]	Soil Properties
GEOG 4000 [0.5]	Field Studies
GEOG 4005 [0.5]	Directed Studies in Geography
GEOG 4013 [0.5]	Cold Region Hydrology
GEOG 4017 [0.5]	Global Biogeochemical Cycles
GEOG 4101 [0.5]	Two Million Years of Environmental Change
GEOG 4103 [0.5]	Water Resources Engineering
GEOG 4104 [0.5]	Microclimatology
GEOG 4108 [0.5]	Permafrost

Science Psychology Courses

PSYC 2001 [0.5]	Introduction to Research Methods in Psychology
PSYC 2002 [0.5]	Introduction to Statistics in Psychology
PSYC 2700 [0.5]	Introduction to Cognitive Psychology
PSYC 3000 [1.0]	Design and Analysis in Psychological Research
PSYC 3506 [0.5]	Cognitive Development
PSYC 3700 [1.0]	Cognition (Honours Seminar)
PSYC 3702 [0.5]	Perception
PSYC 2307 [0.5]	Human Neuropsychology I
PSYC 3307 [0.5]	Human Neuropsychology II

Science Continuation Courses

A course at the 2000 level or above may be used as a Science Continuation credit in a B.Sc. program if it is not in the student's major discipline, and is chosen from the following:

- BIOC (Biochemistry)
- BIOL (Biology) except BIOL 4810 which may be used only as a free elective for any B.Sc. program. Biochemistry students may use BIOL 2005 only as a free elective.
- CHEM (Chemistry)
- COMP (Computer Science) A maximum of two half-credits at the 1000-level in COMP, excluding COMP 1001 may be used as Science Continuation credits.
- ERTH (Earth Sciences), except ERTH 2415 which may be used only as a free elective for any B.Sc. program. Students in Earth Sciences programs may use ERTH 2401, ERTH 2402, and ERTH 2403 only as free electives.
- Engineering. Students wishing to register in Engineering courses must obtain the permission of the Faculty of Engineering and Design.
- ENSC (Environmental Science)
- FOOD (Food Science and Nutrition)
- GEOM (Geomatics)
- HLTH (Health Sciences)
- ISAP (Interdisciplinary Science Practice)
- MATH (Mathematics)
- NEUR (Neuroscience)
- PHYS (Physics), except PHYS 2903
- Science Geography Courses (see list above)
- Science Psychology Courses (see list above)
- STAT (Statistics)
- TSES (Technology, Society, Environment) except TSES 2305. Biology students may use these courses only as free electives. Integrated Science and Environmental Science students may include these courses in their programs but may not count them as part of the Science Sequence.

Science Faculty Electives

Science Faculty Electives are courses at the 1000-4000 level chosen from:

- BIOC (Biochemistry) except BIOC 1900 which may be used only as a free elective for any B.Sc. program.
- BIOL (Biology) except BIOL 4810 which may be used only as a free elective for any B.Sc. program. Biology & Biochemistry students may use BIOL 1010 and BIOL 2005 only as free electives.
- CHEM (Chemistry) except CHEM 1003, CHEM 1004 and CHEM 1007
- COMP (Computer Science) except COMP 1001
- ERTH (Earth Sciences) except ERTH 1004 and ERTH 2415. Earth Sciences students may use ERTH 2401, ERTH 2402 and ERTH 2403 only as free electives.
- Engineering
- ENSC (Environmental Science)
- FOOD (Food Science and Nutrition)
- GEOM (Geomatics)
- HLTH (Health Science)
- ISAP (Interdisciplinary Science Practice)
- MATH (Mathematics)
- NEUR (Neuroscience)
- PHYS (Physics) except PHYS 1901, PHYS 1902, PHYS 1905, and PHYS 2903
- Science Geography (see list above)
- Science Psychology (see list above)
- STAT (Statistics)
- TSES (Technology, Society, Environment) Biology students may use these courses only as free electives.

Advanced Science Faculty Electives

Advanced Science Faculty Electives are courses at the 2000-4000 level chosen from the Science Faculty Electives list above.

Approved Courses Outside the Faculties of Science and Engineering and Design (may include ISAP 1000)

- All courses offered by the Faculty of Arts and Social Sciences, the Faculty of Public and Global Affairs, and the Sprott School of Business are approved as Arts or Social Sciences courses EXCEPT FOR: All Science Geography courses (see list above), all Geomatics (GEOM) courses, all Science Psychology courses (see list above). ISAP 1000 may be used as an Approved Course Outside the Faculties of Science and Engineering and Design.

Free Electives	
Any course is allowable as a Free Elective providing it is not prohibited (see below). Students are expected to comply with prerequisite requirements and enrolment restrictions for all courses as published in this Calendar.	
Courses Allowable Only as Free Electives in any B.Sc. Program	
BIOL 4810 [0.5]	Education Research in Undergraduate Science
CHEM 1003 [0.5]	The Chemistry of Food, Health and Drugs
CHEM 1004 [0.5]	Drugs and the Human Body
CHEM 1007 [0.5]	Chemistry of Art and Artifacts
ERTH 1004 [0.5]	Earth's Epic Tale: A Story Across Billions of Years
ERTH 2415 [0.5]	Natural Disasters
ISCI 1001 [0.5]	Introduction to the Environment
ISCI 2000 [0.5]	Natural Laws
ISCI 2002 [0.5]	Human Impacts on the Environment
PHYS 1901 [0.5]	Planetary Astronomy
PHYS 1902 [0.5]	From our Star to the Cosmos
PHYS 1905 [0.5]	Physics Behind Everyday Life
PHYS 2903 [0.5]	Physics Towards the Future
Prohibited Courses	
The following courses are not acceptable for credit in any B.Sc. program:	
COMP 1001 [0.5]	Introduction to Computational Thinking for Arts and Social Science Students
MATH 1009 [0.5]	Mathematics for Business
MATH 1119 [0.5]	Linear Algebra: with Applications to Business
MATH 1401 [0.5]	Elementary Mathematics for Economics I
MATH 1402 [0.5]	Elementary Mathematics for Economics II
all 0000-level courses	

Co-operative Education

For more information about how to apply for the Co-op program and how the Co-op program works please visit the Co-op website.

All students participating in the Co-op program are governed by the Undergraduate Co-operative Education Policy.

Undergraduate Co-operative Education Policy

Admission Requirements

Students can apply to Co-op in one of two ways: directly from high school, or after beginning a degree program at Carleton.

If a student applies to a degree program with a Co-op option from high school, their university grades will be reviewed two terms to one year prior to their first work term to ensure they meet the academic requirements after their first or second year of study. The time at which the evaluation takes place depends on the program of study. Students will automatically receive an admission decision via their Carleton email account.

Students who did not request Co-op at the time they applied to Carleton can request Co-op after they begin their university studies. To view application instructions and deadlines, please visit carleton.ca/co-op.

To be admitted to Co-op, a student must successfully complete 5.0 or more credits that count towards their degree, meet the minimum CGPA requirement(s) for the student's Co-op option, and fulfil any specified course prerequisites. To see the unique admission and continuation requirements for each Co-op option, please refer to the specific degree programs listed in the Undergraduate Calendar.

Participation Requirements

Co-op Participation Agreement

All students must adhere to the policies found within the Co-op Participation Agreement.

COOP 1000

Once a student has been admitted to the Co-op Program, they will be given access to register in COOP 1000. This zero-credit online course must be completed at least two terms prior to the student's first work term.

Communication with the Co-op Office

Students must maintain contact with the Co-op Office during their job search and while on a work term. All email communication will be conducted via the students' Carleton email account.

Employment

Although every effort is made to ensure a sufficient number of job postings for all Co-op students, no guarantee of employment can be made. The Co-op job search process is competitive, and success is dependent upon factors such as current market conditions, academic performance, skills, motivation, and level of commitment to the job search. It is the student's responsibility to apply for positions via the Co-op job board in addition to actively conducting a self-directed job search. Students who do not obtain a co-op work term are expected to continue with their academic studies. It should be noted that hiring priority for positions within the Federal Government of Canada is given to Canadian citizens.

Registration

- Students must be registered as full-time during all fall and winter study terms beginning the term in which they enroll in COOP 1000.
- Students will be registered in a Co-op Work Term course while at work. This course does not carry academic course credit, but is noted on academic transcripts.
- Students may register in a 0.5 credit during a work term, provided the course is offered during the evening or is offered asynchronously online.
- Students must have at least one term of full-time studies left to complete following their final co-op work

term. Students cannot end their degree on a work term.

Work Term Assessment and Evaluation

Work Term Evaluation

Employers are responsible for submitting to Carleton University final performance evaluations for their Co-op students at the end of their work terms.

Work Term Assessment

In order to successfully complete the co-op work term, students must receive a Satisfactory (SAT) grade on their Co-op Work Term Report, which they must submit at the completion of each four-month work term.

Graduation with the Co-op Designation

In order to graduate with the Co-op Designation, students must satisfy all requirements of the degree program in addition to the successful completion of three or four work terms (the number is dependent upon the student's academic program). Students found in violation of the Co-op Participation Agreement may have the Co-op Designation withheld.

Note: Participation in the co-op option will add up to one additional year for a student to complete their degree program.

Voluntary Withdrawal from the Co-op Option

Students who are currently on a co-op work term or who have already committed to a co-op work term either verbally or in writing may not leave the position and/or withdraw from the co-op option until they have completed the work term and all related requirements.

Involuntary or Required Withdrawal from the Co-op Option

Students may be removed from the Co-op Program for any of the following reasons:

1. Failure to achieve a grade of SAT in COOP 1000;
2. Failure to attend all interviews for positions to which the student has applied;
3. Declining more than one job offer during the job search;
4. Reneging on a co-op position that the student has accepted either verbally or in writing;
5. Continuing a job search after accepting a co-op position;
6. Dismissal from a work term by the co-op employer;
7. Leaving a work term without approval from the Co-op Management Team;
8. Receipt of an unsatisfactory work term evaluation;
9. Receiving a grade of UNS on the work term report.

International Students

All international students are required to possess a Co-op Work Permit issued by Immigration, Refugees and Citizenship Canada before they can begin working. The Co-operative Education Office will provide students with a letter of support to accompany their Co-op Work Permit application. Students are advised to discuss the application process and application requirements with the International Student Services Office.

Co-op Fees

All participating Co-op students are required to pay Co-op fees. For full details, please see the Co-op website.

B.Sc. Honours Biotechnology: Co-op Admission and Continuation Requirements

- Maintain full-time status in each study term;
- Be eligible to work in Canada (for off-campus work);
- Have successfully completed COOP 1000 .

Co-operative Education - Bachelor of Science

The following programs in the Bachelor of Science Honours offer a co-operative education option:

Applied Physics, Biochemistry (including computational), Bioinformatics, Biology (including computational), Biotechnology, Chemistry (including computational), Earth Sciences, Environmental Science, Food Science and Nutrition, Geomatics, Neuroscience, Neuroscience and Mental Health, Physical Geography and Physics.

Students in all streams of the Bachelor of Science must successfully complete three (3) work terms to obtain the co-op designation.

Co-op Admission and Continuation Requirements for Students in the Bachelor of Science

For admission to and continuation in the co-op option, all students must:

- Maintain full-time status in each study term (2.0 credits);
- Be eligible to work in Canada (for off-campus work)
- Have successfully completed COOP 1000

Program-Specific Admission and Continuation Requirements:

Applied Physics, Biochemistry (including computational), Bioinformatics, Biology (including computational), Biotechnology, Chemistry (including computational), Earth Sciences, Environmental Science, Neuroscience, Neuroscience and Mental Health and Physics:

1. Completion of 5.0 or more credits at Carleton University;
2. Registered as a full-time student in the Bachelor of Science Honours degree program;
3. Obtained and maintained a major CGPA of 8.0 or higher and an overall CGPA of 6.50 or higher

Food Science and Nutrition

1. Registered as a full-time student in the Bachelor of Science Honours in Food Science and Nutrition;
2. Obtained and maintained a major CGPA of 9.0 or higher and an overall CGPA of 7.5 or higher in the first three years of academic study
3. Have obtained third-year standing;
4. Successfully completed, by the start date of the first work term, at least 2.0 credits from the following list

of courses: FOOD 3001, FOOD 3002, FOOD 3003, FOOD 3004, and FOOD 3005

Geomatics and Physical Geography:

1. Registered in the Bachelor of Science (Honours) Programs in Physical Geography or Geomatics;
2. Obtained and maintained an overall minimum CGPA of 9.5 and a major CGPA of 9.5;
3. Have obtained third-year standing;
4. Successfully completed, by the start-date of the first work term:
   a. the required second-year methods courses in their program (GEOG/ENST 2005, GEOG/ENST 2006)
   b. the required field course in their program (ENST 3900/GEOG 3000/GEOG 3010/GEOG 3030)
5. Be registered as a full-time student.

Co-op Work Term Courses

Physics, Applied Physics, Biology and Physics, Chemistry and Physics, Mathematics and Physics	
PHYS 3999 [0.0]	Co-operative Work Term Report
Biochemistry and Computational Biochemistry	
BIOC 3999 [0.0]	Co-operative Work Term
Biochemistry and Biotechnology, Bioinformatics, Biology, Biotechnology, Computational Biology, Biology and Physics	
BIOL 3999 [0.0]	Co-operative Work Term Report
Chemistry, Chemistry and Physics, Computational Chemistry	
CHEM 3999 [0.0]	Co-operative Work Term
Earth Sciences	
ERTH 3999 [0.0]	Co-operative Work Term
Food Science	
FOOD 3999 [0.0]	Co-operative Work Term
Environmental Science	
ENSC 3999 [0.0]	Co-operative Work Term
Geomatics	
GEOM 3999 [0.0]	Co-operative Work Term
Neuroscience and Neuroscience Mental Health	
NEUR 3999 [0.0]	Co-operative Work Term
Physical Geography	
GEOG 3999 [0.0]	Co-operative Work Term

Work-Study Patterns

Applied Physics, Biochemistry, Bioinformatics, Biology, Biotechnology, Chemistry, Computational Biochemistry, Computational Biology, Computational Chemistry, Earth Sciences, Environmental Science, Neuroscience, Neuroscience and Mental Health, Physics

Year 1		Year 2		Year 3		Year 4		Year 5	
Term	**Pattern**	**Term**	**Pattern**	**Term**	**Pattern**	**Term**	**Pattern**	**Term**	**Pattern**
Fall	S	Fall	S	Fall	S	Fall	*W/S	Fall	S
Winter	S	Winter	S	Winter	S	Winter	*W/S	Winter	S
Summer	**O/W	Summer	*W	Summer	O/W	Summer	O/W		

Food Science and Nutrition

Year 1		Year 2		Year 3		Year 4		Year 5	
Term	**Pattern**	**Term**	**Pattern**	**Term**	**Pattern**	**Term**	**Pattern**	**Term**	**Pattern**
Fall		Fall	S	Fall	S	Fall	W/S	Fall	S
Winter		Winter	S	Winter	S	Winter	W/S	Winter	S
Summer		Summer		Summer	O/W	Summer	O/W		

Physical Geography, Geomatics

Year 1		Year 2		Year 3		Year 4		Year 5	
Term	**Pattern**	**Term**	**Pattern**	**Term**	**Pattern**	**Term**	**Pattern**	**Term**	**Pattern**
Fall	S	Fall	S	Fall	S	Fall	S/W	Fall	O
Winter	S	Winter	S	Winter	S	Winter	S/W	Winter	S
Summer		Summer		Summer	W	Summer	S/W		

Legend
S: Study
W: Work

Admissions Information

Admission Requirements are for the 2026-27 year only, and are based on the Ontario High School System. Holding the minimum admission requirements only establishes eligibility for consideration. The cut-off averages for admission may be considerably higher than the minimum. See also the **General Admission and Procedures** section of this Calendar. An overall average of at least 70% is normally required to be considered for admission. Some programs may also require specific course prerequisites and prerequisite averages and/or supplementary admission portfolios. 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. Consult admissions.carleton.ca for further details.

Note: Courses listed as *recommended* are not mandatory for admission. Students who do not follow the recommendations will not be disadvantaged in the admission process.

Admissions Information

Admission requirements are based on the Ontario High School System. Prospective students can view the admission requirements through the Admissions website at admissions.carleton.ca. The overall average required for admission is determined each year on a program-by-program basis. Holding the minimum admission requirements only establishes eligibility for consideration; higher averages are required for admission to programs for which the demand for places by qualified applicants exceeds the number of places available. All programs have limited enrolment and admission is not guaranteed. Some programs may also require specific course prerequisites and prerequisite averages and/or supplementary admission portfolios. Consult admissions.carleton.ca for further details.

Note: If a course is listed as *recommended*, it is not mandatory for admission. Students who do not follow the recommendations will not be disadvantaged in the admission process.

Degrees

- B.Sc. (Honours)
- B.Sc. (Major)
- B.Sc.

Admission Requirements

B. Sc. Honours

First Year

The Ontario Secondary School Diploma (OSSD) or equivalent including a minimum of six 4U or M courses. For most programs including Biochemistry, Bioinformatics, Biotechnology, Chemistry, Combined Honours in Biology and Physics, Chemistry and Physics, Computational Biochemistry, Food Science, Nanoscience, Neuroscience and Biology, Neuroscience and Mental Health, and Psychology, the six 4U or M courses must include Advanced Functions, and two of Biology, Chemistry, Earth and Space Sciences, or Physics. (Calculus and Vectors is strongly recommended).

Specific Honours Admission Requirements

For the Honours programs in Earth Sciences, Environmental Science, Geomatics, Integrated Science, and Physical Geography, Calculus and Vectors may be substituted for Advanced Functions.

For the Honours programs in Physics and Applied Physics, and for double Honours in Mathematics and Physics, Calculus and Vectors is required in addition to Advanced Functions and one of 4U Physics, Chemistry, Biology, or Earth and Space Sciences. For all programs in Physics, 4U Physics is strongly recommended.

For Honours in Psychology, a 4U course in English is recommended.

For Honours in Environmental Science, a 4U course in Biology and Chemistry is recommended.

Advanced Standing

Applications for admission beyond first year will be assessed on their merits. Applicants must normally be *Eligible to Continue* in their year level, in addition to meeting the CGPA thresholds described in Section 3.1.9 of the Academic Regulations of the University. Advanced standing will be granted only for those subjects deemed appropriate for the program and stream selected.

B.Sc. Major and B.Sc.

First Year

The Ontario Secondary School Diploma (OSSD) or equivalent including a minimum of six 4U or M courses. The six 4U or M courses must include Advanced Functions and two of Calculus and Vectors, Biology, Chemistry, Earth and Space Science, or Physics (Calculus and Vectors is strongly recommended). For the B.Sc. Major in Physics, 4U Physics is strongly recommended.

Advanced Standing

Applications for admission beyond first year will be assessed on their merits. Applicants must normally be *Eligible to Continue* (EC) in their year level. Advanced standing will be granted only for those subjects deemed appropriate for the program and stream selected.

Co-op Option

Direct Admission to the First Year of the Co-op Option

Applicants must:

1. meet the required overall admission cut-off average and prerequisite course average. These averages may be higher than the stated minimum requirements;
2. be registered as a full-time student in the Bachelor of Science Honours program;
3. be eligible to work in Canada (for off-campus work placements).

Note that meeting the above requirements only establishes eligibility for admission to the program. The prevailing job market may limit enrolment in the co-op option.

Note: continuation requirements for students previously admitted to the co-op option and admission requirements for the co-op option after beginning the program are described in the Co-operative Education Regulations section of this Calendar.

Biotechnology (BTEC) Courses

BTEC 2301 [0.5 credit]
Biotechnology I
An introductory course on the science, technology, entrepreneurial skills and business considerations related to biotechnology. The course will survey broadly across the disciplines of Biology, including applications in agriculture, health, environment and industry.
Includes: Experiential Learning Activity
Also listed as BIOL 2301.
Prerequisite(s): BIOL 1103 and BIOL 1104.
Lectures one and a half hours a week, workshops two hours a week.

BTEC 3301 [0.5 credit]
Biotechnology II
An interdisciplinary course on interactions between science, invention and innovation in biotechnology. Case studies related to regional biotechnology opportunities; social and ethical issues impacting biotechnology.
Includes: Experiential Learning Activity
Also listed as BIOL 3301.
Prerequisite(s): BIOL 2301, BIOL 2104, or BIOL 2107, and BIOL 2200/BIOC 2200 or BIOL 2201, or permission of the Institute.
Lectures and laboratory/workshops three hours a week.

BTEC 3302 [0.5 credit]
Regulations and Intellectual Property
Regulatory frameworks and intellectual property processes in biotechnology industries. Case studies and discussions of regulatory approval, compliance requirements, patentability criteria, IP protection, and ethical consideration in biotechnology innovation and commercialization.
Includes: Experiential Learning Activity
Prerequisite(s): BIOC 2200 or permission of the Institute.
Workshop three hours a week.

BTEC 3303 [0.5 credit]
Quality Control and Quality Assurance
Quality control (QC) and quality assurance (QA) in biotechnology. Case studies and discussions of Quality Management Systems (QMS) and methodologies, risk assessment and mitigation strategies, data integrity, and trends to ensure high-quality standards in biotechnological products and processes.
Includes: Experiential Learning Activity
Prerequisite(s): BIOC 2200 or CHEM 2303.
Workshop three hours a week.

BTEC 3501 [0.5 credit]
Agrifood Technologies
Role of biotechnology in agriculture. Includes crop and animal biotechnology concepts for enhanced crop yield, pest resistance, nutritional quality, and livestock health. Principles of sustainable agriculture to promote environmentally friendly farming practices, ensuring a balance between productivity and ecological integrity.
Includes: Experiential Learning Activity
Prerequisite(s): BIOC 2200 or BIOL 2104.
Workshop or laboratory four hours a week.

BTEC 4501 [0.5 credit]
Food Bio-Innovation
Biotechnological advancements transforming the food industry with emphasis on new food sources, new ingredients, and new production and processing methods.
Includes: Experiential Learning Activity
Prerequisite(s): BIOC 2200.
Workshop or laboratory four hours a week.

BTEC 4601 [0.5 credit]
Regenerative Medicine
In-depth exploration of regeneration medicine, focusing on the mechanisms, techniques, and applications involved in repairing or replacing damaged tissues and organs. Students engage with cutting-edge research and innovative approaches in the field.
Includes: Experiential Learning Activity
Prerequisite(s): BIOL 3201 or HLTH 3303.
Workshop or laboratory four hours a week.

BTEC 4602 [0.5 credit]
Biotherapeutics and Vaccines
In-depth exploration of protein and mRNA-based biotherapeutics and vaccines in biotechnology. Emphasizes modern technologies, focusing on design principles, production challenges, and commercial scaling, equipping students with essential knowledge about scientific and technological aspects critical for effective biotherapeutic and vaccine development.
Includes: Experiential Learning Activity
Prerequisite(s): BIOL 2104 or HLTH 2004.
Workshop or laboratory four hours a week.

BTEC 4701 [0.5 credit]
Environmental Bioremediation
The use of living organisms to remediate contaminated soils and waters. Case studies and discussions of bioremediation processes from a chemical and biological perspective, environmental factors that influence the selection of bioremediation technologies, limits of bioremediation strategies and techniques, and current advances in the field.
Includes: Experiential Learning Activity
Prerequisite(s): BIOL 2303 or HLTH 2004 or CHEM 2800 or FOOD 3005.
Workshop or laboratory four hours a week.

BTEC 4702 [0.5 credit]
Industrial Microbiology
Industrial use of native and engineered microorganisms for generating products like traditional beverages, biopharmaceuticals, hormones, organic acids, biofuels, biopesticides, food additives and more. Critical reasoning skills applied to case studies and project development.
Includes: Experiential Learning Activity
Prerequisite(s): BIOL 2303 or HLTH 2004 or FOOD 3005.
Workshop or laboratory four hours a week.

BTEC 4908 [1.0 credit]
Research Thesis
Students carry out a research project approved by the Director, under the supervision of a faculty member of the Institute, in either the Biology or Chemistry departments. Evaluation based on a written thesis and presentation.
Includes: Experiential Learning Activity
Prerequisite(s): Fourth-year standing in Honours Biotechnology program.
Schedules may vary depending on research project.

BTEC 4909 [1.0 credit]
Practicum
Field placement in private sector providing practical experience in a biotechnology-related field. Sites may vary each year. Evaluation based on a written report and presentation.
Includes: Experiential Learning Activity
Prerequisite(s): Fourth-year standing in Honours Biotechnology program.
Schedules may vary depending on placement.

BTEC 4910 [1.0 credit]
Consulting Project
This course is designed to give students practical experience as a biotechnology consultant by working on a concrete issue brought forward by a biotechnology partner. Evaluation based on a written report and presentation.
Includes: Experiential Learning Activity
Prerequisite(s): Fourth-year standing in Honours Biotechnology program.
Schedules may vary depending on the partnership.