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This publication provides guidance to prospects, applicants, students, faculty and staff.

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1 About the Faculty of Science

The Faculty of Science aims to be a leader in finding solutions critical to economic and human development, including key questions in the environmental sciences, new materials, and new technologies.

To help us achieve these goals, the Faculty has recruited the best scientific minds of this generation and is committed to ensuring that our undergraduate and graduate students receive an education that prepares them for a lifetime of accomplishment. Not only will these new recruits perform key research work, they will also take on an equally important task: teaching the scientists and leaders of tomorrow. Over the next decade, many of these dynamic young academics will become world leaders in their disciplines. The process has already begun in fields as diverse as neuroscience, astrophysics, green chemistry, and earth system science.

Moreover, the Faculty is transforming the way science is taught, with an increased emphasis on student/professor interaction and outreach. This approach emphasizes hands-on research at the undergraduate level and a more personal, one-on-one style between professors and students that traditionally did not begin until the graduate level.

The Faculty counts undergraduate students as one of its key strengths. The calibre of McGill's undergraduates is very high—they boast the highest average entrance grades in Canada—and the Faculty understands that these brilliant young minds are the key to its future.

2 History of the Faculty of Science

The study of science at McGill goes back almost two centuries, when the lower campus was a rough and muddy cow pasture and the University struggled to establish itself. In 1855, the job of principal was given to a Nova Scotia-born geologist, John William Dawson. When he arrived at McGill, Dawson laid out plans for walks and roads, and at his own expense arranged the planting of trees on the entrance avenue. More importantly, Dawson worked diligently to transform McGill from a poorly equipped provincial college into one of the best scientific institutions in the world. In 1882, he successfully lobbied for the creation of the Royal Society of Canada and brought international renown to McGill.

In the century and a half since Dawson steered the Faculty of Science onto the path of excellence, the Faculty has received numerous honours for its groundbreaking research, including Nobel prizes to ten Science alumni or Faculty members, as well as over 100 fellowships in the Royal Society of Canada. More importantly, McGill's scientists have made the world a better place in which to live and have provided answers to the deepest mysteries facing humanity. Examples of McGill's breakthroughs include the world's first effective anti-retroviral HIV drug, the theory explaining photosynthesis, and the discovery of the fastest-spinning pulsar in the known universe.

McGill's Faculty of Science has a long tradition of discovery and innovation that no other Canadian university, and only a handful of U.S. schools can match. Our long tradition of scientific leadership, and the illustrious roster of McGill researchers who changed the world—Sir Ernest Rutherford, Harriet Brooks, Ronald Melzack, Bernard Belleau, Leo Yaffe, and Vicky Kaspi, to name only a few—are key attributes.

Founded upon a deep commitment to excellence, the Faculty of Science continues to attract the best scientists in the world. We remain committed to Dawson's vision of bringing the best to the world, whether it's investigating ways to heal the Earth's fragile ecosystem, finding cleaner, greener ways to synthesise vital chemicals, or pushing back the boundaries of our understanding of the Universe.

3 Programs and Teaching in Science

The Faculty of Science is committed to providing outstanding teaching and research facilities. The Faculty draws on its involvement in cutting-edge research to ensure teaching excellence at the undergraduate level. Professors who spearhead projects that change people's understanding of the world teach regularly at the undergraduate level. Also, research-based independent study courses offer you the opportunity to contribute to your professors' work, rather than just learn about it.

In an effort to supplement classroom learning with real life experience, the Faculty of Science has increased opportunities for undero667. 87ty eray sc1.31 (ay sety radi

4 About the Faculty of Science (Undergraduate)

4.1 Location

Dawson Hall
853 Sherbrooke Street West
Montreal QC H3A 0G5
Canada
Telephone: 514-398-5442
Faculty website: mcgill.ca/science
Science Office for Undergraduate Student Advising (SOUSA): mcgill.ca/science/undergraduate/advice/sousa

The Science Office for Undergraduate Student Advising (SOUSA) is located in Dawson Hall, room 405. SOUSA serves students in the B.Sc. and B.A. & Sc. degrees.

4.2 McGill's Faculty of Science

- **McGill's second-largest faculty:** Consisting of 15 schools and departments focused on teaching, research, and outreach — including the Redpath Museum, Canada's oldest museum of natural history — and 20 research centres and institutes
- **Students:** Over 4,000 undergraduate and over 1,000 graduate students
- **Over 250 faculty members,** including tenured and tenure-track professors
- Has ties with **ten Nobel laureates:** seven were Faculty of Science graduates, while three winners were either Science faculty members or staff
- **Canadian leader** in astrophysics and cosmology, climate change and extreme weather, green chemistry, life sciences (developmental biology), earth systems science, biodiversity and conservation, nanoscience, social neuroscience, sustainability science, and artificial intelligence
- Offers students a variety of **Field Study** opportunities, which take students out of the traditional classroom environment and into a world of strong interdisciplinary, international, and research-based education. Students have opportunities to work with local and indigenous communities, governmental agencies, and NGOs in places as far-ranging as East Africa, Barbados, Panama, and the Arctic
- Offers the **Reginald Fessenden Professorships and Prizes in Science Innovation**, the first such endowed program in Canada, to encourage and support

6.1 Minimum Credit Requirement

The minimum credit requirement for your degree is determined at the time of acceptance and is specified in your letter of admission.

Students are normally admitted to a four-year degree requiring the completion of 120 credits.

6.1.1 Advanced Standing

Advanced Standing of up to 30 credits may be granted to students who obtain satisfactory results in International Baccalaureate, French Baccalaureate, Advanced Levels, Advanced Placement tests, or the Diploma of Collegial Studies (DCS). Quebec students with a DCS in Science are granted 30 credits Advanced Standing and will have normally completed the equivalent of, and are therefore exempt from, the basic science courses in biology, chemistry, mathematics, and physics. Students with satisfactory results in International Baccalaureate, French Baccalaureate, Advanced Levels, and Advanced Placement tests may be exempt from some or all of the basic science courses. You will not be given additional credit toward your degree for any McGill course where the content overlaps substantially with any other course for which you have already received

limits will normally be granted only for valid academic reasons, such as a change of program (subject to departmental approval) and part-time status. If permission is granted, you will receive credit only for required and complementary courses necessary to complete your program requirements.

Students who have been granted Advanced Standing for the International Baccalaureate, Advanced Placement examinations, GCE A-Levels, French Baccalaureate, and other qualifications may complete 120 credits following admission, as per the university regulations described in [University Regulations and Resources](#) > *Student Records* > : *Advanced Standing Transfer Credits*.

6.4 Program Requirements

The Faculty of Science offers a vast array of study and research opportunities at the undergraduate level, and it is very important that you familiarize yourself with all the alternatives open to you before deciding on a program of study. For an overview of programs offered in the B.Sc., see the Faculty of Science Programs of Study at mcgill.ca/science/programs.

6.4.1 Liberal, Major, and Honours Programs

As a Science student, if you need 96 or fewer credits to complete your degree requirements, you are required to select your courses in each term with a view to timely completion of your degree and program requirements. You must register in one of the following types of departmental programs leading to the degree of Bachelor of Science:

6.4.1.1 Liberal Programs

Liberal programs provide students with the opportunity to study the core of one science discipline along with a breadth component from another area of science or from many other disciplines. In a liberal program, you must complete a Core Science Component (CSC) (45–50 credits), plus a Breadth Component (at least 18 credits). The requirements for the Core Science Components are given under departmental sections of this publication whenever applicable.

For the Breadth Component, you must complete one of the following:

- Minor Program (18–24 credits) – one of the programs listed in [section 10.2: Minor Programs](#).
- Arts Minor or Major Concentration (18 or 36 credits) – one of the programs listed in [section 10.5: Arts Major and Minor Concentrations Open to Science Students](#).
- A Core Science Component in a second area (45–50 credits) – at least 24 credits must be distinct from the courses used to satisfy the primary Core Science Component. Note that a second Core Science Component can be selected from any of the Science groups.

6.4.1.2 Major Programs

Major programs are more specialized than liberal programs and are usually centred on a specific discipline or department.

6.4.1.3 Honours Programs

Honours programs typically involve an even higher degree of specialization, often include supervised research, and require students to maintain a high academic standard. Although honours programs are specially designed to prepare you for graduate studies, graduates of the other degree programs may also be admissible to many graduate schools. If you intend to pursue graduate studies in your discipline, you should consult a departmental adviser regarding the appropriate selection of courses in your field.

6.4.2 Minor and Minor Concentration Programs

In addition to the liberal, major, and honours degree programs, as a student in the Faculty of Science, you may select a minor or approved minor concentration program. These are coherent sequences of courses in a given discipline or interdisciplinary area that may be taken in addition to the courses required for the degree program.

Science minors consist of up to 24 credits.

Arts minor concentrations consist of 18 credits.

A minimum of 18 new credits must be completed in the Minor or Minor concentration.

For a list of "Minor Programs," see [section 10.2: Minor Programs](#); for minor concentrations that are approved for Science students, see [section 10.5: Arts Major and Minor Concentrations Open to Science Students](#).

6.4.3 Other Second Programs

In addition to a major or honours program, you may pursue a second major or honours program, or an Arts major concentration program. Each major or honours program must contain a minimum of 36 credits that are distinct from the courses used to satisfy the other program.

6.4.4 Special Designations

The Faculty of Science recognizes Bachelor of Science (B.Sc.) students who have gone beyond a typical B.Sc. experience by awarding certain special designations to their student record and degree at graduation.

6.4.4.1 B.Sc. Global Designation

For details on the B.Sc. Global Designation, students should refer to mcgill.ca/science/undergraduate/programs/bsc-global.

6.4.4.2 Internship Program Designation

All B.Sc. programs can include an internship component. For more details, students should refer to [section 12: Science Internships and Field Studies](#) and mcgill.ca/science/undergraduate/internships-field/internships.

6.4.5 Bieler School of Environment

The Faculty of Science is one of the four faculties in partnership with the Bieler School of Environment. For more information, see [Bieler School of Environment](#).

6.5 Course Requirements

All required and complementary courses used to fulfil program requirements, including the basic Science requirements, must be completed with a grade of C or better. If you fail to obtain a Satisfactory grade in a required course, you must either pass the supplemental e

- Credit will be given for **only one** of the following intermediate statistics courses: AEMA 411, ECON 227D1/D2, ECON 257D1/D2, GEOG 351, MATH 204, PSYC 305, SOCI 461, with the exception that you may receive credit for both PSYC 305 and ECON 227D1/D2 or ECON 257D1/D2.
- Students who have already received credit for MATH 324 or MATH 357 will **not** receive credit for any of the following: AEMA 310, AEMA 411, BIOL 373, ECON 227D1/D2, ECON 257D1/D2, GEOG 202, GEOG 351, MATH 203, MATH 204, MGCR 271, MGCR 273, PSYC 204, PSYC 305, SOCI 350.
- For 500-level statistics courses not listed above, students must consult a program/department adviser to ensure that no significant overlap exists. Where such overlap exists with a course for which the student has already received credit, credit for the 500-level course will not be allowed.
- PSYC 204 may not be taken if a grade of 75% was received in an equivalent course completed at CEGEP.

6.5.2 Courses Outside the Faculties of Arts and Science

As a student in the Faculty of Science, you should consult the statement of regulations for taking courses outside the Faculties of Arts and of Science (see below). A list of approved/not-approved courses in other faculties is posted on the SOUSA website (mcgill.ca/science/undergraduate/handbook). You may take courses on the approved list and may not, under any circumstances, take courses on the not-approved list for credit. Requests for permission to take courses that are not on either list should be addressed to the Associate Dean, Student Affairs for Science.

The regulations are as follows:

- You may take only 6 credits per year, up to 18 credits in all, of courses outside the Faculties of Arts and of Science.
- Courses offered “in the Faculty of Science” or “in the Faculty of Arts” are found in the eCalendar [All Courses](#) search, when filtered by “Faculty of Science” or by “Faculty of Arts.”
- Courses in other faculties that are considered as taught by Science (e.g., BIOT, EXMD, and PHAR) are so designated as offered by the “Faculty of Science” in the eCalendar [All Courses](#) search.
- Courses in Music are considered as outside the Faculties of Arts and of Science, except MUAR courses, which are considered Arts courses.
- All courses listed in the Religious Studies (RELG) section are considered courses in Arts and Science except for courses restricted to B.Th. or S.T.M. students and courses that require permission from the Chair of the B.Th. Committee.
- Students should consult the list of restricted courses outside of the Faculties of Arts and of Science on the SOUSA website (mcgill.ca/science/undergraduate/handbook).
- You must have the necessary prerequisites and permission of the instructor for such courses.
- Credit for computer and statistics courses offered by faculties other than Arts and Science require the permission of the Associate Dean, Student Affairs for Science and will be granted only under exceptional circumstances.
- If you use Minerva to register for a course, and it exceeds the specified limitations or it is not approved

6.5.4 Courses in English as a Second Language (ESL)

ESL courses are only open to students whose primary language is not English and who have studied for fewer than five years in English-language secondary institutions. As a student in the B.Sc., you may take a maximum of 12 credits, including academic writing courses for non-anglophones, from the list of ESL courses published in the Handbook under Course Restrictions mcgill.ca/science/undergraduate/handbook/.

6.5.5 First-Year Seminars: Registration

Registration for First-Year Seminars is limited to students in their first year of study at McGill, i.e., newly admitted students in U0 or U1. These courses are designed to provide a closer interaction with professors and better working relations with peers than is available in large introductory courses. These seminars endeavour to teach the latest scholarly developments and expose participants to advanced research methods. Registration is on a first-come, first-served basis. The maximum number of students in any seminar is 25, although some are limited to fewer than that.

You may take only one First-Year Seminar. If you register for more than one, you will be obliged to withdraw from all but one of them. Please consult the departmental listings for course descriptions and availability.

First-Year Seminars

| | |
|----------|------------------------------------|
| CHEM 199 | FYS: Why Chemistry? |
| EPSC 199 | FYS: Earth & Planetary Exploration |
| PSYC 199 | FYS: Mind-Body Medicine |
| PSYT 199 | FYS: Mental Illness and the Brain |

The First-Year Seminars offered by the Faculty of Arts are also open to Science students. For a complete listing, please consult [Faculty of Arts > Undergraduate > Browse Academic Units & Programs > : First-Year Seminars](#).

6.5.6 Course Credit Weight

The credit assigned to a particular course should reflect the amount of effort it demands of you. Normally, one credit will represent three hours total work per week for one term—including a combination of lecture hours, other contact hours, such as laboratory periods, tutorials, and problem periods, as well as personal study time.

7 Advising

If you need 96 or fewer credits to complete your degree requirements, you must consult an academic adviser in your proposed department of study to obtain advice and approval of your course selection. Quebec students with a Diploma of Collegial Studies in Science have normally taken the equivalent of, and are therefore exempt from, the 100-level basic science courses in Biology, Chemistry, Mathematics, and Physics. Such students may also be exempt from some 200-level courses. If you are a student with satisfactory results in International Baccalaureate, French Baccalaureate, Adv

9 Examinations

Students should refer to [University Regulations and Resources > Undergraduate > : Examinations: General Information](#) for information about final examinations and deferred examinations. Note that for the Faculty of Science, [University Regulations and Resources > Undergraduate > Examinations: General Information > Final Examinations > : Final Examinations: University Regulations Concerning Final Examinations](#)

10.1.1.2 Major Programs

- Anatomy and Cell Biology: *section 13.2.5: Bachelor of Science (B.Sc.) - Major Anatomy and Cell Biology (67 credits)*
- Biochemistry: *section 13.4.5: Bachelor of Science (B.Sc.) - Major Biochemistry (64 credits)*
- Biology: *section 13.5.8: Bachelor of Science (B.Sc.) - Major Biology (59 credits)*
- Biology – Quantitative Biology: *section 13.5.9: Bachelor of Science (B.Sc.) - Major Biology - Quantitative Biology (73 credits)*
- Microbiology and Immunology: *section 13.23.5: Bachelor of Science (B.Sc.) - Major Microbiology and Immunology (66 credits)*
- Pharmacology: *section 13.29.5: Bachelor of Science (B.Sc.) - Major Pharmacology (67 credits)*
- Physiology: *section 13.31.5: Bachelor of Science (B.Sc.) - Major Physiology (65 credits)*
- Psychology: *section 13.33.8: Bachelor of Science (B.Sc.) - Major Psychology (54 credits)*

10.1.1.3 Honours Programs

- Anatomy and Cell Biology: *section 13.2.6: Bachelor of Science (B.Sc.) - Honours Anatomy and Cell Biology (73 credits)*
- Biochemistry: *section 13.4.6: Bachelor of Science (B.Sc.) - Honours Biochemistry (73 credits)*
- Biology: *section 13.5.11: Bachelor of Science (B.Sc.) - Honours Biology (72 credits)*
- Biology – Quantitative Biology: *section 13.5.12: Bachelor of Science (B.Sc.) - Honours Biology - Quantitative Biology (79 credits)*
- Immunology (Interdepartmental): *section 13.18.3: Bachelor of Science (B.Sc.) - Honours Immunology (Interdepartmental) (75 credits)*
- Microbiology and Immunology: *section 13.23.6: Bachelor of Science (B.Sc.) - Honours Microbiology and Immunology (72 credits)*
- Pharmacology – application required, see departmental section for information: *section 13.29.6: Bachelor of Science (B.Sc.) - Honours Pharmacology (76 cr)*

- Chemistry – General option: *section 13.7.7: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Chemistry - General (49 credits)*
- Computer Science: *section 13.9.8: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Computer Science (45 credits)*
- Earth and Planetary Sciences: *section 13.10.7: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Earth and Planetary Sciences (45 credits)*
- Geography: *section 13.17.7: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Geography (49 credits)*
- Mathematics: *section 13.22.9: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Mathematics (45 credits)*
- Physics: *section 13.30.8: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Physics (45 credits)*
- Software Engineering: *section 13.9.9: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Software Engineering (49 credits)*
- Statistics: *section 13.22.10: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Statistics (48 credits)*

10.1.4.2 Major Programs

- Atmospheric Science: *section 13.3.6: Bachelor of Science (B.Sc.) - Major Atmospheric Science (62 credits)*
- Chemistry: *section 13.7.8: Bachelor of Science (B.Sc.) - Major Chemistry (59 credits)*
- Chemistry – Atmosphere and Environment option: *section 13.7.9: Bachelor of Science (B.Sc.) - Major Chemistry - Atmosphere and Environment (63 credits)*
- Chemistry – Bio-organic option: *section 13.7.10: Bachelor of Science (B.Sc.) - Major Chemistry - Bio-organic (63 credits)*
- Chemistry – Biophysical option: *section 13.7.11: Bachelor of Science (B.Sc.) - Major Chemistry: Biophysical Chemistry (66 credits)*
- Chemistry – Materials option: *section 13.7.12: Bachelor of Science (B.Sc.) - Major Chemistry - Materials (62 credits)*
- Chemistry – Measurement option: *section 13.7.13: Bachelor of Science (B.Sc.) - Major Chemistry - Measurement (62 credits)*
- Computer Science: *section 13.9.10: Bachelor of Science (B.Sc.) - Major Computer Science (63 credits)*
- Computer Science – Computer Games option: *section 13.9.12: Bachelor of Science (B.Sc.) - Major Computer Science - Computer Games (65 credits)*
- Earth System Science: *section 13.11.4: Bachelor of Science (B.Sc.) - Major Earth System Science (57 credits)*
- Environment – Atmospheric Environment and Air Quality domain: *: Bachelor of Science (B.Sc.) - Major Environment - Atmospheric Environment and Air Quality (60 credits)*
- Environment – Biodiversity and Conservation domain: *: Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Major Environment - Biodiversity and Conservation (63 credits)*
- Environment – Earth Sciences and Economics domain: *: Bachelor of Science (B.Sc.) - Major Environment - Earth Sciences and Economics (66 credits)*
- Environment – Ecological Determinants of Health domain – Cellular: *: Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Major Environment - Ecological Determinants of Health - Cellular (63 credits)*
- Environment – Ecological Determinants of Health domain – Population: *: Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Major Environment - Ecological Determinants of Health- Population (63 credits)*
- Environment – Environmetrics domain: *: Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Major Environment - Environmetrics (63 credits)*
- Environment – Food Production and Environment domain: *: Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Major Environment - Food Production and Environment (63 credits)*
- Environment – Land Surface Processes and Environmental Change domain: *: Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Major Environment-Land Surface Processes and Environmental Change (63 credits)*
- Environment – Renewable Resource Management domain: *: Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Major Environment - Renewable Resource Management (63 credits)*
- Environment – Water Environments and Ecosystems domain – Biological: *: Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Major Environment - Water Environments & Ecosystems - Biological (60 credits)*
- Environment – Water Environments and Ecosystems domain – Physical: *: Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Major Environment - Water Environments and Ecosystems - Physical (63 credits)*
- Geography: *section 13.17.8: Bachelor of Science (B.Sc.) - Major Geography (58 credits)*
- Geology: *section 13.10.8: Bachelor of Science (B.Sc.) - Major Geology (66 credits)*
- Mathematics: *section 13.22.11: Bachelor of Science (B.Sc.) - Major Mathematics (54 credits)*
- Physics – Biological option: *section 13.30.10: Bachelor of Science (B.Sc.) - Major Physics: Biological Physics (82 credits)*
- Physics: *section 13.30.9: Bachelor of Science (B.Sc.) - Major Physics (63 credits)*
- Software Engineering: *section 13.9.13: Bachelor of Science (B.Sc.) - Major Software Engineering (63 credits)*

10.1.4.3 Joint Major Programs

- Atmospheric Science and Physics: *section 13.3.7: Bachelor of Science (B.Sc.) - Major Atmospheric Science and Physics (69 credits)*
- Mathematics and Computer Science – see Mathematics and Statistics: *section 13.22.12: Bachelor of Science (B.Sc.) - Major Mathematics and Computer Science (72 credits)*
- Physics and Computer Science – see Physics: *section 13.30.12: Bachelor of Science (B.Sc.) - Major Physics and Computer Science (66 credits)*

- Physics and Geophysics: [section 13.30.11: Bachelor of Science \(B.Sc.\) - Major Physics and Geophysics \(69 credits\)](#)
- Statistics and Computer Science: [section 13.22.13: Bachelor of Science \(B.Sc.\) - Major Statistics and Computer Science \(72 credits\)](#)

10.1.4.4 Honours Programs

- Applied Mathematics: [section 13.22.14: Bachelor of Science \(B.Sc.\) - Honours Applied Mathematics \(63 credits\)](#)
- Atmospheric Science: [section 13.3.8: Bachelor of Science \(B.Sc.\) - Honours Atmospheric Science \(74 credits\)](#)
- Chemistry: [section 13.7.14: Bachelor of Science \(B.Sc.\) - Honours Chemistry \(71 credits\)](#)
- Chemistry – Bio-organic option: [section 13.7.16: Bachelor of Science \(B.Sc.\) - Honours Chemistry - Bio-organic \(75 credits\)](#)
- Chemistry – Atmosphere and Environment option: [section 13.7.15: Bachelor of Science \(B.Sc.\) - Honours Chemistry - Atmosphere and Environment \(75 credits\)](#)
- Chemistry – Materials: [section 13.7.18: Bachelor of Science \(B.Sc.\) - Honours Chemistry - Materials \(74 credits\)](#)
- Chemistry – Measurement: [section 13.7.19: Bachelor of Science \(B.Sc.\) - Honours Chemistry - Measurement \(74 credits\)](#)
- Computer Science: [section 13.9.14: Bachelor of Science \(B.Sc.\) - Honours Computer Science \(75 credits\)](#)
- Earth System Science: [section 13.11.5: Bachelor of Science \(B.Sc.\) - Honours Earth System Science \(66 credits\)](#)
- Environment: [: Bachelor of Science \(B.Sc.\) - Honours Environment \(72 credits\)](#)
- Geography: [section 13.17.9: Bachelor of Science \(B.Sc.\) - Honours Geography \(66 credits\)](#)
- Geology: [section 13.10.9: Bachelor of Science \(B.Sc.\) - Honours Geology \(75 credits\)](#)
- Mathematics: [section 13.22.15: Bachelor of Science \(B.Sc.\) - Honours Mathematics \(63 credits\)](#)
- Physics: [section 13.30.13: Bachelor of Science \(B.Sc.\) - Honours Physics \(78 credits\)](#)
- Planetary Sciences: [section 13.10.10: Bachelor of Science \(B.Sc.\) - Honours Planetary Sciences \(78 credits\)](#)
- Probability and Statistics: [section 13.22.16: Bachelor of Science \(B.Sc.\) - Honours Probability and Statistics \(63 credits\)](#)
- Software Engineering: [section 13.9.16: Bachelor of Science \(B.Sc.\) - Honours Software Engineering \(75 credits\)](#)

10.1.4.5 Joint Honours Programs

- Mathematics and Computer Science: [section 13.22.18: Bachelor of Science \(B.Sc.\) - Honours Mathematics and Computer Science \(78 credits\)](#)
- Mathematics and Physics: [section 13.30.15: Bachelor of Science \(B.Sc.\) - Honours Mathematics and Physics \(81 credits\)](#)
- Physics and Chemistry: [section 13.30.16: Bachelor of Science \(B.Sc.\) - Honours Physics and Chemistry \(80 credits\)](#)
- Physics and Computer Science: [section 13.30.17: Bachelor of Science \(B.Sc.\) - Honours Physics and Computer Science \(81 credits\)](#)
- Statistics and Computer Science: [section 13.22.17: Bachelor of Science \(B.Sc.\) - Honours Statistics and Computer Science \(79 credits\)](#)

10.2 Minor Programs

Minor Programs

Atmospheric Science, [section 13.3.4: Bachelor of Science \(B.Sc.\) - Minor Atmospheric Science \(18 credits\)](#)

Biology, [section 13.5.6: Bachelor of Science \(B.Sc.\) - Minor Biology \(25 credits\)](#)

Biotechnology, [section 13.6.5: Bachelor of Science \(B.Sc.\) - Minor Biotechnology \(for Science Students\) \(24 credits\)](#)

Chemical Engineering, [section 13.7.6: Bachelor of Science \(B.Sc.\) - Minor Chemical Engineering \(24 credits\)](#)

Chemistry, [section 13.7.5: Bachelor of Science \(B.Sc.\) - Minor Chemistry \(20 credits\)](#)

Cognitive Science, [section 13.8.2: Bachelor of Science \(B.Sc.\) - Minor Cognitive Science \(24 credits\)](#)

Computer Science, [section 13.9.7: Bachelor of Science \(B.Sc.\) - Minor Computer Science \(24 credits\)](#)

Earth System Science, [section 13.11.3: Bachelor of Science - Minor Earth System Science \(18 credits\)](#)

Education for Science Students, [section 13.35.4: Bachelor of Science \(B.Sc.\) - Minor Education for Science Students \(18 credits\)](#)

Electrical Engineering, [section 13.30.7: Bachelor of Science \(B.Sc.\) - Minor Electrical Engineering \(24 credits\)](#)

Entrepreneurship for Science Students, [section 13.12.2: Bachelor of Science \(B.Sc.\) - Minor Entrepreneurship for Science Students \(18 credits\)](#)

Environment, [: Bachelor of Science \(Agricultural and Environmental Sciences\) \(B.Sc.\(Ag.Env.Sc.\)\) or Bachelor of Science \(B.Sc.\) - Minor Environment \(18 credits\)](#)

Minor Programs

Field Study, *section 13.15.1: Field Studies - Minor Field Studies (18 credits)*

Finance for Non-Management Students, *section 13.21.1: Bachelor of Commer*

10.5 Arts Major and Minor Concentrations Open to Science Students

For more information, please see the relevant departmental entries in [Faculty of Arts](#) > [Undergraduate](#).

10.5.1 Major Concentrations

Major Concentrations

African Studies, : *Bachelor of Arts (B.A.) - Major Concentration African Studies (36 credits)*

Anthropology, : *Bachelor of Arts (B.A.) - Major Concentration Anthropology (36 credits)*

Art History, : *Bachelor of Arts (B.A.) - Major Concentration Art History (36 credits)*

Classics, : *Bachelor of Arts (B.A.) - Major Concentration Classics (36 credits)*

East Asian Studies, : *Bachelor of Arts (B.A.) - Major Concentration East Asian Studies (36 credits)*

Economics, : *Bachelor of Arts (B.A.) - Major Concentration Economics (36 credits)*

English - Cultural Studies, : *Bachelor of Arts (B.A.) - Major Concentration English - Cultural Studies (36 credits)*

English - Drama and Theatre, : *Bachelor of Arts (B.A.) - Major Concentration English - Drama and Theatre (36 credits)*

English - Literature, : *Bachelor of Arts (B.A.) - Major Concentration English - Literature (36 credits)*

Gender, Sexuality, Feminist, & Social Justice Studies, : *Bachelor of Arts (B.A.) - Major Concentration Gender, Sexuality, Feminist, & Social Justice Studies (36 credits)*

Geography (Urban Studies), : *Bachelor of Arts (B.A.) - Major Concentration Geography (Urban Studies) (36 credits)*

German Studies, : *Bachelor of Arts (B.A.) - Major Concentration German Studies (36 credits)*

Hispanic Languages, : *Bachelor of Arts (B.A.) - Major Concentration Hispanic Studies - Languages (36 credits)*

Hispanic Literature and Culture, : *Bachelor of Arts (B.A.) - Major Concentration Hispanic Studies - Literature and Culture (36 credits)*

History, : *Bachelor of Arts (B.A.) - Major Concentration History (36 credits)*

International Development Studies, : *Bachelor of*

Minor Concentrations

Arabic Language, : *Bachelor of Arts (B.A.) - Minor Concentration Arabic Language (18 credits)*

Art History, : *Bachelor of Arts (B.A.) - Minor Concentration Art History (18 credits)*

Canadian Studies, : *Bachelor of Arts (B.A.) - Minor Concentration Canadian Studies (18 credits)*

Classics, : *Bachelor of Arts (B.A.) - Minor Concentration Classics (18 credits)*

Minor Concentrations

South Asian Studies, : *Bachelor of Arts (B.A.) - Minor Concentration South Asian Studies (18 credits)*

Turkish Language, : *Bachelor of Arts (B.A.) - Minor Concentration Turkish Language (18 credits)*

Urdu Language, : *Bachelor of Arts (B.A.) - Minor Concentration Ur*

To apply, you must be a Canadian citizen or permanent resident of Canada. See mcgill.ca/science/research/undergraduate-research/nserc for more information.

11.2.2 SURA: Science Undergraduate Research Awards

Science Undergraduate Research Awards—SURAs—are for both Canadian and international McGill students registered in a B.Sc. or B.A. & Sc. science undergraduate program (B.A. students may wish to look into programs offered by the Faculty of Arts). SURAs are broadly similar to the NSERC USRA; two differences are that *international students may apply*, and *supervision is not restricted to professors with NSERC research grants* and thus SURAs can also support social science or medical science research.

See mcgill.ca/science/research/undergraduate-research/sura for details.

11.3 Undergraduate Poster Showcase

Each year, the Faculty of Science holds an undergraduate poster showcase to celebrate the work of our undergraduate students. This event, sponsored by the Office of Science Education, is an opportunity for students to present research, projects and assignments completed inside or outside class.

Everyone is welcome to attend.

For more details and the date, please refer to mcgill.ca/ose/undergraduate-poster-showcase.

11.4 Getting involved in research as an undergraduate

Opportunities at McGill

Departments and individual researchers at McGill offer various opportunities for undergraduate students to get involved in research. These arrangements may be voluntary or remunerated by academic credit or income.

Some are formal programs that you can find more information about elsewhere in the eCalendar:

- [section 11.1: Research Project Courses](#)
- [section 11.1.1: "396" Undergraduate Research Project Courses](#)
- [section 11.2: Undergraduate Student Research Awards](#)

Others come about through informal discussions between students and professors.

For more information on finding research opportunities at McGill, including tips for contacting researchers, visit mcgill.ca/science/research/undergraduate-research/finding-opportunities.

Internships and field studies

Some science internships and field study programs include a research component. Refer to [section 12: Science Internships and Field Studies](#) for more information.

Beyond McGill

You may also want to look for opportunities funded or offered by external foundations or institutions, research agencies, other academic institutions, or scholarly societies. Examples include: a provincial cancer research society, the science funding agency of another country which you wish to visit or where you hold citizenship, research hospitals or universities in another city, or an international psychological association.

12 Science Internships and Field Studies

The [Science Internships & Field Studies Office](#) promotes field studies and internship opportunities to interested students seeking hands-on experience. The office coordinates the field study semesters offered through the Faculty of Science and provides information on internship opportunities to students who are in Science programs at McGill. Whether you decide to participate in a field study semester or apply classroom theory to practice, the [Science Internships & Field Studies Office](#) will offer you assistance in your decision.

Burnside Hall, Room 720
805 Sherbrooke Street West
Montreal QC H3A 0B9
Telephone: 514-398-1063; 514-398-8365
Email: ifso.science@mcgill.ca
Website: [mcgill.ca/science/under3Tm\(v\)Tj100e19dstudysemesterorapply6TareT](http://mcgill.ca/science/under3Tm(v)Tj100e19dstudysemesterorapply6TareT)

12.1 Internship Program: Industrial Practicum (IP) and Internship Year in Science (IYS)

The Internship Program is open to all Science undergraduate students, as well as qualified students in other undergraduate degrees or programs, including majors in Environment, Computer Science, Geography

13.1 B.Sc. Freshman Program

If you need 97–120 credits (four years) to complete your degree requirements, you must register in the Science Freshman program, which is designed to provide the basic science foundation for your subsequent three-year Liberal, Major, or Honours program. For a detailed description of the Science Freshman program, you should consult [section 13.1.1: Bachelor of Science \(B.Sc.\) - Freshman Program \(30 credits\)](#) and the Science Freshman Student information available on the SOUSA website, mcgill.ca/science/undergraduate/handbook.

If you have completed the Diploma of Collegial Studies, Advanced Placement exams, Advanced Lev

- histology;
- embryology;
- neuroanatomy; and
- gross anatomy.

The **Honours** program is designed as the first phase in the training of career cell and molecular biologists. The **Major** and **Liberal** programs offer decreasing levels of specialization in Anatomy and Cell Biology but with a broader base in other biological sciences. These programs also form a sound background for graduate studies in Anatomy and Cell Biology, or for further professional training, including medical school and other health programs. A B.Sc. in Anatomy and Cell Biology provides an excellent preparation for technical and administrative positions in laboratories of universities, research institutions, hospitals, and pharmaceutical and biotechnological industries.

The Department is equipped to perform protein purification; recombinant DNA technology; micro-injection of molecules into single cells; cytochemical, immunocytochemical, and fluorescent analysis and electron microscopy; proteomics; and genomics. The Department has a well-equipped centre for electron microscopy as well as a centre for confocal and immunofluorescence. The Department's cryo-electron microscope facility is unique and provides cutting edge technology with which to apply fundamental discoveries to therapeutic applications. Human anatomy classes are taught in the fully-equipped cadaver lab and students have access to 3D printers and other learning tools.

13.2.3 Anatomy and Cell Biology (ANAT) Faculty

Chair

Craig Mandato

Emeritus Professors

Gary C. Bennett; B.A., B.Sc.(Sir G. Wms.), M.Sc., Ph.D.(McG.)

John J.M. Bergeron; B.Sc.(McG.), D.Phil.(Oxf.)

James R. Brawer; B.Sc.(Tufts), Ph.D.(Harv.)

Louis Hermo; B.A.(Loyola), M.Sc., Ph.D.(McG.)

Sandra C. Miller; B.Sc.(Sir G. Wms.), M.Sc., Ph.D.(McG.)

Dennis G. Osmond; C.M., B.Sc., M.B., Ch.B., D.Sc.(Brist.), M.R.C.S., L.R.C.P., F.R.S.C.

Hershey Warshawsky; B.Sc.(Sir G. Wms.), M.Sc., Ph.D.(McG.)

Professors

Chantal Autexier; B.Sc.(C'dia), Ph.D.(McG.)

Samuel David; Ph.D.(Manit.) (*joint appt. with Neurology and Neurosurgery*)

Elaine Davis; B.Sc., M.Sc.(UWO), Ph.D.(McG.)

Timothy Kennedy; B.Sc.(McM.), M.Phil., Ph.D.(Col.) (*joint appt. with Neurology and Neurosurgery*)

Nathalie Lamarche-Vane; B.Sc., Ph.D.(Montr.)

Marc D. McKee; B.Sc., M.Sc., Ph.D.(McG.) (*joint appt. with Dentistry*)

Peter McPherson; B.Sc.(Manit.), Ph.D.(Iowa) (*joint appt. with Neurology and Neurosurgery*)

Carlos R. Morales; D.V.M.(UNNE, Argentina), Ph.D.(McG.)

Joaquin Ortega; B.Sc.(Zaragoza), Ph.D.(Autonoma, Madrid)

Barry I. Posner; M.D.(Manit.), F.R.C.P.(C) (*joint appt. with Medicine and Health Science*)

Dieter Reinhardt; M.S.(Kaiserslautern), Ph.D.(Munich) (*joint appt. with Dentistry*)

Alfredo Ribeiro-da-Silva; M.D., Ph.D.(U.Porto) (*joint appt. with Pharmacology and Therapeutics*)

Wayne Sossin; S.B.(MIT), Ph.D.(Stan.) (*joint appt. with Neurology and Neurosurgery*)

Stefano Stifani; D.Chem.(Rome), Ph.D.(Alta.) (*joint appt. with NeuroloMcG.*)

Associate Professors

Craig Mandato; B.Sc., Ph.D.(Wat.)

Geoffroy P. Noël; Ph.D.(Br. Col.)

John F. Presley; B.A., Ph.D.(Texas)

Assistant Professors

Susanne Bechstedt; B.Sc.(Flor. St.), M.Sc.(Friedrich Schiller), Ph.D.(Max Planck)

Khanh Huy Bui; B.Sc.(UNSW), M.Sc.(Chalmers), Ph.D.(ETH Zürich)

Wafa Djerboua; M.Ed (Ottawa), M.D. University of Constantine (Algeria)

Sean McW

Adjunct Professors

Gregor Andelfinger; M.D.(Ulm)
 Philippe Campeau; M.D.(Laval)
 Michel Cayouette; Ph.D.(Laval)
 Frédéric Charron; B.Sc.(Montr.), Ph.D.(McG.)
 Jean-François Côté; Ph.D.(McG.)
 Daniel Cyr; B.Sc., M.Sc.(C'dia), Ph.D.(Manit.)
 Jacques Drouin; B.Sc., D.Sc.(Laval)
 Jennifer Estall; Ph.D.(Tor.)
 Patrick Freud; B.Sc., D.C.(Parker)
 Michael Greenwood; B.Sc., M.Sc.(C'dia), Ph.D.(McG.)
 David Hipfner; B.Sc., Ph.D.(Qu.)
 Artur Kania; Ph.D.(Baylor)
 Justin Kollman; Ph.D.(Calif.-San Diego)
 Stephane Lefrancois; B.Sc., Ph.D.(McG.)
 Alexei Pshezhetsky; Ph.D.(Moscow St.)
 Isabelle Rouiller; Ph.D.(Herts.)
 Michael Sacher; Ph.D.(McG.)
 Elitza Tocheva; B.Sc., Ph.D.(Br. Col.)
 Javier Vargas; Ph.D. (UCM, Spain)

13.2.4 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Anatomy and Cell Biology (48 credits)

Students may complete this program with a minimum of 47 credits or a maximum of 48 credits depending on their choice of complementary courses.

Required Courses (32 credits)

Note: ANAT 261 must be taken in U1.

* Students who have taken the equivalent of CHEM 212 and/or MATH 203 in CEGEP (as defined at <http://www.mcgill.ca/students/courses/plan/transfer/>) are exempt and must replace these credits with elective course credits to satisfy the total credit requirement for their degree.

| | | |
|-----------|-----|---|
| ANAT 212 | (3) | Molecular Mechanisms of Cell Function |
| ANAT 214 | (3) | Systemic Human Anatomy |
| ANAT 261 | (4) | Introduction to Dynamic Histology |
| ANAT 262 | (3) | Introductory Molecular and Cell Biology |
| BIOL 200 | (3) | Molecular Biology |
| BIOL 202 | (3) | Basic Genetics |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |

One of the following statistics courses:

| | | |
|----------|-----|--|
| MATH 203 | (3) | Principles of Statistics 1 |
| PSYC 204 | (3) | Introduction to Psychological Statistics |

Complementary Courses (16 credits)

Students complete a minimum of 15 or a maximum of 16 complementary course credits selected as follows:

9 credits of advanced anatomy courses (AAC) selected from:

| | | |
|----------|-----|-----------------------------------|
| ANAT 314 | (3) | Human Musculoskeletal Anatomy |
| ANAT 321 | (3) | Circuitry of the Human Brain |
| ANAT 322 | (3) | Neuroendocrinology |
| ANAT 365 | (3) | Cellular Trafficking |
| ANAT 381 | (3) | Experimental Embryology |
| ANAT 514 | (3) | Advanced Human Anatomy Laboratory |
| ANAT 565 | (3) | Diseases-Membrane Trafficking |
| NEUR 310 | (3) | Cellular Neurobiology |

6-7 credits of biologically oriented courses (BOC) selected from:

| | | |
|----------|-----|-------------------------------|
| ANAT 314 | (3) | Human Musculoskeletal Anatomy |
| ANAT 321 | (3) | Circuitry of the Human Brain |

| | | |
|-----------|-----|---|
| ANAT 262 | (3) | Introductory Molecular and Cell Biology |
| BIOL 200 | (3) | Molecular Biology |
| BIOL 202 | (3) | Basic Genetics |
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| CHEM 222* | (4) | Introductory Organic Chemistry 2 |
| MIMM 214 | (3) | Introductory Immunology: Elements of Immunity |
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |

One of the following statistics courses:

| | | |
|-----------|-----|--|
| BIOL 373 | (3) | Biometry |
| MATH 203* | (3) | Principles of Statistics 1 |
| PSYC 204 | (3) | Introduction to Psychological Statistics |

Complementary Courses (24 credits)

Complementary courses are selected as follows with a minimum of 6 credits at the 400 level or higher:

MIMMum of 6 0 1 C)of 6 crediv0 0 m)

| | | |
|----------|-----|----------------------------------|
| BIOC 312 | (3) | Biochemistry of Macromolecules |
| BIOC 450 | (3) | Protein Structure and Function |
| BIOC 458 | (3) | Membranes and Cellular Signaling |
| BIOC 503 | (3) | Immunochemistry |

| | | |
|----------|-----|--|
| PHAR 562 | (3) | Neuropharmacology |
| PHAR 563 | (3) | Endocrine Pharmacology |
| PHGY 311 | (3) | Channels, Synapses and Hormones |
| PHGY 312 | (3) | Respiratory, Renal, & Cardiovascular Physiology |
| PHGY 313 | (3) | Blood, Gastrointestinal, & Immune Systems Physiology |
| PHGY 314 | (3) | Integrative Neuroscience |
| PHGY 451 | (3) | Advanced Neurophysiology |
| PHGY 502 | (3) | Exercise Physiology |
| PHGY 508 | (3) | Advanced Renal Physiology |
| PHGY 513 | (3) | Translational Immunology |
| PHGY 515 | (3) | Blood-Brain Barrier in Health and Disease |
| PHGY 516 | (3) | Physiology of Blood |
| PHGY 517 | (3) | Artificial Internal Organs |
| PHGY 518 | (3) | Artificial Cells |
| PHGY 552 | (3) | Cellular and Molecular Physiology |
| PHGY 556 | (3) | Topics in Systems Neuroscience |
| PSYT 455 | (3) | Neurochemistry |
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |

13.2.6 Bachelor of Science (B.Sc.) - Honours Anatomy and Cell Biology (73 credits)

| | | |
|-----------|-----|--|
| BIOL 373 | (3) | Biometry |
| MATH 203* | (3) | Principles of Statistics 1 |
| PSYC 204 | (3) | Introduction to Psychological Statistics |

Complementary Courses (21 credits)

Complementary courses are selected as follows with a minimum of 6 credits at the 400 level or higher:

18 credits of advanced anatomy courses (AAC) selected from:

* Note: Students may take either ANAT 321 OR ANAT 323.

| | | |
|------------|-----|--|
| ANAT 314 | (3) | Human Musculoskeletal Anatomy |
| ANAT 321** | (3) | Circuitry of the Human Brain |
| ANAT 322 | (3) | Neuroendocrinology |
| ANAT 323** | (3) | Clinical Neuroanatomy |
| ANAT 365 | (3) | Cellular Trafficking |
| ANAT 381 | (3) | Experimental Embryology |
| ANAT 416 | (3) | Development, Disease and Regeneration |
| ANAT 458 | (3) | Membranes and Cellular Signaling |
| ANAT 514 | (3) | Advanced Human Anatomy Laboratory |
| ANAT 541 | (3) | Cell and Molecular Biology of Aging |
| ANAT 542 | (3) | Transmission Electron Microscopy of Biological Samples |
| ANAT 565 | (3) | Diseases-Membrane Trafficking |
| NEUR 310 | (3) | Cellular Neurobiology |

3 credits of biologically oriented courses (BOC) selected from:

| | | |
|----------|-----|--|
| ANAT 314 | (3) | Human Musculoskeletal Anatomy |
| ANAT 321 | (3) | Circuitry of the Human Brain |
| ANAT 322 | (3) | Neuroendocrinology |
| ANAT 323 | (3) | Clinical Neuroanatomy |
| ANAT 365 | (3) | Cellular Trafficking |
| ANAT 381 | (3) | Experimental Embryology |
| ANAT 416 | (3) | Development, Disease and Regeneration |
| ANAT 458 | (3) | Membranes and Cellular Signaling |
| ANAT 541 | (3) | Cell and Molecular Biology of Aging |
| ANAT 542 | (3) | Transmission Electron Microscopy of Biological Samples |
| ANAT 565 | (3) | Diseases-Membrane Trafficking |
| BIOC 311 | (3) | Metabolic Biochemistry |
| BIOC 312 | (3) | Biochemistry of Macromolecules |
| BIOC 450 | (3) | Protein Structure and Function |
| BIOC 458 | (3) | Membranes and Cellular Signaling |
| BIOC 503 | (3) | Immunochemistry |
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 303 | (3) | Developmental Biology |

| | | |
|----------|-----|--|
| BIOL 306 | (3) | Neural Basis of Behaviour |
| BIOL 313 | (3) | Eukaryotic Cell Biology |
| BIOL 314 | (3) | Molecular Biology of Cancer |
| BIOL 320 | (3) | Evolution of Brain and Behaviour |
| BIOL 370 | (3) | Human Genetics Applied |
| BIOL 518 | (3) | Advanced Topics in Cell Biology |
| BIOL 520 | (3) | Gene Activity in Development |
| BIOL 524 | (3) | Topics in Molecular Biology |
| BIOL 532 | (3) | Developmental Neurobiology Seminar |
| BIOL 544 | (3) | Genetic Basis of Life Span |
| BIOL 546 | (3) | Genetics of Model Systems |
| BIOL 551 | (3) | Principles of Cellular Control |
| BIOL 575 | (3) | Human Biochemical Genetics |
| BIOL 588 | (3) | Advances in Molecular/Cellular Neurobiology |
| BIOT 505 | (3) | Selected Topics in Biotechnology |
| COMP 204 | (3) | Computer Programming for Life Sciences |
| EXMD 401 | (3) | Physiology and Biochemistry Endocrine Systems |
| EXMD 502 | (3) | Advanced Endocrinology 1 |
| EXMD 503 | (3) | Advanced Endocrinology 02 |
| EXMD 504 | (3) | Biology of Cancer |
| EXMD 506 | (3) | Advanced Applied Cardiovascular Physiology |
| EXMD 507 | (3) | Advanced Applied Respiratory Physiology |
| EXMD 508 | (3) | Advanced Topics in Respiration |
| MIMM 314 | (3) | Intermediate Immunology |
| MIMM 323 | (3) | Microbial Physiology |
| MIMM 324 | (3) | Fundamental Virology |
| MIMM 387 | (3) | The Business of Science |
| MIMM 413 | (3) | Parasitology |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 465 | (3) | Bacterial Pathogenesis |
| MIMM 466 | (3) | Viral Pathogenesis |
| MIMM 509 | (3) | Inflammatory Processes |
| NEUR 310 | (3) | Cellular Neurobiology |
| NEUR 502 | (3) | Basic and Clinical Aspects of Neuroimmunology |
| PATH 300 | (3) | Human Disease |
| PHAR 300 | (3) | Drug Action |
| PHAR 301 | (3) | Drugs and Disease |
| PHAR 303 | (3) | Principles of Toxicology |
| PHAR 562 | (3) | Neuropharmacology |
| PHAR 563 | (3) | Endocrine Pharmacology |
| PHGY 311 | (3) | Channels, Synapses and Hormones |
| PHGY 312 | (3) | Respiratory, Renal, & Cardiovascular Physiology |
| PHGY 313 | (3) | Blood, Gastrointestinal, & Immune Systems Physiology |

| | | |
|----------|-----|--|
| PHGY 314 | (3) | Integrative Neuroscience |
| PHGY 451 | (3) | Advanced Neurophysiology |
| PHGY 502 | (3) | Exercise Physiology |
| PHGY 508 | (3) | Advanced Renal Physiology |
| PHGY 513 | (3) | Translational Immunology |
| PHGY 515 | (3) | Blood-Brain Barrier in Health and Disease |
| PHGY 516 | (3) | Physiology of Blood |
| PHGY 517 | (3) | Artificial Internal Organs |
| PHGY 518 | (3) | Artificial Cells |
| PHGY 552 | (3) | Cellular and Molecular Physiology |
| PHGY 556 | (3) | Topics in Systems Neuroscience |
| PSYT 455 | (3) | Neurochemistry |
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |

13.3 Atmospheric and Oceanic Sciences (ATOC)

13.3.1 Location

Burnside Hall, Room 945
805 Sherbrooke Street West
Montreal QC H3A 0B9
Telephone: 514-398-3764
Fax: 514-398-6115
Email: info.aos@mcgill.ca
Website: mcgill.ca/meteo

13.3.2 About Atmospheric and Oceanic Sciences

The Department of Atmospheric and Oceanic Sciences offers, at the undergraduate level, a broad range of courses and degree programs in atmospheric science (meteorology). At the postgraduate level, programs of study are offered in physical oceanography, air-sea interaction, and climate research as well as in different branches of atmospheric science. The study of atmospheric science is based largely on physics and applied mathematics. All required courses except those at the introductory level generally have prerequisites or corequisites in physics, mathematics, and atmospheric science. One of the goals of the discipline is to develop the understanding necessary to improve our ability to predict the weather, but atmospheric science is more than weather forecasting.

Another important area of study focuses on the changes in global climate caused by the changing chemical composition of the atmosphere. The approach to the study of climate change is quantitative in the Department of Atmospheric and Oceanic Sciences. Like other parts of physics, atmospheric science attempts to create theoretical models of its complex processes as a means of analyzing the motion and composition of the air, its thermodynamic behaviour, and its interaction with radiation and with the solid or liquid surface beneath it.

From one viewpoint, the atmosphere may be studied as a large volume of gas by the methods of fluid mechanics: winds, circulation patterns, turbulence, and energy and momentum exchanges are the ideas employed in this approach. Alternatively, the atmosphere may be studied from the point of view of its detailed physics: how water condenses in the air; how cloud droplets make rain; how sunlight warms the ground and the ground warms the air above it by radiation and convection; and how the atmosphere and ocean interact to shape the weather and climate. A comprehensive understanding requires both viewpoints, and these are reflected in the curriculum.

The Department of Atmospheric and Oceanic Sciences offers four main programs in Atmospheric Science:

- **Honours**
- **Major**
- **Minor**
- **Joint Major** in Atmospheric Science and Physics

The **Honours** program is meant for students with high standing. It is based on courses similar to those in the Major program, but provides opportunities to perform research and to take advanced courses. The **Major** program, although somewhat less intensive, satisfies the requirements for a professional career as a meteorologist, and like the Honours program equips the student to undertake postgraduate study in meteorology, atmospheric science, and related

sciences (physical oceanography) at any of the leading universities. The Department also offers a special one-year Diploma program to B.Sc. or B.Eng. graduates.

An undergraduate degree in Atmospheric Science is an excellent background for professional careers in government service or private industry and/or graduate study in the physical sciences. Environment and Climate Change Canada (and the Meteorological Service of Canada in particular) has traditionally

13.3.4 Bachelor of Science (B.Sc.) - Minor Atmospheric Science (18 credits)

This Minor may be taken in conjunction with any program in the Faculty of Science.

Required Courses (3 credits)

ATOC 214 (3) Introduction: Physics of the Atmosphere

Complementary Courses (15 credits)

3-6 credits selected from:

ATOC 215 (3) Oceans, Weather and Climate
ATOC 219* (3) Introduction to Atmospheric Chemistry
CHEM 219* (3) Introduction to Atmospheric Chemistry

* Note: Students may select ATOC 219 or CHEM 219 but not both.

Complementary Course

9-12 credits selected from:

ATOC 309 (3) Weather Radars and Satellites
ATOC 312 (3) Rotating Fluid Dynamics
ATOC 315 (3) Thermodynamics and Convection
ATOC 357 (3) Atmospheric and Oceanic Science Laboratory
ATOC 512 (3) Atmospheric and Oceanic Dynamics
ATOC 513 (3) Waves and Stability
ATOC 515 (3) Turbulence in Atmosphere and Oceans
ATOC 519 (3) Advances in Chemistry of Atmosphere
ATOC 521 (3) Cloud Physics
ATOC 525 (3) Atmospheric Radiation
ATOC 531 (3) Dynamics of Current Climates
ATOC 540 (3) Synoptic Meteorology 1
ATOC 548 (3) Mesoscale Meteorology.
ATOC 558 (3) Numerical Methods and Laboratory
ATOC 568 (3) Ocean Physics

13.3.5 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Atmospheric and Oceanic Sciences (48 credits)

45-48 credits

Required Courses (21 credits)

ATOC 214 (3) Introduction: Physics of the Atmosphere
ATOC 312 (3) Rotating Fluid Dynamics
ATOC 315 (3) Thermodynamics and Convection
MATH 222 (3) Calculus 3
MATH 223 (3) Linear Algebra
MATH 314 (3) Advanced Calculus
Ordinary Dif

Complementary Courses (27 credits)

24-27 credits:

Note: All students are encouraged to consult with the Undergraduate Adviser for help selecting from among the complementary courses.

3-6 credits selected from:

| | | |
|----------|-----|---------------------------------------|
| ATOC 215 | (3) | Oceans, Weather and Climate |
| ATOC 219 | (3) | Introduction to Atmospheric Chemistry |

3 credits selected from:

13.3.6 Bachelor of Science (B.Sc.) - Major Atmospheric Science (62 credits)

Required Courses (24 credits)

| | | |
|----------|-----|---|
| ATOC 214 | (3) | Introduction: Physics of the Atmosphere |
| ATOC 312 | (3) | Rotating Fluid Dynamics |
| | | Thermodynamics and Conv |

| | | |
|-------------|-----|--|
| MATH 203* | (3) | Principles of Statistics 1 |
| MATH 317 | (3) | Numerical Analysis |
| MATH 319 | (3) | Introduction to Partial Differential Equations |
| MATH 323 | (3) | Probability |
| MATH 324* | (3) | Statistics |
| PHYS 333 | (3) | Thermal and Statistical Physics |
| PHYS 340** | (3) | Majors Electricity and Magnetism |
| PHYS 342*** | (3) | Majors Electromagnetic Waves |
| PHYS 350** | (3) | Honours Electricity and Magnetism |
| PHYS 352*** | (3) | Honours Electromagnetic Waves |

* Students cannot receive credit for both MATH 203 and MATH 324.

** Students cannot receive credit for both PHYS 340 and PHYS 350.

*** Students cannot receive credit for both PHYS 342 and PHYS 352.

Weather Analysis and Forecasting Stream (17 credits)

(16-17 credits)

13 credits from:

| | | |
|----------|-----|-------------------------------|
| ATOC 309 | (3) | Weather Radars and Satellites |
| ATOC 521 | (3) | Cloud Physics |
| ATOC 540 | (3) | Synoptic Meteorology 1 |
| ATOC 541 | (3) | Synoptic Meteorology 2 |
| ATOC 546 | (1) | Current Weather Discussion |

3-4 credits selected from:

| | | |
|-----------|-----|--|
| ATOC 404+ | (3) | Climate Physics |
| ATOC 512 | (3) | Atmospheric and Oceanic Dynamics |
| ATOC 513 | (3) | Waves and Stability |
| ATOC 525 | (3) | Atmospheric Radiation Paleoclimate Dynamics |

Climate Science Stream (15 credits)

6 credits from:

| | | |
|-----------|-----|------------------------------|
| ATOC 404+ | (3) | Climate Physics |
| ATOC 531 | (3) | Dynamics of Current Climates |
| PHYS 404+ | (3) | Climate Physics |

+ Students cannot receive credit for both ATOC 404 and PHYS 404.

9 credits (at least 6 of which must be ATOC) selected from:

| | | |
|---|-----|-------------------------------------|
| ATOC 512 | (3) | Atmospheric and Oceanic Dynamics |
| ATOC 513 | (3) | Waves and Stability |
| ATOC 519 | (3) | Advances in Chemistry of Atmosphere |
| ATOC 521 | (3) | Cloud Physics |
| ATOC 525 | (3) | Atmospheric Radiation |
| ATOC 530 | (3) | Paleoclimate Dynamics |
| A 507.961 Tmo 75.469 492.2(4) Tm(4C 530) Tsyno 221 970 1001 | | Synoptic Meteorology |

| | | |
|------------|-----|---|
| ATOC | | |
| ATOC 525 | | |
| ATOC 530 | | |
| ATOC 531 | | |
| ATOC 540 | | |
| ATOC 541 | (3) | |
| ATOC 546 | (1) | |
| ATOC 548 | (3) | M |
| ATOC 558 | (3) | Numerical |
| ATOC 568 | (3) | Ocean Physics |
| CHEM 367 | (3) | Instrumental Analysis 1 |
| CHEM 575 | (3) | Chemical Kinetics |
| EPSC 513 | (3) | Climate and the Carbon Cycle |
| EPSC 542 | (3) | Chemical Oceanography |
| ESYS 300 | (3) | Investigating the Earth System |
| ESYS 301 | (3) | Earth System Modelling |
| GEOG 322 | (3) | Environmental Hydrology |
| GEOG 372 | (3) | Running Water Environments |
| MATH 555++ | (4) | Fluid Dynamics |
| PHYS 404+ | (3) | Climate Physics |
| PHYS 432++ | (3) | Physics of Fluids |
| PHYS 512 | (3) | Computational Physics with Applications |

+ Students cannot receive credit for ATOC 404 and PHYS 404.

++ Students cannot receive credit for both PHYS 432 or MATH 555.(3)

| | | |
|----------|-----|----------------------------------|
| PHYS 230 | (3) | Dynamics of Simple Systems |
| PHYS 232 | (3) | Heat and Waves |
| PHYS 241 | (3) | Signal Processing |
| PHYS 257 | (3) | Experimental Methods 1 |
| PHYS 258 | (3) | Experimental Methods 2 |
| PHYS 331 | (3) | Topics in Classical Mechanics |
| PHYS 333 | (3) | Thermal and Statistical Physics |
| PHYS 340 | (3) | Majors Electricity and Magnetism |
| PHYS 342 | (3) | Majors Electromagnetic Waves |
| PHYS 346 | (3) | Majors Quantum Physics |

| | | |
|----------|-----|--|
| ATOC 312 | (3) | Rotating Fluid Dynamics |
| ATOC 315 | (3) | Thermodynamics and Convection |
| ATOC 480 | (3) | Honours Research Project |
| COMP 208 | (3) | Computer Programming for Physical Sciences and Engineering |
| MATH 222 | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 314 | (3) | Advanced Calculus |
| MATH 315 | (3) | Ordinary Differential Equations |

Complementary Courses (47 credits)

45-47 credits

Note: Students are required to fulfill the core complementary requirements along with one of the four streams listed below. In cases of overlap, each course can only be used once toward the satisfaction of the core complementary courses or the chosen stream.

Core (24 credits)

3-6 credits selected from:

| | | |
|----------|-----|-----------------------------|
| ATOC 215 | (3) | Oceans, Weather and Climate |
|----------|-----|-----------------------------|

| | | |
|-------------|-----|--|
| MATH 203* | (3) | Principles of Statistics 1 |
| MATH 317 | (3) | Numerical Analysis |
| MATH 319 | (3) | Introduction to Partial Differential Equations |
| MATH 323 | (3) | Probability |
| MATH 324 | (3) | Statistics |
| PHYS 333 | (3) | Thermal and Statistical Physics |
| PHYS 340** | (3) | Majors Electricity and Magnetism |
| PHYS 342*** | (3) | Majors Electromagnetic Waves |
| PHYS 350** | (3) | Honours Electricity and Magnetism |
| PHYS 352*** | (3) | Honours Electromagnetic Waves |

* Students cannot receive credit for both MATH 203 and MATH 324.

** Students cannot receive credit for both PHYS 340 and PHYS 350.

*** Students cannot receive credit for both PHYS 342 and PHYS 352.

Weather Analysis and Forecasting Stream (23 credits)

(22-23 credits)

16 credits from:

| | | |
|----------|-----|----------------------------------|
| ATOC 309 | (3) | Weather Radars and Satellites |
| ATOC 512 | (3) | Atmospheric and Oceanic Dynamics |
| ATOC 521 | (3) | Cloud Physics |
| ATOC 540 | (3) | Synoptic Meteorology 1 |
| ATOC 541 | (3) | Synoptic Meteorology 2 |
| ATOC 546 | (1) | Current Weather Discussion |

6-7 credits selected from:

| | | |
|------------|-----|---|
| ATOC 404+ | (3) | Climate Physics |
| ATOC 513 | (3) | Waves and Stability |
| ATOC 515 | (3) | Turbulence in Atmosphere and Oceans |
| ATOC 525 | (3) | Atmospheric Radiation |
| ATOC 530 | (3) | Paleoclimate Dynamics |
| ATOC 531 | (3) | Dynamics of Current Climates |
| ATOC 558 | (3) | Numerical Methods and Laboratory |
| ATOC 568 | (3) | Ocean Physics |
| ESYS 300 | (3) | Investigating the Earth System |
| ESYS 301 | (3) | Earth System Modelling |
| MATH 555++ | (4) | Fluid Dynamics |
| PHYS 404+ | (3) | Climate Physics |
| PHYS 432++ | (3) | Physics of Fluids |
| PHYS 512 | (3) | Computational Physics with Applications |

+ Students cannot receive credit for both ATOC 404 and PHYS 404.

++ Students cannot receive credit for both PHYS 432 or MATH 555.

Climate Science Stream (22 credits)

(21-22 credits)

15 credits from:

| | | |
|-----------|-----|---|
| ATOC 519 | (3) | Advances in Chemistry of Atmosphere |
| ATOC 525 | (3) | Atmospheric Radiation |
| ATOC 530 | (3) | Paleoclimate Dynamics |
| ATOC 540 | (3) | Synoptic Meteorology 1 |
| ATOC 558 | (3) | Numerical Methods and Laboratory |
| CHEM 367 | (3) | Instrumental Analysis 1 |
| CHEM 575 | (3) | Chemical Kinetics |
| EPSC 513 | (3) | Climate and the Carbon Cycle |
| EPSC 542 | (3) | Chemical Oceanography |
| MATH 423 | (3) | Applied Regression |
| PHYS 404+ | (3) | Climate Physics |
| PHYS 512 | (3) | Computational Physics with Applications |

+ Student cannot receive credit for both ATOC 404 and PHYS 404.

General Stream (22 credits)

21-22 credits (at least 15 of which must be ATOC) selected from:

| | | |
|------------|-----|---|
| ATOC 309 | (3) | Weather Radars and Satellites |
| ATOC 404+ | (3) | Climate Physics |
| ATOC 512 | (3) | Atmospheric and Oceanic Dynamics |
| ATOC 513 | (3) | Waves and Stability |
| ATOC 519 | (3) | Advances in Chemistry of Atmosphere |
| ATOC 521 | (3) | Cloud Physics |
| ATOC 525 | (3) | Atmospheric Radiation |
| ATOC 530 | (3) | Paleoclimate Dynamics |
| ATOC 531 | (3) | Dynamics of Current Climates |
| ATOC 540 | (3) | Synoptic Meteorology 1 |
| ATOC 541 | (3) | Synoptic Meteorology 2 |
| ATOC 546 | (1) | Current Weather Discussion |
| ATOC 548 | (3) | Mesoscale Meteorology. |
| ATOC 558 | (3) | Numerical Methods and Laboratory |
| ATOC 568 | (3) | Ocean Physics |
| CHEM 367 | (3) | Instrumental Analysis 1 |
| CHEM 575 | (3) | Chemical Kinetics |
| EPSC 513 | (3) | Climate and the Carbon Cycle |
| EPSC 542 | (3) | Chemical Oceanography |
| ESYS 300 | (3) | Investigating the Earth System |
| ESYS 301 | (3) | Earth System Modelling |
| MATH 423 | (3) | Applied Regression |
| MATH 555++ | (4) | Fluid Dynamics |
| PHYS 404+ | (3) | Climate Physics |
| PHYS 432++ | (3) | Physics of Fluids |
| PHYS 512 | (3) | Computational Physics with Applications |

+ Students cannot receive credit for both ATOC 404 and PHYS 404.

++ Students cannot receive credit for both PHYS 432 or MATH 555.

13.3.9 Diploma (Dip.) Meteorology (30 credits)

The Department offers an intensive, one-year program in theoretical and applied meteorology to B.Sc. or B.Eng. graduates of suitable standing in physics, applied mathematics or other appropriate disciplines, leading to a Diploma in Meteorology. The program is designed for students with little or no previous background in meteorology who wish to direct their experience to atmospheric or environmental applications, or who need to fulfil academic prerequisites in meteorology to qualify for employment. For further information, consult the Administrative Officer

The following programs are also available with an internship component:

- Major in

Honours students intending to pursue an M.Sc. in Biochemistry may be interested in the B.Sc./M.Sc. track, which offers a streamlined path to a graduate degree.

Our Major and Honours programs provide a sound background for students aiming for a professional career in biochemistry. The less specialized Liberal program allows students to select courses in other fields of interest. The Liberal program provides students with the opportunity to study the core of one science discipline along with a breadth component from another area of science or from many other disciplines; for more information, see [Faculty of Science](#)

>

Professors

Jerry Pelletier; B.Sc., Ph.D.(McG.) (*James McGill Professor*)

Nahum Sonenberg; M.Sc., Ph.D.(Weizmann Inst.), F.R.S.C., F.R.S. (*James McGill Professor*) (*Gilman Cheney Chair in Biochemistry*)

David Y. Thomas; B.Sc.(Brist.), M.Sc., Ph.D.(UCL; UK), F.R.S.C. (*Canada Research Chair in Molecular Genetics*)

Michel L. Tremblay; B.Sc., M.Sc.(Sher.), Ph.D.(McM.), F.R.S.C. (*Jeanne and Jean-Louis Levesque Chair in Cancer Research*)

Associate Professors

Sidong Huang; B.A.(Boston), Ph.D.(Calif. San Francisco) (*Canada Research Chair in Functional Genomics*)

Selena M. Sagan; B.Sc., (McG.), Ph.D. (Ott.)

Martin Schmeing; B.Sc.(McG.), Ph.D.(Yale) (*Canada Research Chair in Macromolecular Machines*)

Jose G. Teodoro; B.Sc.(UWO), Ph.D.(McG.) (*CIHR New Investigators Award; Chercheur-boursier du FRSQ*)

Jason C. Young; B.Sc.(Tor.), Ph.D.(McM.)

Assistant Professors

Natasha C. Chang; B.Sc., M.Sc.(McG.)

Maxime Denis; B.Sc., Ph.D.(Montr.)

Lawrence Kazak; Ph.D.(Camb.)

William Pastor; Ph.D.(Harv.)

Maria Vera Ugalde; B.Sc., Ph.D.(Navarra)

Ian Watson; B.Sc., Ph.D.(Tor.) (*Canada Research Chair in Functional Genomics of Melanoma*)

Associate Members

Gary Brouhard (*Dept. of Biology*)

Marc Fabian (*Dept. of Oncology*)

Robert S. Kiss (*Dept. of Medicine and Health Science*)

Gergely Lukacs (*Dept. of Physiology*)

Luke McCaffrey (*Dept. of Oncology*)

Joaquin Ortega (*Dept. of Anatomy & Cell Biology*)

Janusz Rak (*Dept. of Medicine and Health Science*)

Stéphane Richard (*Depts. of Medicine and Health Science, and Oncology*)

Reza Salavati (*Inst. of Parasitology*)

Erwin Schurr (*Ctr. for Host Resistance, MGH*)

Peter Siegel (*Rosalind and Morris Goodman Cancer Research Centre, Dept. of Medicine and Health Science*)

Ivan Topisirovic (*Dept. of Oncology*)

Youla S. Tsantrizos (*Dept. of Chemistry*)

Bernard Turcotte (*Dept. of Medicine and Health Science*)

Josie Ursini-Siegel (*Dept. of Oncology*)

Simon Wing (*Dept. of Medicine and Health Science*)

Xiang-Jiao Yang (*Rosalind and Morris Goodman Cancer Research Centre, Dept. of Medicine and Health Science*)

Adjunct Professors

Jacques Drouin; B.Sc., D.Sc.(Laval) (*IRCM*)

Enrico Purisima; B.Sc.(Ateneo de Manila), M.Sc., Ph.D.(Cornell) (*NRC/BRI*)

Julie St-Pierre; B.Sc., M.Sc.(Laval), Ph.D.(Trin. Coll., Cambridge) (*Ott.*)

13.4.4 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Biochemistry (47 credits)

U1 Required Courses (23 credits)

* Students with CEGEP-level credit for CHEM 212 and/or CHEM 222 should replace these courses with elective courses.

| | | |
|-----------|-----|--|
| BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOC 220 | (3) | Laboratory Methods in Biochemistry and Molecular Biology 1 |
| BIOL 200 | (3) | Molecular Biology |
| BIOL 202 | (3) | Basic Genetics |
| CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| CHEM 222* | (4) | Introductory Organic Chemistry 2 |

U1 Complementary Courses** (6 credits)

** Complementary courses listed for U1 and U2 may be taken in later years if necessary to accommodate courses that must be taken in U1 and U2 as part of the breadth component of the program.

6 credits selected from:

| | | |
|----------|-----|---|
| BIOL 205 | (3) | Functional Biology of Plants and Animals |
| MIMM 211 | (3) | Introductory Microbiology |
| MIMM 214 | (3) | Introductory Immunology: Elements of Immunity |
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |

U2 Required Courses (12 credits)

| | | |
|----------|-----|--|
| BIOC 311 | (3) | Metabolic Biochemistry |
| BIOC 312 | (3) | Biochemistry of Macromolecules |
| BIOC 320 | (3) | Laboratory Methods in Biochemistry and Molecular Biology 2 |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |

U2 Complementary Courses** (3 credits)

** Complementary courses listed for U1 and U2 may be taken in later years if necessary to accommodate courses that must be taken in U1 and U2 as part of the breadth component of the program.

3 credits selected from:

| | | |
|----------|-----|--|
| BIOL 373 | (3) | Biometry |
| CHEM 267 | (3) | Introductory Chemical Analysis |
| CHEM 297 | (1) | Introductory Analytical Chemistry Laboratory |
| COMP 202 | (3) | Foundations of Programming |
| COMP 204 | (3) | Computer Programming for Life Sciences |
| MATH 203 | (3) | Principles of Statistics 1 |
| MATH 222 | (3) | Calculus 3 |
| PSYC 204 | (3) | Introduction to Psychological Statistics |

U3 Complementary Courses (3 credits)

3 credits selected from:

| | | |
|----------|-----|--------------------------------|
| BIOC 450 | (3) | Protein Structure and Function |
| BIOC 454 | (3) | Nucleic Acids |

13.4.5 Bachelor of Science (B.Sc.) - Major Biochemistry (64 credits)

Students may transfer into the Major program at any time, provided they have met all course requirements.

U1 Required Courses (23 credits)

* Note: Students with CEGEP-level credit for the equivalents of CHEM 212 and/or CHEM 222 (see <http://www.mcgill.ca/students/courses/plan/transfer/> for accepted equivalents) may not take these courses at McGill and should replace them with elective courses to satisfy the total credit requirement for their degree.

| | | |
|-----------|-----|--|
| BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOC 220 | (3) | Laboratory Methods in Biochemistry and Molecular Biology 1 |
| BIOL 200 | (3) | Molecular Biology |
| BIOL 202 | (3) | Basic Genetics |
| CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| CHEM 222* | (4) | Introductory Organic Chemistry 2 |

U1 Complementary Courses (6 credits)

6 credits selected from:

| | | |
|----------|-----|---|
| BIOL 205 | (3) | Functional Biology of Plants and Animals |
| MIMM 211 | (3) | Introductory Microbiology |
| MIMM 214 | (3) | Introductory Immunology: Elements of Immunity |
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |

U2 Required Courses (20 credits)

| | | |
|----------|-----|--|
| ANAT 262 | (3) | Introductory Molecular and Cell Biology |
| BIOC 311 | (3) | Metabolic Biochemistry |
| BIOC 312 | (3) | Biochemistry of Macromolecules |
| BIOC 320 | (3) | Laboratory Methods in Biochemistry and Molecular Biology 2 |
| CHEM 214 | (3) | Physical Chemistry/Biological Sciences 2 |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| CHEM 362 | (2) | Advanced Organic Chemistry Laboratory |

U2 Complementary Courses (3 credits)

3 credits selected from:

| | | |
|----------|-----|--|
| BIOL 309 | (3) | Mathematical Models in Biology |
| BIOL 373 | (3) | Biometry |
| CHEM 267 | (3) | Introductory Chemical Analysis |
| COMP 202 | (3) | Foundations of Programming |
| COMP 204 | (3) | Computer Programming for Life Sciences |

For graduation in the Honours program, students must complete a minimum of 90 credits, pass all required courses with no grade less than B-, and achieve a CGPA of at least 3.20.

U1 Required Courses (23 credits)

* Note: Students with CEGEP-level credit for the equi* Note: Sturad58e equi1 24accept.95for the equi

U3 Required Cour

OR

Dr. Monroe Cohen
Physiology
Telephone: 514-398-4342
Email: monroe.cohen@mcgill.ca

13.5 Biology (BIOL)

13.5.1 Location

Stewart Biology Building, Room N7/9B
1205 avenue Docteur Penfield
Montreal QC H3A 1B1
Telephone: 514-398-4109
Website: mcgill.ca/biology

13.5.2 About Biology

Biology is the study of living things at the molecular, cellular, organismal, and ecosystem levels. It deals with fundamental questions such as:

- the origin and evolution of plants and animals;
- interactions between living organisms and their environment;
-

Our core undergraduate program will expose you to the broad areas of biology at all of these levels of complexity. At the same time you will be able to focus on topics related to your specific interests through complementary and elective courses. Beyond the large introductory classes, our class sizes are relatively small and you will have lots of opportunities for contact with your instructors; this is one of our strengths! Biology's teaching and research resources are extended by affiliation with the Redpath Museum, the hospitals and research institutes of the McGill University Health Centre, the Montreal Neurological Institute, the Sheldon Biotechnology Institute, and the Smithsonian Tropical Research Institute in Panama. Field courses enable you to study biology in a natural setting, in local ecosystems (e.g., at McGill's Gault Nature Reserve), and in distant ones such as Barbados, Panama, and East Africa. The Biology Department is also deeply committed to providing individual research experiences to its undergraduates. U2- and U3-level students, not just Honours program students, can carry out semester- or year-long independent study projects for course credit in Biology department research labs. Numerous summer opportunities are also available.

Undergraduate students are represented by the MBSU (McGill Biology Students Union) in the Departmental Assembly and in Standing Committees.

Inquiries about undergraduate programs should be directed to:

Student Affairs Office
 Stewart Biology Building, Room N7/9B
 Telephone: 514-398-4109
 Email: nancy.nelson@mcgill.ca
 Website: mcgill.ca/biology/undergraduate-studies/advising-planning/biology-advising



Note to those interested in the B.A. & Sc. program: Both a major and a minor concentration in Biology are available to students pursuing the B.A. & Sc. degree. These concentrations are described in [Bachelor of Arts and Science > Undergraduate > Browse Academic Units & Programs > : Biology \(BIOL\)](#).

13.5.3 Preprogram Requirements

Requirements for the Major and Honours programs in Biology are:

- two courses in elementary Biology;
- two courses in general Chemistry;
- two courses in Mathematics (as per the Freshman requirements);
- one or two courses in Physics (mechanics and electromagnetism), depending on your choice of upper year courses.

Students entering the B.A. & Sc., the Liberal program, and the Biology Science Minor have the same biology, chemistry, and mathematics requirements. The physics requirements will vary according to their future direction. Note that satisfying the minimum Freshman science requirements does not necessarily qualify students for medical or dental school admissions requirements.

Students planning to take one of the joint majors or the Quantitative Biology Major or Honours options should consult:

Undergraduate Adviser
 Stewart Biology Building, Room N7/9B
 Telephone: 514-398-4109

to ensure they are taking the appropriate prerequisites.

13.5.4 Biology Concentrations



Note: The concentrations set out below are only guidelines for specialized training. *They do not constitute sets of requirements.*



Note: *Courses used to satisfy the complementary course components of the Major program must be at the 300+ level. Any 200 level courses listed below must be taken as electives.*



Note: Please see guidelines and policies for taking courses outside Arts and Science at mcgill.ca/science/undergraduate/handbook#bsc-outside-course-restrictions.

If you are interested in advanced studies in any biological discipline, you are strongly advised to develop their skills in computing as appropriate. As an aid to students wishing to specialize, key and suggested courses are listed by discipline.

13.5.4.1 CEEB: Conservation, Ecology, Evolution and Behaviour

BIOL 304, BIOL 305, BIOL 308, BIOL 309, BIOL 310, BIOL 311, BIOL 320, BIOL 324, BIOL 331, BIOL 320, BIOL 324, BIOL 331, BIOL 334D1,D2, BIOL 335, BIOL 350, BIOL 352, BIOL 363, BIOL 377, BIOL 396, BIOL 413, BIOL 418, BIOL 427, BIOL 428, BIOL429, BIOL 432, BIOL 436, BIOL 441, BIOL 451, BIOL 465, BIOL 466, BIOL 467, BIOL 468D1/D2, BIOL 469D1/D2, BIOL 507, BIOL 510, BIOL 515, BIOL 517, BIOL 540, BIOL 553, BIOL 569, BIOL 573, BIOL 592, BIOL 594, GEOG 302, GEOG 305, GEOG 306, GEOG 308, GEOG 322, GEOG 470, REDM 400; MAC CAMPUS: PARA 424, PLNT 358, PLNT 460, WILD 307, WILD 350, WILD 415, WILD 420, WILD 421

13.5.4.1.1 MCDB: Molecular, Cellular and Developmental Biology

BIOL 300, BIOL 301, BIOL 303, BIOL 306, BIOL 309, BIOL 313, BIOL 314, BIOL 316, BIOL 324, BIOL 370, BIOL 377, BIOL 396, BIOL 413, BIOL 416, BIOL 466, BIOL 467, BIOL 468D1/D2, BIOL 469D1/D2, BIOL 518, BIOL 520, BIOL 524, BIOL 544, BIOL 546, BIOL 551, BIOL 565, BIOL 568, BIOL 569, BIOL 575, BIOL 588, BIOL 592, BIOC 311, HGEN 400, MIMM 314

135.4.1.1.1 NBB: Neurobiology and behaviour

BIOL 300, BIOL 303, BIOL 304, BIOL 305, BIOL 306, BIOL 307, BIOL 309, BIOL 320, BIOL 377, BIOL 389, BIOL 413, BIOL 414, BIOL 466, BIOL 467, BIOL 468D1/D2, BIOL 469D1/D2, BIOL 506, BIOL 507, BIOL 517, BIOL 530, BIOL 532, BIOL 580, BIOL 588, BIOL 592, ANAT 321, ANAT 322, NEUR 310, PHAR 562, PHGY 311, PHGY 314, PHGY 425, PHGY 451, PHGY 556, PSYC 311, PSYC 318, PSYC 342, PSYC 410, PSYC 470, PSYC 455, PSYT 500

13.5.5 Biology Faculty

Chair

Gregor Fussmann

Graduate Program Director

Frédéric Guichard

Tamara Western

Emeritus Professors

Gregory G. Brown; B.Sc.(Notre Dame), Ph.D.(CUNY)

A. Howard Bussey; B.Sc., Ph.D.(Brist.), F.R.S.C.

Robert L. Carroll; B.S.(Mich.), M.A., Ph.D.(Harv.), F.R.S.C.

Ronald Chase; A.B.(Stan.), Ph.D.(MIT)

Rajinder S. Dhindsa; B.Sc., M.Sc.(Punj.), Ph.D.(Wash.)

Jacob Kalf; M.S.A.(Tor.), Ph.D.(Ind.)

Donald L. Kramer; B.Sc.(Boston Coll.), Ph.D.(Br. Col.)

Martin J. Lechowicz; B.A.(Mich. St.), M.S., Ph.D.(Wisc.)

Louis Lefebvre; BSc., M.S., PhD. (U. de Montreal)

Barid B. Mukherjee; B.Sc., M.Sc.(Calc.), M.Sc.(Brigham Young), Ph.D.(Utah)

Gerald S. Pollack; M.A., Ph.D.(Princ.)

Ronald Poole; B.Sc., Ph.D.(Birm.)

Derek Roff; B.Sc.(Syd.), Ph.D.(Br. Col.), F

Professors

Richard Roy; B.Sc.(Bishop's), Ph.D.(Laval) (*Molson Chair of Genetics*)

Daniel J. Schoen; B.Sc., M.Sc.(Mich.), Ph.D.(Calif., Berk.) (*Macdonald Professor of Botany*)

Associate Professors

Gary Brouhard; B.S.E., M.S.E., Ph.D.(Mich.)

Thomas E. Bureau; B.Sc.(Calif.), Ph.D.(Texas)

Melania Cristescu; B.Sc., M.Sc.(Ovidius Univ. Constanta, Romania), Ph.D.(Guelph) (*Canada Research Chair in Ecological Genomics of Aquatic Invasions*)

David Dankort; B.Sc., Ph.D.(McM.)

Joseph A. Dent; B.Sc.(Mich.), Ph.D.(Colo.)

Irene Gregory-Eaves; B.Sc.(Vic., BC), M.Sc., Ph.D.(Qu.) (*Canada Research Chair in Fresh Water Ecology & Global Change*)

Paul Harrison; B.Sc.(NUI), Ph.D.(Lond.)

Michael Hendricks; B.A.(Bowdoin), Ph.D.(Sing.) (*Canada Research Chair in Neurobiology & Behaviour*)

Brian Leung; B.Sc.(Br. Col.), Ph.D.(Car.) (*on sabbatical, Fall semester*)

Nam-Sung Moon; B.Sc., Ph.D.(McG.)

Simon Reader; B.A. Hon.(Univ. of Cambridge), Ph.D.(Yale)

Rodrigo Reyes-Lamothe; BSc. (Universidad Autonoma de Mexico), Lic.(UNAM), M.Sc.(C' d ia), D.Phil.(Oxf.) (*Canada Research Chair in Chromosome Biology*)(*on sabbatical*)

Jon Sakata; B.A.(Cornell), Ph.D.(Texas-Austin, Institute for Neuroscience)

Frieder Schoeck; Dipl.(Erhagen), Ph.D.(Max Planck)

Jacalyn Vogel; M.Sc.(E. Ill.), Ph.D.(Kansas)

Alanna Watt; B.Sc.(C'dia), Ph.D.(Brandeis)

Tamara Western; B.Sc.(Dal.), Ph.D.(Br. Col.)(*on sabbatical*)

Sarah Woolley; B.Sc.(Duke), Ph.D.(Texas-Austin)

Monique Zetka; B.Sc., Ph.D.(Br. Col.)

Hugo Zheng; M.Sc.(Helsinki), Ph.D.(Oxf. Brookes)

Assistant Professors

Abigail Gerhold; B.A.(Cornell), Ph.D.(Calif., Berk.)

Mélanie Guigueno; B.Sc., M.Sc.(Manit.), Ph.D.(UWO)

Anna Hargreaves; B.Sc.(Trent), MSc.(Calg.), Ph.D.(Qu.)

Arnold Hayer; M.Sc.(ESBS, France), Ph.D.(ETH Zurich)

Tomoko Ohyama; B.Sc., M.Sc.(Keio), Ph.D.(Baylor)

Laura Pollock; M.Sc.(S. Illinois); Ph.D.(Melb.)

Fiona Soper; B.Sc.(Qld.); Ph.D.(Cornell)

Jennifer Sunday; B.Sc.(Br. Col.), Ph.D.(Simon Fraser)

Stephanie C. Weber; B.Sc.(Duke), Ph.D.(Stan.)

Associate Members

BioEngineering: Adam Hendricks

Centre for Research in Neuroscience: Donald Van Meyel

Glen site: Hugh J. Clarke, Daniel Dufort, David Rosenblatt, Teruko Taketo

MNI: Kenneth Hastings

Physics: Paul Francois

Redpath Museum: Rowan Barrett, David Green, Hans Larsson, Virginie Millien, Anthony Ricciardi

| | | |
|----------|-----|--|
| BIOL 216 | (3) | Biology of Behaviour |
| BIOL 302 | (3) | Fundamentals of Genetics and Genomics |
| COMP 204 | (3) | Computer Programming for Life Sciences |

Complementary Courses (21-23 credits)

Core (6-8 credits)

3 or 4 credits selected from:

| | | |
|-----------|-----|--|
| CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |

* If a student has already taken CHEM 212 or its equivalent, the credits can be made up with CHEM 204, CHEM 222, or a 3- or 4-credit Biology complementary course to be approved by the Biology Adviser.

3 or 4 credits selected from:

| | | |
|----------|-----|--|
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| BIOL 311 | (3) | Advanced Methods in Organismal Biology |

Other (15 credits)

15 credits of Biology complementary courses at the 300-500 levels, including at least 3 credits at the 400-500 levels. Up to 6 credits may be from non-BIOL science courses, with

9 credits (3 credits from each of Blocks A, B and C):

Block A-Ecology and Evolution:

| | | |
|----------|-----|---------------------|
| BIOL 304 | (3) | Evolution |
| BIOL 305 | (3) | Animal Diversity |
| BIOL 308 | (3) | Ecological Dynamics |

Block B-Molecular and Cellular:

| | | |
|----------|-----|-------------------------------|
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 303 | (3) | Developmental Biology |
| BIOL 313 | (3) | Eukaryotic Cell Biology |

Block C-Neuro/Behaviour:

| | | |
|----------|-----|---------------------------|
| BIOL 306 | (3) | Neural Basis of Behaviour |
| BIOL 307 | (3) | Behavioural Ecology |

Other (15 credits)

15 credits other Biology courses at the 300-500 levels, of which 6 credits must be at the 400-500 levels; may include up to 6 credits of research, and may include up to 6 credits of other non-BIOL science courses subject to Adviser approval.

13.5.9 Bachelor of Science (B.Sc.) - Major Biology - Quantitative Biology (73 credits)

Interdisciplinary research that draws from the natural and physical sciences is an important aspect of modern biology. The Quantitative Biology option is designed for students with a deep interest in biology who wish to gain a strong grounding in physical sciences and their application to biological questions. The program has two options: an ecology and evolutionary biology stream, and a physical biology stream. Both streams provide a balance of theory and experimental components.

Students may complete this program with a minimum of 68 credits or a maximum of 73 credits depending on whether MATH 222 and CHEM 212 are completed.

Advising notes for U0 students

It is highly recommended that freshman BIOL, CHEM, MATH, and PHYS courses be selected with the Program Adviser to ensure they meet the core requirements of the Quantitative Biology option.

This program is recommended for U1 students achieving a CGPA of 3.20 or better; and entering CEGEP students with a Math/Science R-score of 28.0 or better.

Required Courses (43 credits)

Bio-Physical Sciences Core (31 credits)

| | | |
|------------|-----|---|
| BIOL 219 | (4) | Introduction to Physical Molecular and Cell Biology |
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| BIOL 395 | (1) | Quantitative Biology Seminar |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| COMP 202** | (3) | Foundations of Programming |
| MATH 222* | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 315 | (3) | Ordinary Differential Equations |
| MATH 323 | (3) | Probability |

MATH 324 (3) Statistics

*Students who have taken the equivalent of CHEM 212 or MATH 222 can make up the credits with a complementary 3 or 4 credit course in consultation with a stream adviser.

**Students who have sufficient knowledge of programming should take COMP 250 Introduction to Computer Science rather than COMP 202.

Biology (6 credits)

BIOL 202 (3) Basic Genetics
 BIOL 215 (3) Introduction to Ecology and Evolution

Physics (6 credits)

PHYS 230 (3) Dynamics of Simple Systems
 PHYS 232 (3) Heat and Waves

Course Requirements for Quantitative Biology Streams (21 credits)

21 credits from one of the following two streams:

Stream 1: Theoretical Ecology and Evolutionary Biology (21 credits)

Biology

BIOL 205 (3) Functional Biology of Plants and Animals
 BIOL 206 (3) Methods in Biology
 BIOL 304 (3) Evolution
 BIOL 308 (3) Ecological Dynamics

Field Courses - 3 credits from the following list or any other field course with permission:

BIOL 240 (3) Monterejan Flora
 BIOL 331 (3) Ecology/Behaviour Field Course
 BIOL 334 (3) Applied Tropical Ecology
 BIOL 432 (3) Limnology

6 credits chosen from the following list of courses at the 400 level or above:

* Students choose either both BIOL 596 and BIOL 597, or BIOL 598.

BIOL 432 (3) Limnology
 BIOL 434 (3) Theoretical Ecology
 BIOL 435 (3) Natural Selection
 BIOL 465 (3) Conservation Biology
 BIOL 509 (3) Methods in Molecular Ecology
 BIOL 510 (3) Advances in Community Ecology
 BIOL 515 (3) Advances in Aquatic Ecology
 BIOL 540 (3) Ecology of Species Invasions
 BIOL 594 (3) Advanced Evolutionary Ecology
 BIOL 596* (1) Advanced Experimental Design
 BIOL 597* (2) Advanced Biostatistics

BIOL 598* (3) Advanced Design and Statistics

Stream 2: Physical Biology (21 credits)

BIOL 319 (3) Introduction to Biophysics
PHYS 329 (3) Statistical Physics with Biophysical Applications
PHYS 346 (3) Majors Quantum Physics

300-level complementary courses: 6 credits from the following:

BIOL 300 (3) Molecular Biology of the Gene
BIOL 303 (3) Developmental Biology
BIOL 306 (3) Neural Basis of Behaviour
BIOL 309 (3) Mathematical Models in Biology
BIOL 313 (3) Eukaryotic Cell Biology

500-level complementary courses: 6 credits from the following:

BIOL 518 (3) Advanced Topics in Cell Biology
BIOL 520 (3) Gene Activity in Development
BIOL 524 (3) Topics in Molecular Biology
BIOL 530 (3) Advances in Neuroethology
BIOL 551 (3) Principles of Cellular Control
BIOL 588 (3) Advances in Molecular/Cellular Neurobiology

Complementary Courses

Quantitative Biology - Theoretical Ecology and Evolutionary Biology, and Physical Biology streams

9 credits from the following:

Recommendations for either Theoretical Ecology and Evolutionary Biology or Physical Biology streams

BIOL 466 (3) Independent Research Project 1
COMP 206 (3) Introduction to Software Systems
COMP 250 (3) Introduction to Computer Science
COMP 251 (3) Algorithms and Data Structures
COMP 350* (3) Numerical Computing
COMP 364 (3) Computer Tools for Life Sciences
MATH 235** (3) Algebra 1
MATH 240** (3) Discrete Structures
MATH 314 (3) Advanced Calculus
MATH 317* (3) Numerical Analysis
MATH 319 (3) Introduction to Partial Differential Equations
MATH 326 (3) Nonlinear Dynamics and Chaos
MATH 327 (3) Matrix Numerical Analysis
MATH 348 (3) Euclidean Geometry
MATH 437 (3) Mathematical Methods in Biology

MATH 447

(3)

Introduction to Stochastic Processes

* Students may take COMP 350 OR MATH 317.

**MA

| | | |
|-------------|-----|----------------------------------|
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| BIOL 395 | (1) | Quantitative Biology Seminar |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| COMP 202** | (3) | Foundations of Programming |
| MATH 222* | (3) | Calculus 3 |
| MATH 223*** | (3) | Linear Algebra |
| MATH 247*** | (3) | Honours Applied Linear Algebra |
| MATH 315 | (3) | Ordinary Differential Equations |
| MATH 323 | (3) | Probability |

* If a student has already taken CHEM 212 or its equivalent, or MATH 222 or its equivalent, the credits can be made up with a complementary course in consultation with the Program Adviser.

** Students who have sufficient knowledge in a programming language should take COMP 250 (3 credits) "Introduction to Computer Science" rather than COMP 202.

*** Students may take either MATH 223 or MATH 247.

Biology and Mathematics Core

9 credits

| | | |
|----------|-----|---------------------------------------|
| BIOL 215 | (3) | Introduction to Ecology and Evolution |
| MATH 242 | (3) | Analysis 1 |
| MATH 243 | (3) | Analysis 2 |

Complementary Courses (39 credits)

For the 39 credits, students complete 21 credits of BIOL, NEUR, PHGY, PSYC courses including one of three streams (Ecology and Evolutionary Ecology, Molecular Evolution, Neurosciences) and 18 credits of MATH courses.

Math or Biology Research Course

Note: Students selecting a BIOL course count this toward their 21 credits of BIOL, NEUR, PHGY, PSYC courses while students selecting a MATH course count this toward their 18 credits of MATH courses.

3-6 credits from the following Math or Biology research courses:

| | | |
|----------|-----|--------------------------------|
| BIOL 466 | (3) | Independent Research Project 1 |
| BIOL 467 | (3) | Independent Research Project 2 |
| BIOL 468 | (6) | Independent Research Project 3 |
| MATH 410 | (3) | Majors Project |

Of the remaining complementary courses, at least 6 credits must be at the 400 level or above.

Math Courses

15 credits (if MATH 410 was selected as a research course) or 18 credits of MATH courses chosen from Stream 1 or 2 and from "Remaining Math Courses" as follows:

Stream 1: Theory

12 credits from the following courses:

* Students may take either MATH 317 or MATH 327.

| | | |
|-----------|-----|--|
| MATH 314 | (3) | Advanced Calculus |
| MATH 317* | (3) | Numerical Analysis |
| MATH 319 | (3) | Introduction to Partial Differential Equations |

| | | |
|-----------|-----|------------------------------|
| MATH 326 | (3) | Nonlinear Dynamics and Chaos |
| MATH 327* | (3) | Matrix Numerical Analysis |

Stream 2: Statistics

9 credits from the following:

| | | |
|----------|-----|--------------------------------------|
| MATH 324 | (3) | Statistics |
| MATH 423 | (3) | Applied Regression |
| MATH 447 | (3) | Introduction to Stochastic Processes |

Remaining Math Courses

Remaining 3-9 credits of MATH courses may be chosen from any of the two preceding sequences and/or from the following list:

| | | |
|----------|-----|----------------------------------|
| MATH 204 | (3) | Principles of Statistics 2 |
| MATH 340 | (3) | Discrete Mathematics |
| MATH 437 | (3) | Mathematical Methods in Biology |
| MATH 523 | (4) | Generalized Linear Models |
| MATH 524 | (4) | Nonparametric Statistics |
| MATH 525 | (4) | Sampling Theory and Applications |

BIOL, NEUR, PHGY, PHYS, PSYC Courses

18 credits (if 3 credit BIOL course was selected as a research course) or 15 credits (if 6 credit BIOL research course was selected) of BIOL, NEUR, PHGY, PHYS, PSYC courses including one of three streams.

Note: Some courses in the streams may have prerequisites.

Ecology and Evolutionary Ecology Stream

At least 15 credits selected as follows:

3 credits of:

| | | |
|----------|-----|--------------------|
| BIOL 206 | (3) | Methods in Biology |
|----------|-----|--------------------|

3 credits from the following field courses or any other field course with permission:

| | | |
|------------|-------|---------------------------------------|
| BIOL 240 | (3) | Monteregian Flora |
| BIOL 331 | (3) | Ecology/Behaviour Field Course |
| BIOL 334D1 | (1.5) | Applied Tropical Ecology |
| BIOL 334D2 | (1.5) | Applied Tropical Ecology |
| BIOL 432 | (3) | Limnology |
| BIOL 573 | (3) | Vertebrate Palaeontology Field Course |

At least 9 credits chosen from the following list

| | | |
|----------|-----|--|
| BIOL 202 | (3) | Basic Genetics |
| BIOL 205 | (3) | Functional Biology of Plants and Animals |
| BIOL 304 | (3) | Evolution |
| BIOL 305 | (3) | Animal Diversity |

| | | |
|----------|-----|-------------------------------|
| BIOL 308 | (3) | Ecological Dynamics |
| BIOL 310 | (3) | Biodiversity and Ecosystems |
| BIOL 324 | (3) | Ecological Genetics |
| BIOL 434 | (3) | Theoretical Ecology |
| BIOL 509 | (3) | Methods in Molecular Ecology |
| BIOL 569 | (3) | Developmental Evolution |
| BIOL 594 | (3) | Advanced Evolutionary Ecology |

Molecular Evolution Stream

At least 15 credits selected as follows:

3 credits

| | | |
|----------|-----|----------------|
| BIOL 202 | (3) | Basic Genetics |
|----------|-----|----------------|

At least 12 credits selected from the following list:

| | | |
|----------|-----|---------------------------------|
| BIOL 303 | (3) | Developmental Biology |
| BIOL 304 | (3) | Evolution |
| BIOL 313 | (3) | Eukaryotic Cell Biology |
| BIOL 518 | (3) | Advanced Topics in Cell Biology |
| BIOL 569 | (3) | Developmental Evolution |
| BIOL 592 | (3) | Integrated Bioinformatics |

Neurosciences Stream

At least 15 credits selected as follows:

3 credits from:

| | | |
|----------|-----|---------------------------|
| BIOL 306 | (3) | Neural Basis of Behaviour |
|----------|-----|---------------------------|

At least 12 credits selected from:

| | | |
|----------|-----|--------------------------------------|
| BIOL 320 | (3) | Evolution of Brain and Behaviour |
| BIOL 389 | (3) | Laboratory in Neurobiology |
| BIOL 530 | (3) | Advances in Neuroethology |
| BIOL 580 | (3) | Genetic Approaches to Neural Systems |
| NEUR 310 | (3) | Cellular Neurobiology |
| NEUR 507 | (3) | Topics in Radionuclide Imaging |
| NEUR 570 | (3) | Human Brain Imaging |
| PHGY 314 | (3) | Integrative Neuroscience |
| PHGY 425 | (3) | Analyzing Physiological Systems |
| PHGY 552 | (3) | Cellular and Molecular Physiology |
| PSYC 427 | (3) | Sensorimotor Neuroscience |
| PSYT 455 | (3) | Neurochemistry |
| PSYT 502 | (3) | Brain Evolution and Psychiatry |

Remaining BIOL, NEUR, PHGY, PSYC

For the remaining BIOL, NEUR, PHGY, PSYC complementary course credits, if any, students top up their credits to the necessary 18-21 credits with any course listed in the above three streams. Other relevant courses may be substituted with the approval of the Program Adviser.

13.5.11 Bachelor of Science (B.Sc.) - Honours Biology (72 credits)

The Honours program in Biology is intended for students who are interested in gaining a concentrated research experience. A broad range of fundamental biological concepts spanning molecules and cells to organisms and ecosystems, including development, behaviour and evolution is supplemented with research in a chosen area. Potential areas of focus include: (1) molecular, cellular and developmental biology, (2) conservation, ecology and evolution, and (3) neurobiology and behaviour.

Acceptance into the Honours program at the end of U2 requires a CGPA of 3.50 and approval of a 9- or 12-credit Independent Studies proposal (see listing of BIOL 479D1/BIOL 479D2, BIOL 480D1/BIOL 480D2 for details). For an Honours degree, a minimum CGPA of 3.50 at Graduation and adherence to the program as outlined below are the additional requirements.

First Class Honours will be awarded to students graduating with a CGPA of 3.75 or better, and having successfully completed the Honours program

Required Courses (35 credits)

| | | |
|----------|-----|--|
| BIOL 200 | (3) | Molecular Biology |
| BIOL 201 | (3) | Cell Biology and Metabolism |
| BIOL 205 | (3) | Functional Biology of Plants and Animals |
| BIOL 206 | (3) | Methods in Biology |
| BIOL 215 | (3) | Introduction to Ecology and Evolution |
| | | Biology of Behaviour |

BIOL 313 (3) Eukaryotic Cell Biology

Block C-Neuro/Behaviour:

BIOL 306 (3) Neural Basis of Behaviour

BIOL 307 (3) Behavioural Ecology

Honours Block (9-12 credits)

BIOL 479D1 (4.5) Honours Research Project 1

BIOL 479D2 (4.5) Honours Research Project 1

OR

BIOL 480D1 (6) Honours Research Project 2

BIOL 480D2 (6) Honours Research Project 2

Other (12-15 credits)

15 credits of Biology courses at the 300-500 levels if taking BIOL 479D1/D2, or 12 credits if taking BIOL 480D1/D2. With permission of the Biology Adviser, up to 6 credits may be taken from other science department courses (300-500 levels). Up to 3 credits of previous independent research courses may be included. Must include 6 credits of 400-500 levels.

Bac

| | | |
|-------------|-----|---|
| MATH 315+ | (3) | Ordinary Differential Equations |
| MATH 323++ | (3) | Probability |
| MATH 324+++ | (3) | Statistics |
| MATH 325+ | (3) | Honours Ordinary Differential Equations |
| MATH 356++ | (3) | Honours Probability |
| MATH 357+++ | (3) | Honours Statistics |

* Students who have taken the equivalent of CHEM 212 or MATH 222 can make up the credits with complementary 3 or 4 credit courses in consultation with a stream adviser.

** Students who have sufficient knowledge of programming should take COMP 250 Introduction to Computer Science rather than COMP 202.

*** Students take MATH 223 or MATH 247.

+ Students take MATH 315 or MATH 325.

++ Students take MATH 323 or MATH 356.

+++ Students take MATH 324 or MATH 357.

Note: 6 credits of either MATH or PHYS courses to be taken at the honours lev

Field Courses

3 credits from the following list or any other field course with permission:

| | | |
|----------|-----|--------------------------------|
| BIOL 240 | (3) | Monteregian Flora |
| BIOL 331 | (3) | Ecology/Behaviour Field Course |
| BIOL 334 | (3) | Applied Tropical Ecology |
| BIOL 432 | (3) | Limnology |

6 credits chosen from the following list of courses at the 400 level or above:

* Students choose either both BIOL 596 and BIOL 597, or BIOL 598.

| | | |
|-----------|-----|--------------------------------|
| BIOL 432 | (3) | Limnology |
| BIOL 434 | (3) | Theoretical Ecology |
| BIOL 435 | (3) | Natural Selection |
| BIOL 465 | (3) | Conservation Biology |
| BIOL 509 | (3) | Methods in Molecular Ecology |
| BIOL 510 | (3) | Advances in Community Ecology |
| BIOL 515 | (3) | Advances in Aquatic Ecology |
| BIOL 540 | (3) | Ecology of Species Invasions |
| BIOL 594 | (3) | Advanced Evolutionary Ecology |
| BIOL 596* | (1) | Advanced Experimental Design |
| BIOL 597* | (2) | Advanced Biostatistics |
| BIOL 598* | (3) | Advanced Design and Statistics |

Stream 2: Physical Biology

21 credits

9 credits from:

| | | |
|-----------|-----|--------------------------------------|
| BIOL 319* | (3) | Introduction to Biophysics |
| PHYS 319* | (3) | Introduction to Biophysics |
| | | Statistical Physics with Biophysical |

6 credits from the following:

| | | |
|----------|-----|---|
| BIOL 518 | (3) | Advanced Topics in Cell Biology |
| BIOL 520 | (3) | Gene Activity in Development |
| BIOL 524 | (3) | Topics in Molecular Biology |
| BIOL 530 | (3) | Advances in Neuroethology |
| BIOL 551 | (3) | Principles of Cellular Control |
| BIOL 588 | (3) | Advances in Molecular/Cellular Neurobiology |

Complementary Courses (9 credits)

Recommendations for either Theoretical Ecology and Evolutionary Biology or Physical Biology streams

| | | |
|------------|-----|--|
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| COMP 251 | (3) | Algorithms and Data Structures |
| COMP 350* | (3) | Numerical Computing |
| COMP 364 | (3) | Computer Tools for Life Sciences |
| MATH 235** | (3) | Algebra 1 |
| MATH 240** | (3) | Discrete Structures |
| MATH 314 | (3) | Advanced Calculus |
| MATH 317* | (3) | Numerical Analysis |
| MATH 319 | (3) | Introduction to Partial Differential Equations |
| MATH 326 | (3) | Nonlinear Dynamics and Chaos |
| MATH 327 | (3) | Matrix Numerical Analysis |
| MATH 348 | (3) | Euclidean Geometry |
| MATH 437 | (3) | Mathematical Methods in Biology |
| MATH 447 | (3) | Introduction to Stochastic Processes |

* Students may take COMP 350 OR MATH 317.

** MATH 235 or MATH 240 are required for COMP 251.

Recommendations for Physical Biology stream

| | | |
|-----------|-----|--|
| BIEN 310 | (3) | Introduction to Biomolecular Engineering |
| BIEN 320 | (3) | Molecular, Cellular and Tissue Biomechanics |
| BIEN 340 | (3) | Transport Phenomena in Biological Systems 2 |
| BIEN 510 | (3) | Engineered Nanomaterials for Biomedical Applications |
| BIEN 530 | (3) | Imaging and Bioanalytical Instrumentation |
| CHEM 222 | (4) | Introductory Organic Chemistry 2 |
| PHYS 242* | (2) | Electricity and Magnetism |
| PHYS 257 | (3) | Experimental Methods 1 |
| PHYS 342 | (3) | Majors Electromagnetic Waves |
| PHYS 413 | (3) | Physical Basis of Physiology |
| PHYS 434 | (3) | Optics |
| PHYS 519 | (3) | Advanced Biophysics |
| PHYS 534 | (3) | Nanoscience and Nanotechnology |

* PHYS 242 is required for PHYS 342 and PHYS 434.

Recommendations for Theoretical Ecology and Evolutionary Biology stream

| | | |
|----------|-----|---|
| BIOL 310 | (3) | Biodiversity and Ecosystems |
| BIOL 324 | (3) | Ecological Genetics |
| MATH 242 | (3) | Analysis 1 |
| MATH 340 | (3) | Discrete Mathematics |
| MATH 423 | (3) | Applied Regression |
| MATH 524 | (4) | Nonparametric Statistics |
| MATH 525 | (4) | Sampling Theory and Applications |
| PHYS 329 | (3) | Statistical Physics with Biophysical Applications |

13.5.13 Biology (BIOL) Related Programs and Study Semesters

13.5.13.1 Joint Major in Computer Science and Biology

For more information, see [section 13.9.11: Bachelor of Science \(B.Sc.\) - Major Computer Science and Biology \(74 credits\)](#).

13.5.13.2 Joint Honours in Computer Science and Biology

For more information, see [section 13.9.15: Bachelor of Science \(B.Sc.\) - Honours Computer Science and Biology \(77 credits\)](#).

13.5.13.3 Panama Field Study Semester

The program is a joint venture between McGill University and the Smithsonian Tropical Research Institute (STRI) in Panama. For more information, see [Study Abroad & Field Studies > Undergraduate > Field Study Semesters and Off-Campus Courses > Field Study Minor > : Panama Field Study Semester](#). You can also visit the follo

academic adviser, students must submit their course list to the program supervisor, who will certify that the student's complete program conforms to the requirements for the Minor. Students should ensure that they will have fulfilled the prerequisite requirements for the courses selected.

The course BIOT 505 *Selected Topics in Biotechnology* is considered as taught by the Faculty of Science.

13.6.3 General Regulations

To obtain the Minor in Biotechnology, students must:

- satisfy the requirements both for the departmental program and for the Minor;
- complete 24 credits, 18 of which must be exclusively for the Minor program, and outside of their primary program;
- obtain a grade of C or better in the courses presented for the Minor.

13.6.4 Biotechnology (BIOT) Minor Program

Program Supervisor

TBD

Telephone: TBD

Email: TBD

Program Adviser

Nancy Nelson

Stew

BIOL 551 (3) Principles of Cellular Control

Molecular Biology (Biochemistry)

BIOC 311 (3) Metabolic Biochemistry
BIOC 312 (3) Biochemistry of Macromolecules
BIOC 450 (3) Protein Structure and Function
BIOC 454 (3) Nucleic Acids
PSYT 455 (3) Neurochemistry

Physiology

EXMD 401 (3) Physiology and Biochemistry Endocrine Systems
EXMD 502 (3) Advanced Endocrinology 1
EXMD 503 (3) Advanced Endocrinology 02
PHAR 562 (3) Neuropharmacology
PHAR 563 (3) Endocrine Pharmacology
PHGY 517 (3) Artificial Internal Organs
PHGY 518 (3) Artificial Cells

Pollution

CHEE 593 (3) Industrial Water Pollution Control
CIVE 225 (4) Environmental Engineering
CIVE 430 (3) Water Treatment and Pollution Control
CIVE 557 (3) Microbiology for Environmental Engineering

13.6.6 Biotechnology (BIOT) Related Programs

13.6.6.1 Program for Students in the Faculty of Engineering

See [Faculty of Engineering > Undergraduate > Browse Academic Units & Programs > Minor Programs > : Bachelor of Engineering \(B.Eng.\) - Minor Biotechnology \(for Engineering Students\) \(24 credits\)](#) for details.

13.7 Chemistry (CHEM)

13.7.1 Location

Otto Maass Chemistry Building
801 Sherbrooke Street West
Montreal QC H3A 0B8
Departmental Office: Room 322
Telephone: 514-398-6999
Website: 240.1.155.833 193.13.6T09.2st

Professors

M.P. Andrews; B.Sc., M.Sc., Ph.D.(Tor.)

P. Ariya; B.Sc., Ph.D.(York)

B.A. (Tasmania) B.Sc. (UQAC) Ph.D. (U.S.) 0 0 21601.297.028 708 Ph.D.(T

K. Auclair; B.Sc.(UQAC), Ph.D.(Alta.)

C.J. Barrett; B.Sc., M.Sc., Ph.D.(Qu.)

D.S. Bohle; B.A.(Reed), M.Phil., Ph.D.(Auck.)

I.S. Butler; B.Sc., Ph.D.(Brist.), F.C.I.C.

G. Cosa; B.Sc.(UNRC, Argentina), Ph.D.(Ott.)

M.J. Damha; B.Sc., Ph.D.(McG.), F.C.I.C.

T. Friš i ; B.Sc.(Zagreb), Ph.D.(Iowa)

D.N. Harpp; A.B.(Middlebury), M.A.(Wesl.), Ph.D.(N. Carolina), F.C.I.C.

A. Kakkar; B.Sc., M.Sc.(Chan. U., India), Ph.D.(Wat.)

R.B. Lennox; B.Sc., M.Sc., Ph.D.(Tor.), F.C.I.C., F.R.S.C.

C.J. Li; B.Sc.(Zhengzhou), M.S.(Chin. Acad. Sci.), Ph.D.(McG.), F.R.S.C.

N. Luedtke; B.Sc.(Wash.), M.Sc., Ph.D.(Calif. -San Diego)

J. Mauzeroll; B.Sc.(McG.), Ph.D.(Texas-Austin)

N. Moitessier; M.Sc., Ph.D.(Nancy)

D. Perepichka; B.Sc.(Donetsk, Ukraine), Ph.D.(Nat. Aca. Sci., Ukraine)

D.M. Ronis; B.Sc.(McG.), Ph.D.(MIT)

H. Sleiman; B.Sc.(Beirut), Ph.D.(Stan.)

Y.S. Tsantrizos; B.Sc., M.Sc., Ph.D.(McG.)

T.G.M. van de Ven; Kand. Doc.(Utrecht), Ph.D.(McG.)

P. Wiseman; B.Sc.(St. FX), Ph.D.(UWO)**B.06lina),e; Blumrett; B.Princ.C.47m(B.06lina)1 0**

Adjunct Professors

I. Wharf; B.Sc., Ph.D.(Imperial Coll.) R. Zamboni; B.Sc., Ph.D.(McG.)

Faculty Lecturers

L. Pavelka; B.Sc., Ph.D.(UWO)

S. Sewall; B.Sc., Ph.D.(McG.)

P. Sirjoosingh; B.Sc., M.Sc.(Dehli), Ph.D.(Penn St.)

13.7.5 Bachelor of Science (B.Sc.) - Minor Chemistry (20 credits)**Required Courses (13 credits)**

* Denotes courses with CEGEP equivalents.

If any of the required courses are part of your primary program or were taken at CEGEP, then they must be substituted by courses from the minor options list that are not part of your primary program. The total number of credits exclusive to the minor is at least 19.

| | | |
|-----------|-----|--|
| CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| CHEM 267 | (3) | Introductory Chemical Analysis |
| CHEM 281 | (3) | Inorganic Chemistry 1 |

Complementary Courses

6-7 credits **

| | | |
|-----------|-----|--|
| CHEM 214 | (3) | Physical Chemistry/Biological Sciences 2 |
| CHEM 219 | (3) | Introduction to Atmospheric Chemistry |
| CHEM 222* | (4) | Introductory Organic Chemistry 2 |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| CHEM 319 | (3) | Chemistry of Energy, Storage and Utilization |
| CHEM 334 | (3) | Advanced Materials |
| CHEM 381 | (3) | Inorganic Chemistry 2 |
| CHEM 462 | (3) | Green Chemistry |

** Any level 300-500 CHEM course can be substituted for courses within this list.

13.7.6 Bachelor of Science (B.Sc.) - Minor Chemical Engineering (24 credits)

A Chemical Engineering Minor will be of interest to Chemistry students who wish to study the problems of process engineering and its related subjects. A student completing this Minor will be able to make the important link between molecular sciences and industrial processing. This Minor will not provide Professional Engineering accreditation.

Required Courses (6 credits)

| | | |
|----------|-----|-----------------------------------|
| CHEE 200 | (3) | Chemical Engineering Principles 1 |
| CHEE 204 | (3) | Chemical Engineering Principles 2 |

Complementary Courses (18 credits)

At least one of:

| | | |
|----------|-----|-------------------------------------|
| CHEE 220 | (3) | Chemical Engineering Thermodynamics |
| CHEE 314 | (3) | Fluid Mechanics |

with the remainder chosen from the following:

* Students select either CHEE 494 or CHEE 495

| | | |
|-----------|-----|--|
| CHEE 230 | (3) | Environmental Aspects of Technology |
| CHEE 315 | (3) | Heat and Mass Transfer |
| CHEE 351 | (3) | Separation Processes |
| CHEE 370 | (3) | Elements of Biotechnology |
| CHEE 380 | (3) | Materials Science |
| CHEE 438 | (3) | Engineering Principles in Pulp and Paper Processes |
| CHEE 452 | (3) | Particulate Systems |
| CHEE 494* | (3) | Research Project and Seminar 1 |
| CHEE 495* | (4) | Research Project and Seminar 2 |
| CHEE 587 | (3) | Chemical Processing: Electronics Industry |
| CHEE 592 | (3) | Industrial Air Pollution Control |
| CHEE 593 | (3) | Industrial Water Pollution Control |
| MATH 314 | (3) | Advanced Calculus |

13.7.7 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Chemistry - General (49 credits)

Program Prerequisites

PRE-PROGRAM REQUIREMENTS:

Students entering from the Freshman program must have included CHEM 110 and CHEM 120 or CHEM 115, BIOL 111 or BIOL 112, MATH 133, MATH 140/MATH 141 or MATH 150/MATH 151, PHYS 131/PHYS 142, or their equivalents in their Freshman year. Quebec students must have completed the DEC with appropriate science and mathematics courses. Note that students who have successfully completed MATH 150 and MATH 151 do not have to take MATH 222.

Required Basic Core Courses (26 credits)

The required courses in this program consist of 26 credits in chemistry and mathematics listed below. The courses marked with an asterisk (*) are omitted from the program of students who have successfully completed them at the CEGEP level.

| | | |
|----------|-----|-----------------------------------|
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| CHEM 345 | (3) | Introduction to Quantum Chemistry |
| CHEM 367 | (3) | Instrumental Analysis 1 |
| CHEM 377 | (3) | Instrumental Analysis 2 |
| CHEM 392 | (3) | Experimental Chemistry 1 |
| PHYS 242 | (2) | Electricity and Magnetism |

Complementary Course (6 credits)

6 credits from:

| | | |
|----------|-----|-----------------------------------|
| CHEM 355 | (3) | Applications of Quantum Chemistry |
| MATH 315 | (3) | Ordinary Differential Equations |

Chemistry courses at the 300+ level.

Bac

| | | |
|------------|-----|--|
| CHEM 392 | (3) | Experimental Chemistry 1 |
| CHEM 493 | (2) | Advanced Physical Chemistry Laboratory |
| MATH 222** | (3) | Calculus 3 |
| PHYS 242 | (2) | Electricity and Magnetism |

Complementary Courses (6 credits)

6 credits of Chemistry (CHEM) courses at the 400 level or higher, or MATH 315 plus 3 credits of Chemistry courses at the 400 level or higher.

13.7.9 Bachelor of Science (B.Sc.) - Major Chemistry - Atmosphere and Environment (63 credits)**Program Prerequisites**

PRE-PROGRAM REQUIREMENTS:

Students entering from the Freshman program must have included CHEM 110 and CHEM 120 or CHEM 115, BIOL 111 or BIOL 112, MATH 133, MATH 140/MATH 141 or MATH 150/MATH 151, PHYS 131/PHYS 142, or their equivalents in their Freshman year. Quebec students must have completed the DEC with appropriate science and mathematics courses. Note that students who have successfully completed MATH 150 and MATH 151 do not have to take MATH 222.

Required Courses (57 credits)

The required courses in this program consist of 57 credits in chemistry and mathematics, listed below. The courses marked with an asterisk (*) are omitted from the program of students who have successfully completed them at the CEGEP level but the Chemistry courses must be replaced by courses in that discipline if students wish to be eligible for admission to the Ordre des chimistes du Québec. Students from outside Quebec or transfer students should consult the Academic Adviser.

See <http://www.mcgill.ca/chemistry/current-undergraduate-students/advising/>.

A computer science course, either COMP 202 or COMP 208, is strongly recommended during U1 for students who have no previous introduction to computer programming. Students should contact their adviser on this matter. Completion of Mathematics MATH 222 and MATH 315 during U1 is also strongly recommended.

* Denotes courses with CEGEP equivalents.

** Students who have successfully completed MATH 150 and MATH 151 are not required to take MATH 222.

| | | |
|------------|-----|---|
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| CHEM 213 | (3) | Introductory Physical Chemistry 1: Thermodynamics |
| CHEM 219 | (3) | Introduction to Atmospheric Chemistry |
| CHEM 222* | (4) | Introductory Organic Chemistry 2 |
| CHEM 267 | (3) | Introductory Chemical Analysis |
| CHEM 273 | (3) | Introductory Physical Chemistry 2: Kinetics and Methods |
| CHEM 281 | (3) | Inorganic Chemistry 1 |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| CHEM 332 | (3) | Biological Chemistry |
| CHEM 345 | (3) | Introduction to Quantum Chemistry |
| CHEM 355 | (3) | Applications of Quantum Chemistry |
| CHEM 365 | (2) | Statistical Thermodynamics |
| CHEM 367 | (3) | Instrumental Analysis 1 |
| CHEM 377 | (3) | Instrumental Analysis 2 |
| CHEM 381 | (3) | Inorganic Chemistry 2 |
| CHEM 392 | (3) | Experimental Chemistry 1 |
| CHEM 493 | (2) | Advanced Physical Chemistry Laboratory |
| MATH 222** | (3) | Calculus 3 |
| MATH 315 | (3) | Ordinary Differential Equations |

Complementary Courses (6 credits)

3 credits, one of:

| | | |
|----------|-----|---|
| ATOC 214 | (3) | Introduction: Physics of the Atmosphere |
| CHEM 462 | (3) | Green Chemistry |
| CHEM 519 | (3) | Advances in Chemistry of Atmosphere |
| CHEM 532 | (3) | Structural Organic Chemistry |
| MATH 317 | (3) | Numerical Analysis |

3 credits, one of:

| | | |
|----------|-----|-------------------------------|
| ATOC 315 | (3) | Thermodynamics and Convection |
| CHEM 567 | (3) | Chemometrics: Data Analysis |
| CHEM 575 | (3) | Chemical Kinetics |
| CHEM 597 | (3) | Analytical Spectroscopy |
| EPSC 542 | (3) | Chemical Oceanography |

13.7.10 Bachelor of Science (B.Sc.) - Major Chemistry - Bio-organic (63 credits)**Program Prerequisites**

PRE-PROGRAM REQUIREMENTS:

Students entering from the Freshman program must have included CHEM 110 and CHEM 120 or CHEM 115, BIOL 111 or BIOL 112, MATH 133, MATH 140/MATH 141 or MATH 150/MATH 151, PHYS 131/PHYS 142, or their equivalents in their Freshman year. Quebec students must have completed the DEC with appropriate science and mathematics courses. Note that students who have successfully completed MATH 150 and MATH 151 do not have to take MATH 222.

Required Courses (57 credits)

The required courses in this program consist of 60 credits in chemistry, biology and mathematics, listed below. The courses marked with an asterisk (*) are omitted from the program of students who have successfully completed them at the CEGEP level but the Chemistry courses must be replaced by courses in that discipline if students wish to be eligible for admission to the Ordre des chimistes du Québec. Students from outside Quebec or transfer students should consult the Academic Adviser.

See <http://www.mcgill.ca/chemistry/current-undergraduate-students/advising/>.

A computer science course, either COMP 202 or COMP 208, is strongly recommended during U1 for students who have no previous introduction to computer programming. Students should contact their adviser on this matter. Completion of Mathematics MATH 222 during U1 is also strongly recommended.

* Denotes courses with CEGEP equivalents.

** Students who have successfully completed MATH 150 and MATH 151 are not required to take MATH 222.

| | | |
|-----------|-----|---|
| BIOL 200 | (3) | Molecular Biology |
| BIOL 201 | (3) | Cell Biology and Metabolism |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| CHEM 213 | (3) | Introductory Physical Chemistry 1: Thermodynamics |
| CHEM 222* | (4) | Introductory Organic Chemistry 2 |
| CHEM 267 | (3) | Introductory Chemical Analysis |
| CHEM 273 | (3) | Introductory Physical Chemistry 2: Kinetics and Methods |
| CHEM 281 | (3) | Inorganic Chemistry 1 |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| CHEM 345 | (3) | Introduction to Quantum Chemistry |
| CHEM 355 | (3) | Applications of Quantum Chemistry |

| | | |
|------------|-----|--|
| CHEM 367 | (3) | Instrumental Analysis 1 |
| CHEM 377 | (3) | Instrumental Analysis 2 |
| CHEM 381 | (3) | Inorganic Chemistry 2 |
| CHEM 392 | (3) | Experimental Chemistry 1 |
| CHEM 493 | (2) | Advanced Physical Chemistry Laboratory |
| CHEM 502 | (3) | Advanced Bio-Organic Chemistry |
| MATH 222** | (3) | Calculus 3 |
| | (2) | Electricity and Magnetism |

MATH 323

(3)

Probability

PHYS 329

(3)

Statistical Physics with Biophysical Applications

Chemistry

DEC with appropriate science and mathematics courses. Note that students who hav

Program Prerequisites

PRE-PROGRAM REQUIREMENTS:

Students entering from the Freshman program must have included CHEM 110 and CHEM 120 or CHEM 115, BIOL 111 or BIOL 112, MATH 133, MATH 140/MATH 141 or MATH 150/MATH 151, PHYS 131/PHYS 142, or their equivalents in their Freshman year. Quebec students must have completed the DEC with appropriate science and mathematics courses. Note that students who have successfully completed MATH 150 and MATH 151 do not have to take MATH 222.

Required Courses (59 credits)

The required courses in this program consist of 59 credits in chemistry, physics and mathematics, listed below. The courses marked with an asterisk (*) are omitted from the program of students who have successfully completed them at the CEGEP level. Students completing this program will not be eligible for admission to the Ordre des chimistes du Québec without additional chemistry electives. This program is not currently accredited by the Canadian Society for Chemistry. See <http://www.chemistry.mcgill.ca/advising/inside/advisors.php>.

Completion of Mathematics MATH 222 and MATH 315 during U1 is also strongly recommended.

* Denotes courses with CEGEP equivalents.

** Students who have successfully completed MATH 150 and MATH 151 are not required to take MATH 222.

| | | |
|------------|-----|--|
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| CHEM 213 | (3) | Introductory Physical Chemistry 1: Thermodynamics |
| CHEM 222* | (4) | Introductory Organic Chemistry 2 |
| CHEM 267 | (3) | Introductory Chemical Analysis |
| CHEM 273 | (3) | Introductory Physical Chemistry 2: Kinetics and Methods |
| CHEM 281 | (3) | Inorganic Chemistry 1 |
| CHEM 345 | (3) | Introduction to Quantum Chemistry |
| CHEM 355 | (3) | Applications of Quantum Chemistry |
| CHEM 365 | (2) | Statistical Thermodynamics |
| CHEM 367 | (3) | Instrumental Analysis 1 |
| CHEM 377 | (3) | Instrumental Analysis 2 |
| CHEM 381 | (3) | Inorganic Chemistry 2 |
| CHEM 493 | (2) | Advanced Physical Chemistry Laboratory |
| CHEM 575 | (3) | Chemical Kinetics |
| COMP 208 | (3) | Computer Programming for Physical Sciences and Engineering |
| MATH 222** | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 315 | (3) | Ordinary Differential Equations |
| PHYS 241 | (3) | Signal Processing |
| PHYS 242 | (2) | Electricity and Magnetism |

Complementary Courses (3 credits)

3 credits from:

| | | |
|----------|-----|----------------------------------|
| CHEM 514 | (3) | Biophysical Chemistry |
| CHEM 516 | (3) | Nuclear and Radiochemistry |
| CHEM 531 | (3) | Chemistry of Inorganic Materials |
| CHEM 533 | (3) | Small Molecule Crystallography |
| CHEM 534 | (3) | Nanoscience and Nanotechnology |
| CHEM 547 | (3) | Laboratory Automation |
| CHEM 555 | (3) | NMR Spectroscopy |

| | | |
|----------|-----|-----------------------------|
| CHEM 556 | (3) | Advanced Quantum Mechanics |
| CHEM 567 | (3) | Chemometrics: Data Analysis |
| CHEM 577 | (3) | Electrochemistry |
| CHEM 585 | (3) | Colloid Chemistry |
| CHEM 593 | (3) | Statistical Mechanics |
| CHEM 597 | (3) | Analytical Spectroscopy |

13.7.14 Bachelor of Science (B.Sc.) - Honours Chemistry (71 credits)

Note: Attainment of the Honours degree requires a CGPA of at least 3.00.

Program Prerequisites

PRE-PROGRAM REQUIREMENTS:

Students entering from the Freshman program must hav

Complementary Courses (18 credits)

6 credits of research*:

* Students may take up to 12 Research Project credits but only 6 of these may be used to fulfil the program requirement.

| | | |
|----------|-----|----------------------------------|
| CHEM 470 | (6) | Research Project 1 |
| CHEM 480 | (3) | Undergraduate Research Project 2 |

12 credits of additional Chemistry courses as follows:

6 credits of Chemistry courses at the 300 level or higher, or MATH 315 plus 3 credits of Chemistry courses at the 300 level or higher, and

6 credits of Chemistry courses at the 400 level or higher.

13.7.15 Bachelor of Science (B.Sc.) - Honours Chemistry - Atmosphere and Environment (75 credits)

Note: Attainment of the Honours degree requires a CGPA of at least 3.00.

Program Prerequisites

PRE-PROGRAM REQUIREMENTS:

Students entering from the Freshman program must have included CHEM 110 and CHEM 120 or CHEM 115, BIOL 111 or BIOL 112, MATH 133, MATH 140/MATH 141 or MATH 150/MATH 151, PHYS 131/PHYS 142, or their equivalents in their Freshman year. Quebec students must have completed the DEC with appropriate science and mathematics courses. Note that students who have successfully completed MATH 150 and MATH 151 do not have to take MATH 222.

Required Courses (63 credits)

The required courses in this program consist of 63 credits in chemistry and mathematics, listed below.

| | | |
|------------|-----|--|
| CHEM 392 | (3) | Experimental Chemistry 1 |
| CHEM 462 | (3) | Green Chemistry |
| CHEM 493 | (2) | Advanced Physical Chemistry Laboratory |
| CHEM 519 | (3) | Advances in Chemistry of Atmosphere |
| MATH 222** | (3) | Calculus 3 |
| MATH 315 | (3) | Ordinary Differential Equations |

Complementary Courses (12 credits)

6 credits of research*:

* Students may take up to 12 Research Project credits but only 6 of these may be used to fulfil the program requirement.

| | | |
|----------|-----|----------------------------------|
| CHEM 470 | (6) | Research Project 1 |
| CHEM 480 | (3) | Undergraduate Research Project 2 |

3 credits, one of:

| | | |
|----------|-----|---|
| ATOC 214 | (3) | Introduction: Physics of the Atmosphere |
| CHEM 532 | (3) | Structural Organic Chemistry |
| MATH 317 | (3) | Numerical Analysis |

3 credits, one of:

| | | |
|----------|-----|-------------------------------|
| ATOC 315 | (3) | Thermodynamics and Convection |
| CHEM 567 | (3) | Chemometrics: Data Analysis |
| CHEM 575 | (3) | Chemical Kinetics |
| CHEM 597 | (3) | Analytical Spectroscopy |
| EPSC 542 | (3) | Chemical Oceanography |

13.7.16 Bachelor of Science (B.Sc.) - Honours Chemistry - Bio-organic (75 credits)

Note: Attainment of the Honours degree requires a CGPA of at least 3.00.

Program Prerequisites

PRE-PROGRAM REQUIREMENTS:

Students entering from the Freshman program must have included CHEM 110 and CHEM 120 or CHEM 115, BIOL 111 or BIOL 112, MATH 133, MATH 140/MATH 141 or MATH 150/MATH 151, PHYS 131/PHYS 142, or their equivalents in their Freshman year. Quebec students must have completed the DEC with appropriate science and mathematics courses. Note that students who have successfully completed MATH 150 and MATH 151 do not have to take MATH 222.

Required Courses (57 credits)

The required courses in this program consist of 57 credits in chemistry, biology and mathematics, listed below. The courses marked with an asterisk (*) are omitted from the program of students who have successfully completed them at the CEGEP level but the Chemistry courses must be replaced by courses in that discipline if students wish to be eligible for admission to the Ordre des chimistes du Québec. Students from outside Quebec or transfer students should consult the Academic Adviser.

See <http://www.mcgill.ca/chemistry/current-undergraduate-students/advising/>.

A computer science course, either COMP 202 or COMP 208, is strongly recommended during U1 for students who have no previous introduction to computer programming. Students should contact their adviser on this matter. Completion of Mathematics MATH 222 during U1 is also strongly recommended.

* Denotes courses with CEGEP equivalents.

** Students who have successfully completed MATH 150 and MATH 151 are not required to take MATH 222.

(3)

Molecular Biology

13.7.17 Bachelor of Science (B.Sc.) - Honours Chemistry: Biophysical Chemistry (75 credits)

This program trains students in the fundamentals of chemistry and develops the physical science, computational, and mathematical skills needed for advanced biophysical chemistry research in the biomedical and biotechnology industries. The program features integrative, interdisciplinary courses in bio-physical sciences.

Program Prerequisites

Note: Attainment of the Honours degree requires a CGPA of at least 3.00.

Pre-Program Requirements: Students entering from the Freshman program must have included CHEM 110 and CHEM 120 or CHEM 115, BIOL 111 or BIOL 112, MATH 133, MATH 140/MATH 141 or MATH 150/MATH 151, PHYS 131/PHYS 142, or their equivalents in their Freshman year. Quebec students must have completed the DEC with appropriate science and mathematics courses. Note that students who have successfully completed MATH 150 and MATH 151 do not have to take MATH 222.

Required Courses (65 credits)

The courses marked with an asterisk (*) are omitted from the program of students who have successfully completed them at the CEGEP level. Students completing the program will not be eligible for admission to the Ordre des chimistes du Québec without additional chemistry electives. This program is not currently accredited by the Canadian Society for Chemistry.

Completion of Mathematics MATH 222 and MATH 315 during U1 is strongly recommended.

* Denotes courses with CEGEP equivalents.

** Students who have successfully completed MATH 150 and MATH 151 are not required to take MATH 222.

Bio-Physical Sciences Core

| | | |
|------------|-----|---|
| BIOL 219 | (4) | Introduction to Physical Molecular and Cell Biology |
| BIOL 319 | (3) | Introduction to Biophysics |
| BIOL 395 | (1) | Quantitative Biology Seminar |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| MATH 222** | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra Ordinary Dif |

| | | |
|----------|-----|----------------------------------|
| CHEM 281 | (3) | Inorganic Chemistry 1 |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| CHEM 332 | (3) | Biological Chemistry |

Adv

The required courses in this program consist of 59 credits in chemistry, physics and mathematics, listed below. The courses marked with an asterisk (*) are omitted from the program of students who hav

* Students may take up to 9 Research Project credits but only 6 of these may be used to fulfil the program requirement.

CHEM 470 (6) Research Project 1

CHEM 480 (3) Undergraduate Research Project 2

Or other research-related courses at the 400 or 500 lev

13.9 Computer Science (COMP)

13.9.1 Location

Main Office

McConnell Engineering Building, Room 318

3480 University Street

Montreal QC H3A 0E9

Telephone: 514-398-7071

Fax: 514-398-3883

Undergraduate Student Affairs Office

McConnell Engineering Building, Room 320

3480 University Street

Montreal QC H3A 0E9

T

Assistant Professors

B. Richards; B.Sc.(Tor), M.Sc., D.Phil.(Oxf.)
R. Robere; B.Sc.(Nfld.), M.Sc., Ph.D.(Tor.)
D. Rolnick; B.Sc.(MIT), Ph.D.(Freie Universitat Berlin)
X. Si; BE (Nankai University)

Faculty Lecturer

G. Alberini; B.Sc., M.Sc.(Universita degli Studi di Padova, Italy), Ph.D.(McG.)
D. Beccerra; B.Sc., M.Sc. (Universidad Nacional de Colombia Bogota)
J. D'Silva; M.Sc. (McG., BTECH CS Cochin University of Science & Technology), Ph.D. (McG.)
J. Vybihal; B.Sc., M.Sc.(McG.)

Associate Members

L. Addario-Berry (*Math & Stats*)
D. Bzdok (*Biological and Biomedical Engineering*)
L. Collins (*Neurology and Neurosurgery*)
B. Fung (*Information Studies*)
S. Gravel (*Human Genetics*)
D. Nowrouzezahrai (*Electrical and Computer Engineering*)
T. O'Donnell (*Linguistics*)
P. Savadjiev (*Diagnostic Radiology*)
D. Schlimm (*History and Philosophy of Mathematics*)
T Shultz (*Psychology*)
Y. Yang (*Mathematics and Statistics*)

Adjunct Professors

S. Andrews, D. Bahdanaum, M.G. Bellemare, X. Chen, F. Diaz, G. Grant, S. Kahou, T. Kuo, N. Le Roux, A. Louis, I. Rekleitis, B. Shepherd, A.R. Soriano, D. Tarlow, A. Trischler

13.9.7 Bachelor of Science (B.Sc.) - Minor Computer Science (24 credits)

Students must obtain approval from their main program adviser, and are also strongly encouraged to speak with a School of Computer Science adviser before choosing complementary courses. A particular course selection must be approved before the student registers for their final term of studies.

Students should note that COMP 251 is a prerequisite for many upper level COMP courses. Upper level COMP courses may have prerequisites that are not part of the Minor such as MATH 222, MATH 223, or MATH 323. Students will not get credit for these courses toward the Minor.

Students may receive up to 6 credits toward the Minor by taking certain approved courses outside the School of Computer Science. These courses must have a high computer science content and must be approved by the School of Computer Science in advance. If a student's Major program requires Computer Science courses, up to 6 credits of Computer Science courses may be used to fulfill both Major and Minor requirements.

Required Courses (9 credits)

* Students who have sufficient knowledge of computer programming do not need to take COMP 202, but it must be replaced with an additional computer science complementary course.

| | | |
|-----------|-----|----------------------------------|
| COMP 202* | (3) | Foundations of Programming |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |

Complementary Courses (15 credits)

15 credits selected from the courses below and computer science courses at the 300 level or above (except COMP 364 and COMP 396).

| | | |
|----------|-----|----------------------------------|
| COMP 251 | (3) | Algorithms and Data Structures |
| COMP 273 | (3) | Introduction to Computer Systems |
| MATH 240 | (3) | Discrete Structures |

13.9.8 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Computer Science (45 credits)

This program provides an introduction to the principles of computer science and offers opportunity to get insight into some of its sub-areas. Having only 45 credits, it allows students to combine it with minor or major concentrations in other disciplines.

Required Courses (18 credits)

* Students who have sufficient knowledge in a programming language do not need to take COMP 202, but it must be replaced with an additional computer science complementary course.

| | | |
|-----------|-----|----------------------------------|
| COMP 202* | (3) | Foundations of Programming |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| COMP 251 | (3) | Algorithms and Data Structures |
| COMP 273 | (3) | Introduction to Computer Systems |
| MATH 240 | (3) | Discrete Structures |

Complementary Courses (27 credits)

3 credits from each of the groups A, B, C, and D.

Group A

| | | |
|----------|-----|-------------|
| MATH 222 | (3) | Calculus 3 |
| MATH 323 | (3) | Probability |
| MATH 324 | (3) | Statistics |

Group B

| | | |
|----------|-----|----------------------|
| MATH 223 | (3) | Linear Algebra |
| MATH 318 | (3) | Mathematical Logic |
| MATH 340 | (3) | Discrete Mathematics |

Group C

| | | |
|----------|-----|-----------------------|
| COMP 330 | (3) | Theory of Computation |
| COMP 350 | (3) | Numerical Computing |
| COMP 360 | (3) | Algorithm Design |

Group D

| | | |
|----------|-----|-------------------------------------|
| COMP 302 | (3) | Programming Languages and Paradigms |
| COMP 303 | (3) | Software Design |

An additional 3 credits may be selected from Group A or B.

The remaining complementary credits must be selected from any COMP courses at the 300 level or above except COMP 364 and COMP 396.

13.9.9 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Software Engineering (49 credits)

This program covers a core of programming and software engineering courses and allows students to select courses that aim at practical aspects of software development.

Required Courses (36 credits)

* Students who have sufficient knowledge in a programming language do not need to take COMP 202 and can replace it with additional computer science complementary course credits.

| | | |
|------------|-----|-------------------------------------|
| COMP 202* | (3) | Foundations of Programming |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| COMP 251 | (3) | Algorithms and Data Structures |
| COMP 273 | (3) | Introduction to Computer Systems |
| COMP 302 | (3) | Programming Languages and Paradigms |
| COMP 303 | (3) | Software Design |
| COMP 310 | (3) | Operating Systems |
| COMP 361D1 | (3) | Software Engineering Project |
| COMP 361D2 | (3) | Software Engineering Project |
| MATH 223 | (3) | Linear Algebra |
| MATH 240 | (3) | Discrete Structures |

Complementary Courses (13 credits)

3 credits selected from:

1 221.503 Tm(1 2ih cI1hcre3s selected f(Softw The Tj of C371u031hDGrnted f(Softw((3 1 82.67 465.482 814 48f(Soft.642 Tm(COMf1 0 0 12.223 Tm(3 credits sel

13.9.10 Bachelor of Science (B.Sc.) - Major Computer Science (63 credits)

This program is the standard Major program offered by the School of Computer Science. It provides a broad introduction to the principles of computer science and offers ample opportunity to acquire in-depth knowledge of several sub-disciplines. At the same time, its credit requirements allow students to take an additional minor.

Students may complete this program with a minimum of 60 credits or a maximum of 63 credits depending if they are exempt from taking COMP 202.

Required Courses (33 credits)

* Students who have sufficient knowledge in a programming language do not need to take COMP 202.

| | | |
|-----------|-----|-------------------------------------|
| COMP 202* | (3) | Foundations of Programming |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| COMP 251 | (3) | Algorithms and Data Structures |
| COMP 273 | (3) | Introduction to Computer Systems |
| COMP 302 | (3) | Programming Languages and Paradigms |
| COMP 303 | (3) | Software Design |
| COMP 310 | (3) | Operating Systems |
| MATH 222 | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 240 | (3) | Discrete Structures |

Complementary Courses (30 credits)

Students should talk to an academic adviser before choosing their complementary courses.

At least 6 credits selected from:

| | | |
|----------|-----|-----------------------|
| COMP 330 | (3) | Theory of Computation |
| COMP 350 | (3) | Numerical Computing |
| COMP 360 | (3) | Algorithm Design |

3-9 credits selected from:

* Must include at least one of MATH 323 and MATH 340.

| | | |
|-----------|-----|----------------------|
| MATH 318 | (3) | Mathematical Logic |
| MATH 323* | (3) | Probability |
| MATH 324 | (3) | Statistics |
| MATH 340* | (3) | Discrete Mathematics |

At least 6 credits at the 400-level or above.

The remaining credits selected from computer science courses at the 300 level or above (except COMP 364 and COMP 396) and ECSE 539.

Note: Students have to make sure that they have the appropriate prerequisites when choosing upper-level courses.

Bac

Students may complete this program with a minimum of 63 credits and maximum of 74 credits depending upon whether they take COMP 202/204, CHEM 212, MATH 222, and COMP 462 versus COMP 561.

Program prerequisites: U0 (freshman) students should take: BIOL 111-112, CHEM 110-120, MATH 133, MATH 140-141 or MATH 150-151, PHYS 101-102 or PHYS 131-142. Note that MATH 150-151 provides equivalence for required course MATH 222.

Students who do not have a background in computer programming at the level of COMP 202 or COMP 204 must take one of these courses. COMP 204 is considered equivalent to COMP 202 as a prerequisite for COMP 206 and COMP 250.

Required Courses (46 credits)

36-46 credits:

Bio-Physical Sciences Core

| | | |
|------------|-----|---|
| BIOL 219 | (4) | Introduction to Physical Molecular and Cell Biology |
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| BIOL 395 | (1) | Quantitative Biology Seminar |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| COMP 202** | (3) | Foundations of Programming |
| MATH 222* | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 323 | (3) | Probability |

Computer Science and Mathematics

| | | |
|------------|-----|--|
| COMP 204** | (3) | Computer Programming for Life Sciences |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| COMP 251 | (3) | Algorithms and Data Structures |
| MATH 240 | (3) | Discrete Structures |

Biology

| | | |
|----------|-----|---------------------------------------|
| BIOL 202 | (3) | Basic Genetics |
| BIOL 215 | (3) | Introduction to Ecology and Evolution |

Required Joint Courses

| | | |
|----------|-----|---|
| COMP 401 | (3) | Project in Biology and Computer Science |
|----------|-----|---|

* Students with CEGEP-level credit for the equivalents of MATH 222 and/or CHEM 212 (see <http://www.mcgill.ca/students/courses/plan/transfer/> for accepted equivalents) may not take these courses at McGill and should replace them with elective courses to satisfy the total credit requirement for their degree.

** Students may take either COMP 202 or COMP 204, but not both. Students who have sufficient knowledge in a programming language are not required to take these courses.

Complementary Courses

27-28 credits

3-4 credits from the following:

| | | |
|----------|-----|--|
| COMP 462 | (3) | Computational Biology Methods |
| COMP 561 | (4) | Computational Biology Methods and Research |

3-6 from the following:

| | | |
|----------|-----|---------------------------------|
| MATH 315 | (3) | Ordinary Differential Equations |
| MATH 324 | (3) | Statistics |

The remaining 18-21 credits is to be chosen from the following, with at least 9 credits at the 400 level or above.

Computer Science Block

9-12 credits from the following, with 3-6 credits at the 400 level or above.

Note: All COMP courses at the 400 level or above (except COMP 400, 401, 402, 499, 462, and 561).

| | | |
|-------------|-----|-------------------------------------|
| COMP 273 | (3) | Introduction to Computer Systems |
| COMP 302 | (3) | Programming Languages and Paradigms |
| COMP 303 | (3) | Software Design |
| COMP 307 | (2) | Principles of Web Development |
| COMP 310 | (3) | Operating Systems |
| COMP 322 | (1) | Introduction to C++ |
| COMP 330 | (3) | Theory of Computation |
| COMP 350 | (3) | Numerical Computing |
| COMP 360 | (3) | Algorithm Design |
| COMP 361D1* | (3) | Software Engineering Project |
| COMP 361D2* | (3) | Software Engineering Project |

* Students must take both COMP 361D1 and COMP 361D2.

Biology Block

9-12 credits from the following, with 3-6 credits at the 400 level or above:

| | | |
|----------|-----|-----------------------------------|
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 303 | (3) | Developmental Biology |
| BIOL 304 | (3) | Evolution |
| BIOL 306 | (3) | Neural Basis of Behaviour |
| BIOL 308 | (3) | Ecological Dynamics |
| BIOL 309 | (3) | Mathematical Models in Biology |
| BIOL 310 | (3) | Biodiversity and Ecosystems |
| BIOL 313 | (3) | Eukaryotic Cell Biology |
| BIOL 314 | (3) | Molecular Biology of Cancer |
| BIOL 316 | (3) | Biomembranes and Organelles |
| BIOL 319 | (3) | Introduction to Biophysics |
| BIOL 320 | (3) | Evolution of Brain and Behaviour |
| BIOL 370 | (3) | Human Genetics Applied |
| BIOL 389 | (3) | Laboratory in Neurobiology |
| BIOL 395 | (1) | Quantitative Biology Seminar |
| BIOL 416 | (3) | Genetics of Mammalian Development |
| BIOL 434 | (3) | Theoretical Ecology |
| BIOL 435 | (3) | Natural Selection |
| BIOL 509 | (3) | Methods in Molecular Ecology |
| BIOL 518 | (3) | Advanced Topics in Cell Biology |

| | | |
|----------|-----|---|
| BIOL 520 | (3) | Gene Activity in Development |
| BIOL 524 | (3) | Topics in Molecular Biology |
| BIOL 530 | (3) | Advances in Neuroethology |
| BIOL 532 | (3) | Developmental Neurobiology Seminar |
| BIOL 546 | (3) | Genetics of Model Systems |
| BIOL 551 | (3) | Principles of Cellular Control |
| BIOL 568 | (3) | Topics on the Human Genome |
| BIOL 569 | (3) | Developmental Evolution |
| BIOL 575 | (3) | Human Biochemical Genetics |
| BIOL 580 | (3) | Genetic Approaches to Neural Systems |
| BIOL 588 | (3) | Advances in Molecular/Cellular Neurobiology |
| NEUR 310 | (3) | Cellular Neurobiology |

13.9.12 Bachelor of Science (B.Sc.) - Major Computer Science - Computer Games (65 credits)

This program is a specialization within Computer Science. It fulfills all the basic requirements of the Major Computer Science. The program focuses on topics that are important to understanding the technology behind computer games and to gaining experience in software development and design needed for computer game development.

Students may complete this program with a minimum of 62 credits or a maximum of 65 credits depending on whether they are exempt from taking COMP 202.

Required Courses

(46-49 credits)

* Students who have sufficient knowledge in a programming language do not need to take COMP 202 and can replace it with additional computer science complementary course credits.

| | | |
|-----------|-----|----------------------------------|
| COMP 202* | (3) | Foundations of Programming |
| COMP 206 | (3) | Introduction to Software Systems |

3 credits selected from:

| | | |
|----------|-----|---------------------|
| COMP 350 | (3) | Numerical Computing |
| COMP 360 | (3) | Algorithm Design |

At least 7 credits selected from:

| | | |
|----------|-----|------------------------------------|
| COMP 308 | (1) | Computer Systems Lab |
| COMP 424 | (3) | Artificial Intelligence |
| COMP 521 | (4) | Modern Computer Games |
| COMP 522 | (4) | Modelling and Simulation |
| COMP 529 | (4) | Software Architecture |
| COMP 533 | (3) | Model-Driven Software Development |
| COMP 551 | (4) | Applied Machine Learning |
| COMP 559 | (4) | Fundamentals of Computer Animation |

At least 6 credits selected from:

| | | |
|----------|-----|------------------------|
| COMP 409 | (3) | Concurrent Programming |
| | (3) | Database Systems |

9 credits selected from Groups A and B, with at least 3 credits selected from each:

15 credits selected from Groups C and D, with at least 9 credits selected from Group C, and at least 3 credits selected from Group D.

Group A:

| | | |
|----------|-----|-------------|
| MATH 222 | (3) | Calculus 3 |
| MATH 323 | (3) | Probability |
| MA | (3) | Statistics |

Required Courses (48 credits)

* Students who have sufficient knowledge in a programming language do not need to take COMP 202.

** Students take either MATH 340 or MATH 350.

| | | |
|------------|-----|--|
| COMP 202* | (3) | Foundations of Programming |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| COMP 252 | (3) | Honours Algorithms and Data Structures |
| COMP 273 | (3) | Introduction to Computer Systems |
| COMP 302 | (3) | Programming Languages and Paradigms |
| COMP 303 | (3) | Software Design |
| COMP 310 | (3) | Operating Systems |
| COMP 330 | (3) | Theory of Computation |
| COMP 350 | (3) | Numerical Computing |
| COMP 362 | (3) | Honours Algorithm Design |
| COMP 400 | (3) | Project in Computer Science |
| MATH 222 | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 240 | (3) | Discrete Structures |
| MATH 340** | (3) | Discrete Mathematics |
| MATH 350** | (3) | Honours Discrete Mathematics |

Complementary Courses (27 credits)

6 credits selected from:

| | | |
|----------|-----|--------------------|
| MATH 318 | (3) | Mathematical Logic |
| MATH 323 | (3) | Probability |
| MATH 324 | (3) | Statistics |

The remaining credits selected from computer science courses at the 300 level or above (except COMP 364 and COMP 396) and ECSE 539. At least 12 credits must be at the 500 lev

| | | |
|------------|-----|---|
| BIOL 219 | (4) | Introduction to Physical Molecular and Cell Biology |
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| BIOL 395 | (1) | Quantitative Biology Seminar |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| COMP 202** | (3) | Foundations of Programming |
| MATH 222* | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 323 | (3) | Probability |

Computer Science and Mathematics

| | | |
|-------------|-----|--|
| COMP 204** | (3) | Computer Programming for Life Sciences |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| COMP 252*** | (3) | Honours Algorithms and Data Structures |
| COMP 561 | (4) | Computational Biology Methods and Research |
| MATH 240 | (3) | Discrete Structures |

Biology

| | | |
|----------|-----|---------------------------------------|
| BIOL 202 | (3) | Basic Genetics |
| BIOL 215 | (3) | Introduction to Ecology and Evolution |

Joint Courses

| | | |
|------------|-----|---|
| COMP 402D1 | (3) | Honours Project in Computer Science and Biology |
| COMP 402D2 | (3) | Honours Project in Computer Science and Biology |

* Students with CEGEP-level credit for the equivalents of MATH 222 and/or CHEM 212 (see <http://www.mcgill.ca/students/courses/plan/transfer/> for accepted equivalents) may not take these courses at McGill and should replace them with elective courses to satisfy the total credit requirement (e course.A07tmot i)Tj1 Oi1 0

| | | |
|-------------|-----|------------------------------|
| COMP 310 | (3) | Operating Systems |
| COMP 322 | (1) | Introduction to C++ |
| COMP 330 | (3) | Theory of Computation |
| COMP 350 | (3) | Numerical Computing |
| COMP 360 | (3) | Algorithm Design |
| COMP 361D1^ | (3) | Software Engineering Project |
| COMP 361D2^ | (3) | Software Engineering Project |

All COMP courses at the 400 level or above except COMP 400, 401, 402, 462, 561.

*** Students with credit for COMP 251 cannot take COMP 252, and must instead include at least 6 credits at the 400-level or above, 3 credits of which must be at the 500-level.

^ Students must take both COMP 361D1 and COMP 361D2 or neither.

Biology Block

9-12 credits from the following, with 3-6 credits at the 400 level or above:

| | | |
|----------|-----|------------------------------------|
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 303 | (3) | Developmental Biology |
| BIOL 304 | (3) | Evolution |
| BIOL 306 | (3) | Neural Basis of Behaviour |
| BIOL 308 | (3) | Ecological Dynamics |
| BIOL 309 | (3) | Mathematical Models in Biology |
| BIOL 310 | (3) | Biodiversity and Ecosystems |
| BIOL 313 | (3) | Eukaryotic Cell Biology |
| BIOL 314 | (3) | Molecular Biology of Cancer |
| BIOL 316 | (3) | Biomembranes and Organelles |
| BIOL 319 | (3) | Introduction to Biophysics |
| BIOL 320 | (3) | Evolution of Brain and Behaviour |
| BIOL 370 | (3) | Human Genetics Applied |
| BIOL 389 | (3) | Laboratory in Neurobiology |
| BIOL 395 | (1) | Quantitative Biology Seminar |
| BIOL 416 | (3) | Genetics of Mammalian Development |
| BIOL 434 | (3) | Theoretical Ecology |
| BIOL 435 | (3) | Natural Selection |
| BIOL 509 | (3) | Methods in Molecular Ecology |
| BIOL 518 | (3) | Advanced Topics in Cell Biology |
| BIOL 520 | (3) | Gene Activity in Development |
| BIOL 524 | (3) | Topics in Molecular Biology |
| BIOL 530 | (3) | Advances in Neuroethology |
| BIOL 532 | (3) | Developmental Neurobiology Seminar |
| BIOL 546 | (3) | Genetics of Model Systems |
| BIOL 551 | (3) | Principles of Cellular Control |
| BIOL 568 | (3) | Topics on the Human Genome |
| BIOL 569 | (3) | Developmental Evolution |
| BIOL 575 | (3) | Human Biochemical Genetics |

| | | |
|----------|-----|---|
| BIOL 580 | (3) | Genetic Approaches to Neural Systems |
| BIOL 588 | (3) | Advances in Molecular/Cellular Neurobiology |
| NEUR 310 | (3) | Cellular Neurobiology |

13.9.16 Bachelor of Science (B.Sc.) - Honours Software Engineering (75 credits)

This program provides a more challenging and research-oriented version of the Major Software Engineering program.

Students may complete this program with a maximum of 75 credits or a minimum of 72 credits if they are exempt from taking COMP 202.

Honours students must maintain a CGPA of at least 3.00 during their studies and at graduation.

Required Courses

39-42 credits

* Students who have sufficient knowledge in a programming language do not need to take COMP 202.

| | | |
|------------|-----|-------------------------------------|
| COMP 202* | (3) | Foundations of Programming |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| COMP 251 | (3) | Algorithms and Data Structures |
| COMP 273 | (3) | Introduction to Computer Systems |
| COMP 302 | (3) | Programming Languages and Paradigms |
| COMP 303 | (3) | Software Design |
| COMP 310 | (3) | Operating Systems |
| COMP 361D1 | (3) | Software Engineering Project |
| COMP 361D2 | (3) | Software Engineering Project |
| COMP 400 | (4) | Project in Computer Science |
| ECSE 429 | (3) | Software Validation |
| MATH 223 | (3) | Linear Algebra |
| MATH 240 | (3) | Discrete Structures |

Complementary Courses (33 credits)

At least 9 credits must be from Groups A and B, with at least 3 credits from each:

At least 18 credits must be from Groups C and D, with at least 9 credits from Group C and at least 6 credits from Group D.

At least 12 credits must be from COMP courses at the 500 level or above.

Group A:

| | | |
|----------|-----|-------------|
| MATH 222 | (3) | Calculus 3 |
| MATH 323 | (3) | Probability |
| MATH 324 | (3) | Statistics |

Group B:

| | | |
|----------|-----|-----------------------|
| COMP 330 | (3) | Theory of Computation |
| COMP 360 | (3) | Algorithm Design |

Group C: Software Engineering Specialization

* Students may select either COMP 409 or ECSE 420, but not both.

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Montreal QC H3A 0E8
Telephone: 514-398-6767
Fax: 514-398-4680
Email: kristy.thornton@mcgill.ca
Website: mcgill.ca/eps

13.10.2 About Earth and Planetary Sciences

Earth and Planetary Sciences is a multidisciplinary field that includes the solid Earth and its hydrosphere and extends to the neighbouring terrestrial planets. Principles of chemistry, physics, and mathematics are applied to elucidate the complex and diverse planetary processes at play as we seek to understand how planets like the Earth changed over time and continue to evolve.

Career opportunities are many and diverse in the Earth and Planetary Sciences. Graduates of the Major and Honours in Geology are often recruited by resource (fossil fuel and mineral) exploration companies, as well as the mining and environmental sectors. Industry or government agencies may hire undergraduate students during the summer months, providing them with both financial benefits and first-hand geoscientific experience. Career opportunities in planetary science can also be found in universities and research or

Professors

Don Baker; A.B.(Chic.), Ph.D.(Penn. St.)

Eric Galbraith; B.Sc. (McG.), Ph.D. (Br. Col.)

Galen Halverson; B.A.(Mont.), M.A., Ph.D.(Harv.) (*T.H. Clark Chair in Sedimentary and Petroleum Geology*)

Olivia G. Jensen; B.Sc., M.Sc., Ph.D.(Br. Col.)

Jeffrey McKenzie; B.Sc.(McG.), M.Sc., Ph.D.(Syrac.)

John Stix; A.B.(Dart.), M.Sc., Ph.D.(Tor.)

A.E. (Willy) Williams-Jones; B.Sc., M.Sc.(Natal), Ph.D.(Qu.) (*William E. Logan Professor of Geology*)

Associate Professors

Nicolas Cowan; B.Sc.(McG.), Ph.D.(Wash.) (*joint appt. with Physics*)

Yajing Liu; B.Sc.(Peking), Ph.D.(Harv.)

Jeanne Paquette; B.Sc., M.Sc.(McG.), Ph.D.(SUNY, Stony Brook)

Christie Rowe; A.B.(Smith), Ph.D.(Calif.-Santa Cruz) (*Robert Wares Faculty Scholar*)

Vincent van Hinsberg; Propadeuse, Doctorandus(Utrecht), Ph.D.(Brist.) (*Osisko Faculty Scholar*)

Assistant Professors

Kim Berlo; Propadeuse, Doctorandus(Utrecht), Ph.D.(Brist.)

Peter Douglas; B.Sc.(Pomona), Ph.D.(Yale)

Natalya Gomez; B.Sc., M.Sc.(Tor.), Ph.D.(Harv.)

James Kirkpatrick; B.Sc., M.Sc.(Leeds), Ph.D.(Glas.)

Nagissa Mahmoudi; B.Sc.(Tor.), Ph.D.(McM.)

Faculty Lecturer

W. Minarik; B.A.(St. Olaf), M.Sc.(Wash.), Ph.D.(Rensselaer Poly.)

Adjunct Professors

R. Harrington; B.Sc., M.S., Ph.D.(Calif.-LA), R. Léveillé; B.Sc., Ph.D., D.Phil.(UIB), H. Short; B.A. (Skidmore), M.Sc. (Albany), Ph.D. (Maine)

13.10.5 Bachelor of Science (B.Sc.) - Minor Geology (18 credits)

The Minor Geology offers students from other departments the opportunity to obtain exposure to the Earth Sciences.

Required Courses (6 credits)

| | | |
|----------|-----|-------------------------|
| EPSC 210 | (3) | Introductory Mineralogy |
| EPSC 212 | (3) | Introductory Petrology |

Complementary Courses (12 credits)

3 credits, one of:

| | | |
|----------|-----|----------------------------|
| EPSC 201 | (3) | Understanding Planet Earth |
| EPSC 233 | (3) | Earth and Life History |

9 credits selected from the list below and other 300-lev

| | | |
|----------|-----|---------------------------|
| EPSC 334 | (3) | Invertebrate Paleontology |
| EPSC 350 | (3) | Tectonics |
| EPSC 452 | (3) | Mineral Deposits |
| EPSC 542 | (3) | Chemical Oceanography |
| EPSC 561 | (3) | Ore-forming Processes |

13.10.6 Bachelor of Science (B.Sc.) - Minor Geochemistry (18 credits)

The Minor in Geochemistry focuses on the chemistry of Earth's lithosphere, its reactivity in contact with the atmosphere and/or the hydrosphere, and the chemistry of extra-terrestrial materials.

The appropriate background in chemistry is required: (CHEM 110 and CHEM 120, or their equivalent) and calculus (MATH 139 and MATH 141, or their equivalent).

Required Courses (9 credits)

| | | |
|----------|-----|----------------------------|
| EPSC 201 | (3) | Understanding Planet Earth |
| EPSC 210 | (3) | Introductory Mineralogy |
| EPSC 212 | (3) | Introductory Petrology |

Complementary Courses (9 credits)

9 credits selected from:

| | | |
|----------|-----|---|
| EPSC 220 | (3) | Principles of Geochemistry |
| EPSC 501 | (3) | Crystal Chemistry |
| EPSC 519 | (3) | Isotopes in Earth and Environmental Science |
| EPSC 549 | (3) | Hydrogeology |
| EPSC 570 | (3) | Cosmochemistry |
| EPSC 590 | (3) | Applied Geochemistry Seminar |

13.10.7 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Earth and Planetary Sciences (45 credits)

The B.Sc. (Liberal) program in Earth and Planetary Sciences provides the graduate with a solid core of knowledge of Geology, Geophysics, Earth Systems Science, and Planetary Science while allowing for a broadening of the student's educational experience with courses from the other sciences or the arts. The program is flexible, allowing students to assemble a truly interdisciplinary degree.

Required Courses (21 credits)

| | | |
|----------|-----|----------------------------|
| EPSC 210 | (3) | Introductory Mineralogy |
| EPSC 212 | (3) | Introductory Petrology |
| EPSC 220 | (3) | Principles of Geochemistry |
| EPSC 231 | (3) | Field School 1 |
| EPSC 233 | (3) | Earth and Life History |
| EPSC 303 | (3) | Structural Geology |
| EPSC 320 | (3) | Elementary Earth Physics |

Complementary Courses (24 credits)

3 credits, one of:

| | | |
|----------|-----|----------------|
| EPSC 331 | (3) | Field School 2 |
|----------|-----|----------------|

EPSC 341 (3) Field School 3

plus 21 credits chosen from the following:

Note: Courses at the 300 or higher level in other departments in the Faculties of Science and Engineering may also be used as complementary credits, with the permission of the Director of undergraduate studies.

| | | |
|----------|-----|---|
| EPSC 334 | (3) | Invertebrate Paleontology |
| EPSC 340 | (3) | Earth and Planetary Inference |
| EPSC 350 | (3) | Tectonics |
| EPSC 355 | (3) | Sedimentary Geology |
| EPSC 423 | (3) | Igneous Petrology |
| EPSC 425 | (3) | Sediments to Sequences |
| EPSC 435 | (3) | Applied Geophysics |
| EPSC 445 | (3) | Metamorphic Petrology |
| EPSC 452 | (3) | Mineral Deposits |
| EPSC 501 | (3) | Crystal Chemistry |
| EPSC 519 | (3) | Isotopes in Earth and Environmental Science |
| EPSC 530 | (3) | Volcanology |
| EPSC 542 | (3) | Chemical Oceanography |
| EPSC 547 | (3) | Modelling Geochemical Processes |
| EPSC 548 | (3) | Processes of Igneous Petrology |
| EPSC 549 | (3) | Hydrogeology |
| EPSC 550 | (3) | Selected Topics 1 |
| EPSC 551 | (3) | Selected Topics 2 |
| EPSC 552 | (3) | Selected Topics 3 |
| EPSC 561 | (3) | Ore-forming Processes |
| EPSC 567 | (3) | Advanced Volcanology |
| EPSC 570 | (3) | Cosmochemistry |
| EPSC 580 | (3) | Aqueous Geochemistry |
| EPSC 590 | (3) | Applied Geochemistry Seminar |
| ESYS 300 | (3) | Investigating the Earth System |
| ESYS 301 | (3) | Earth System Modelling |
| ESYS 500 | (3) | Earth System Applications |

13.10.8 Bachelor of Science (B.Sc.) - Major Geology (66 credits)

The program curriculum provides a rigorous foundation in the fundamental earth science subjects and in the advanced subjects relevant to exploration for energy resources, industrial and ore minerals, and to environmental geosciences. The program meets the academic requirements shared by the professional orders for geologists and environmental geoscientists in most Canadian provinces. It also offers students the opportunity to take courses or acquire experience in areas of current research. It is a path to a wide range of careers in industry, teaching and research in earth sciences.

Required Courses (30 credits)

| | | |
|----------|-----|----------------------------|
| EPSC 210 | (3) | Introductory Mineralogy |
| EPSC 212 | (3) | Introductory Petrology |
| EPSC 220 | (3) | Principles of Geochemistry |
| EPSC 231 | (3) | Field School 1 |

| | | |
|----------|-----|-------------------------------|
| EPSC 233 | (3) | Earth and Life History |
| EPSC 240 | (3) | Geology in the Field |
| EPSC 303 | (3) | Structural Geology |
| EPSC 320 | (3) | Elementary Earth Physics |
| EPSC 340 | (3) | Earth and Planetary Inference |
| MATH 222 | (3) | Calculus 3 |

Complementary Courses (36 credits)

15 credits of advanced earth science

| | | |
|----------|-----|---------------------------|
| EPSC 334 | (3) | Invertebrate Paleontology |
| EPSC 355 | (3) | Sedimentary Geology |
| EPSC 423 | (3) | Igneous Petrology |
| EPSC 425 | (3) | Sediments to Sequences |
| EPSC 445 | (3) | Metamorphic Petrology |
| EPSC 452 | (3) | Mineral Deposits |

3 credits of field school

| | | |
|----------|-----|----------------|
| EPSC 331 | (3) | Field School 2 |
| EPSC 341 | (3) | Field School 3 |

3 credits of environmental and ore-forming processes

| | | |
|----------|-----|---|
| EPSC 513 | (3) | Climate and the Carbon Cycle |
| EPSC 519 | (3) | Isotopes in Earth and Environmental Science |
| EPSC 542 | (3) | Chemical Oceanography |
| EPSC 549 | (3) | Hydrogeology |
| EPSC 561 | (3) | Ore-forming Processes |
| EPSC 580 | (3) | Aqueous Geochemistry |
| EPSC 590 | (3) | Applied Geochemistry Seminar |

15 credits of other specializations can be drawn from the categories above or from:

| | | |
|------------|-----|--|
| EPSC 350 | (3) | Tectonics |
| EPSC 435 | (3) | Applied Geophysics |
| EPSC 470D1 | (3) | Undergraduate Thesis Research |
| EPSC 470D2 | (3) | Undergraduate Thesis Research |
| EPSC 482 | (3) | Research in Earth and Planetary Sciences |
| EPSC 501 | (3) | Crystal Chemistry |
| EPSC 503 | (3) | Advanced Structural Geology |
| EPSC 520 | (3) | Earthquake Physics and Geology |
| EPSC 530 | (3) | Volcanology |
| EPSC 547 | (3) | Modelling Geochemical Processes |
| EPSC 548 | (3) | Processes of Igneous Petrology |

| | | |
|----------|-----|----------------------|
| EPSC 550 | (3) | Selected Topics 1 |
| EPSC 551 | (3) | Selected Topics 2 |
| EPSC 552 | (3) | Selected Topics 3 |
| EPSC 567 | (3) | Advanced Volcanology |

Other ATOC, EPSC, ESYS, GEOG, MATH and MIME courses may also be used, with the permission of the Director of undergraduate studies, if they meet the academic requirements of professional orders in most Canadian provinces.

13.10.9 Bachelor of Science (B.Sc.) - Honours Geology (75 credits)

The program curriculum is designed to provide a rigorous foundation in the fundamental earth science disciplines and in the advanced subjects relevant to fundamental and applied research in exploration for energy resources or industrial and ore minerals, and in environmental geosciences. The program meets the academic requirements shared by the professional orders for geologists and environmental geoscientists in most Canadian provinces. It is intended to provide an excellent preparation for graduate work in the earth sciences but offers enough fle

| | | |
|------------|-----|--|
| EPSC 350 | (3) | Tectonics |
| EPSC 423 | (3) | Igneous Petrology |
| EPSC 480D1 | (3) | Honours Research Thesis |
| EPSC 480D2 | (3) | Honours Research Thesis |
| EPSC 510 | (3) | Geodynamics |
| EPSC 570 | (3) | Cosmochemistry |
| MATH 222 | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 314 | (3) | Advanced Calculus |
| MATH 315 | (3) | Ordinary Differential Equations |
| MATH 317 | (3) | Numerical Analysis |
| MATH 319 | (3) | Introduction to Partial Differential Equations |
| PHYS 340 | (3) | Majors Electricity and Magnetism |

Complementary Courses (12 credits)

3 credits from:

| | | |
|----------|-----|-------------------------------|
| PHYS 230 | (3) | Dynamics of Simple Systems |
| PHYS 251 | (3) | Honours Classical Mechanics 1 |

plus 9 credits (three courses) chosen from the following:

Note: Courses at the 300 level or higher in other departments in the Faculty of Science at the University of Toronto (PHYS 251) are eligible for this requirement.

13.10.11 Earth and Planetary Sciences (EPSC) Related Programs

13.10.11.1 Joint Major in Physics and Geophysics

For more information, see [section 13.30: Physics \(PHYS\)](#).

13.10.11.2 Earth System Science Interdepartmental Major

This program is offered by the Departments of Atmospheric and Oceanic Sciences; Earth and Planetary Sciences; and Geography. Students in the Department of Earth and Planetary Sciences who are interested in this program should contact Professor William Minarik (william.minarik@mcgill.ca).

For more information, see [section 13.11: Earth System Science \(ESYS\)](#).

13.10.11.3 Earth System Science Interdepartmental Honours

This program is offered by the Departments of Atmospheric and Oceanic Sciences; Earth and Planetary Sciences; and Geography. Students in the Department of Earth and Planetary Sciences who are interested in this program should contact Professor William Minarik (william.minarik@mcgill.ca).

For more information, see [section 13.11: Earth System Science \(ESYS\)](#).

13.11 Earth System Science (ESYS)

13.11.1 Location

Program Adviser
Dr. W

13.11.3 Bachelor of Science - Minor Earth System Science (18 credits)

The Minor in Earth System Science (ESYS) is offered jointly by the following departments:

Atmospheric and Oceanic Sciences (ATOC)

Earth and Planetary Sciences (EPSC)

Geography (GEOG)

Required Courses (12 credits)

| | | |
|----------|-----|--------------------------------|
| ESYS 200 | (3) | Earth System Processes |
| ESYS 300 | (3) | Investigating the Earth System |
| ESYS 301 | (3) | Earth System Modelling |
| ESYS 500 | (3) | Earth System Applications |

Complementary Courses (6 credits)

Two courses from 2 of 3 ESYS Departments (EPSC, ATOC, or GEOG), 300 level or higher

One of the following two courses:

| | | |
|----------|-----|--------------------------------|
| GEOG 306 | (3) | Raster Geo-Information Science |
| GEOG 308 | (3) | Principles of Remote Sensing |

One of the following two courses:

| | | |
|----------|-----|------------------------|
| ENVR 200 | (3) | The Global Environment |
| GEOG 203 | (3) | Environmental Systems |

One of the following two courses:

| | | |
|----------|-----|---------------------------------------|
| BIOL 215 | (3) | Introduction to Ecology and Evolution |
| ENVR 202 | (3) | The Evolving Earth |

One of the following courses:

| | | |
|----------|-----|------------------------------------|
| ANTH 339 | (3) | Ecological Anthropology |
| GEOG 217 | (3) | Cities in the Modern World |
| GEOG 221 | (3) | Environment and Health |
| GEOG 300 | (3) | Human Ecology in Geography |
| GEOG 310 | (3) | Development and Livelihoods |
| GEOG 382 | (3) | Principles Earth Citizenship |
| GEOG 406 | (3) | Human Dimensions of Climate Change |

15 credits from the following course list, with at least 3 credits from each of subject codes ATOC, EPSC, and GEOG. At least 9 of the 15 credits must be at the 400 level or higher.

Note: Courses at the 300 level or higher in other departments in the Faculties of Science and Engineering may also be used as complementary credits, with the permission of an academic adviser. Please see the list posted on the Departmental web page.

| | | |
|----------|-----|-------------------------------------|
| ATOC 215 | (3) | Oceans, Weather and Climate |
| ATOC 309 | (3) | Weather Radars and Satellites |
| ATOC 315 | (3) | Thermodynamics and Convection |
| ATOC 512 | (3) | Atmospheric and Oceanic Dynamics |
| ATOC 513 | (3) | Waves and Stability |
| ATOC 515 | (3) | Turbulence in Atmosphere and Oceans |
| ATOC 519 | (3) | Advances in Chemistry of Atmosphere |
| ATOC 521 | (3) | Cloud Physics |
| ATOC 525 | (3) | Atmospheric Radiation |
| ATOC 530 | (3) | Paleoclimate Dynamics |
| ATOC 531 | (3) | Dynamics of Current Climates |
| ATOC 540 | (3) | Synoptic Meteorology 1 |
| ATOC 541 | (3) | Synoptic Meteorology 2 |
| BIOL 308 | (3) | Ecological Dynamics |
| BIOL 309 | (3) | Mathematical Models in Biology |
| BIOL 310 | (3) | Biodiversity and Ecosystems |

Mathematical 9sed as complem1720.10 0 1 70(Mathh)Tjy 0 1 67.52 .j1cludermiSchoolm(A)advu95.9 67.52 .jMcGill UnsMath(3)

| | | |
|----------|-----|--|
| BIOL 432 | (3) | Limnology |
| BIOL 434 | (3) | Theoretical Ecology |
| BIOL 441 | (3) | Biological Oceanography |
| BIOL 465 | (3) | Conservation Biology |
| BIOL 540 | (3) | Ecology of Species Invasions |
| BIOL 573 | (3) | Vertebrate Palaeontology Field Course |
| BREE 217 | (3) | Hydrology and Water Resources |
| BREE 319 | (3) | Engineering Mathematics |
| BREE 509 | (3) | Hydrologic Systems and Modelling |
| BREE 510 | (3) | Watershed Systems Management |
| BREE 515 | (3) | Soil Hydrologic Modelling |
| BREE 533 | (3) | Water Quality Management |
| ECON 347 | (3) | Economics of Climate Change |
| ECON 405 | (3) | Natural Resource Economics |
| EPSC 212 | (3) | Introductory Petrology |
| EPSC 320 | (3) | Elementary Earth Physics |
| EPSC 331 | (3) | Field School 2 |
| EPSC 334 | (3) | Invertebrate Paleontology |
| EPSC 340 | (3) | Earth and Planetary Inference |
| EPSC 341 | (3) | Field School 3 |
| EPSC 350 | (3) | Tectonics |
| EPSC 355 | (3) | Sedimentary Geology |
| EPSC 423 | (3) | Igneous Petrology |
| EPSC 425 | (3) | Sediments to Sequences |
| EPSC 445 | (3) | Metamorphic Petrology |
| EPSC 452 | (3) | Mineral Deposits |
| EPSC 519 | (3) | Isotopes in Earth and Environmental Science |
| EPSC 530 | (3) | Volcanology |
| EPSC 542 | (3) | Chemical Oceanography |
| EPSC 549 | (3) | Hydrogeology |
| EPSC 561 | (3) | Ore-forming Processes |
| EPSC 567 | (3) | Advanced Volcanology |
| EPSC 580 | (3) | Aqueous Geochemistry |
| EPSC 590 | (3) | Applied Geochemistry Seminar |
| GEOG 272 | (3) | Earth's Changing Surface |
| GEOG 305 | (3) | Soils and Environment |
| GEOG 307 | (3) | Socioeconomic Applications of GIS |
| GEOG 321 | (3) | Climatic Environments |
| GEOG 322 | (3) | Environmental Hydrology |
| GEOG 350 | (3) | Ecological Biogeography |
| GEOG 351 | (3) | Quantitative Methods |
| GEOG 372 | (3) | Running Water Environments |
| GEOG 401 | (3) | Socio-Environmental Systems: Theory and Simulation |

| | | |
|-----------|-----|---|
| GEOG 470 | (3) | Wetlands |
| GEOG 495 | (3) | Field Studies - Physical Geography |
| GEOG 499 | (3) | Subarctic Field Studies |
| GEOG 505 | (3) | Global Biogeochemistry |
| GEOG 506 | (3) | Advanced Geographic Information Science |
| GEOG 523 | (3) | Global Ecosystems and Climate |
| GEOG 530 | (3) | Global Land and Water Resources |
| GEOG 535 | (3) | Remote Sensing and Interpretation |
| GEOG 536 | (3) | Geocryology |
| GEOG 537 | (3) | Advanced Fluvial Geomorphology |
| GEOG 550 | (3) | Historical Ecology Techniques |
| MATH 314 | (3) | Advanced Calculus |
| MATH 315* | (3) | Ordinary Differential Equations |
| | (3) | Numerical Analysis |

| | | |
|------------|-----|---------------------------------|
| ESYS 301 | (3) | Earth System Modelling |
| ESYS 480D1 | (3) | Honours Research Project |
| ESYS 480D2 | (3) | Honours Research Project |
| ESYS 500 | (3) | Earth System Applications |
| MATH 203 | (3) | Principles of Statistics 1 |
| MATH 222 | (3) | Calculus 3 |
| MATH 315 | (3) | Ordinary Differential Equations |

Complementary Courses (33 credits)

One of the following two courses:

| | | |
|----------|-----|---|
| ATOC 214 | (3) | Introduction: Physics of the Atmosphere |
| ATOC 219 | (3) | Introduction to Atmospheric Chemistry |

One of the following two courses:

| | | |
|----------|-----|----------------------------|
| EPSC 210 | (3) | Introductory Mineralogy |
| EPSC 220 | (3) | Principles of Geochemistry |

One of the following two courses:

| | | |
|----------|-----|--------------------------------|
| GEOG 306 | (3) | Raster Geo-Information Science |
| GEOG 308 | (3) | Principles of Remote Sensing |

One of the following two courses:

| | | |
|----------|-----|------------------------|
| ENVR 200 | (3) | The Global Environment |
| GEOG 203 | (3) | Environmental Systems |

One of the following two courses:

| | | |
|----------|-----|---------------------------------------|
| BIOL 215 | (3) | Introduction to Ecology and Evolution |
| ENVR 202 | (3) | The Evolving Earth |

One of the following courses:

| | | |
|----------|-----|------------------------------------|
| ANTH 339 | (3) | Ecological Anthropology |
| GEOG 217 | (3) | Cities in the Modern World |
| GEOG 221 | (3) | Environment and Health |
| GEOG 300 | (3) | Human Ecology in Geography |
| GEOG 310 | (3) | Development and Livelihoods |
| GEOG 382 | (3) | Principles Earth Citizenship |
| GEOG 406 | (3) | Human Dimensions of Climate Change |

15 credits from the following course list, with at least 3 credits from each of subject codes ATOC, EPSC, and GEOG. At least 9 of the 15 credits must be at the 400 level or higher.

Note: Courses at the 300 level or higher in other departments in the Faculties of Science and Engineering may also be used as complementary credits, with the permission of an academic adviser. Please see the list posted on the Departmental web page.

| | | |
|----------|-----|-------------------------------|
| ATOC 215 | (3) | Oceans, Weather and Climate |
| A | (3) | Weather Radars and Satellites |

13.14 Experimental Medicine (EXMD)

13.14.1 Location

Division of Experimental Medicine
Department of Medicine
1001 Decarie Boulevard
Montreal QC H4A 3J1
Canada
Telephone: 514-934-1934, ext. 34699, 34700 or 36465
Email: experimental.medicine@mcgill.ca
Website: mcgill.ca/expmed

13.14.2 About Experimental Medicine

Experimental Medicine is a Division of the Department of Medicine. There are no B.Sc. programs in Experimental Medicine, but the EXMD courses listed below are considered as courses taught by the Faculty of Science.

Experimental Medicine Courses

| | | |
|----------|-----|--|
| EXMD 401 | (3) | Physiology and Biochemistry Endocrine Systems |
| EXMD 501 | (3) | Clinical Applications of Regenerative Medicine |
| EXMD 502 | (3) | Advanced Endocrinology 01 |
| EXMD 503 | (3) | Advanced Endocrinology 02 |
| EXMD 504 | (3) | Biology of Cancer |
| EXMD 505 | (3) | Directed Readings in Regenerative Medicine |
| EXMD 506 | (3) | Advanced Applied Cardiovascular Physiology |
| EXMD 507 | (3) | Advanced Applied Respiratory Physiology |
| EXMD 508 | (3) | Advanced Topics in Respiration |
| EXMD 509 | (3) | Gastrointestinal Physiology and Pathology |
| EXMD 510 | (3) | Bioanalytical Separation Methods |
| EXMD 511 | (3) | Joint Venturing with Industry |

13.15 Field Study

For details about the available Field Study Semesters, see [Study Abroad & Field Studies](#).

13.15.1 Field Studies - Minor Field Studies (18 credits)

Students participating in any one of the field study semesters, i.e., the Africa Field Study Semester, the Barbados Field Study Semester, the Barbados Interdisciplinary Tropical Studies (BITS) Field Study Semester, McGill Arctic Field Study Semester, or the Panama Field Study Semester may complete the 18-credit Minor in Field Studies.

The Minor consists of the 15 credits of a field study semester plus three additional complementary credits chosen by the student in consultation with their departmental adviser and/or the Field Study Minor adviser.

For students in the B.Sc. Liberal Program, the Field Studies Minor can serve as the breadth component.

Program descriptions for each of the field study semesters are provided below.

Note: The field study semesters are not degree programs. Credits may be counted toward McGill degrees with the permission of program advisers. Students who complete a field study semester may consult the Field Study Minor adviser about completing the Minor program as part of their McGill degree.

Africa Field Study Semester (15 credits)

The Africa Field Study Semester (AFSS) is run through McGill's Canadian Field Study in Africa Program (CFSIA).

The AFSS provides one term of integrated field study in East Africa, with emphasis on environmental conservation, culture change, and sustainable development. Students investigate challenges of sustaining biological diversity and social justice in African environments subject to cultural change, economic development, and environmental stress. Cultural and ecological variation is examined in highland, montane, rangeland, desert, riverine, salt- and fresh-water lake, coastal, and urban settings.

Africa Field Study Semester - Required Courses

6 credits

Students select one course titled "Research in Society and Development in Africa" and one course titled "Research in Ecology and Development in Africa" from the courses below.

| | | |
|----------|-----|---|
| ANTH 451 | (3) | Research in Society and Development in Africa |
| BIOL 451 | (3) | Research in Ecology and Development in Africa |
| GEOG 451 | (3) | Research in Society and Development in Africa |
| NRSC 451 | (3) | Research in Ecology and Development in Africa |

Africa Field Study Semester - Complementary Courses

9 credits from:

* Note: Courses marked with an asterisk ("*") are offered on a rotational basis, at least 3 credits annually.

| | | |
|----------|-----|---------------------------------|
| ANTH 411 | (3) | Primate Studies & Conservation |
| ANTH 416 | (3) | Environment/Development: Africa |
| BIOL 428 | (3) | Biological Diversity in Africa |
| BIOL 429 | (3) | East African Ecology |
| | | Environmental Management 2 |

Students select one 3-credit course titled "Water Resources in Barbados" and one 6-credit course titled "Sustainable Development Plans" from the list below.

| | | |
|----------|-----|-------------------------------|
| AGRI 452 | (3) | Water Resources in Barbados |
| AGRI 519 | (6) | Sustainable Development Plans |
| CIVE 452 | (3) | Water Resources in Barbados |
| CIVE 519 | (6) | Sustainable Development Plans |
| URBP 519 | (6) | Sustainable Development Plans |

Barbados Interdisciplinary Tropical Studies Field Semester (15 credits)

The Barbados Interdisciplinary Tropical Studies (BITS) Field Semester is an activity-filled, hands-on experience for students with an interest in international studies with a Caribbean flavour. The focus is on sustainable agri-food, nutrition, and energy production on a tropical island with a tourist-based economy. It is offered annually (in the Summer). It consists of two 2-hour orientation sessions conducted on the Macdonald campus and at the Bellairs Research Institute in Barbados, followed by three 3-credit and one 6-credit project courses at Bellairs Research Institute. This program integrates intensive course work with group project work and contributes to the formation of professionals with planning, managing, decision-making, and communication skills. The program addresses a global need for experienced professionals capable of interacting with various levels of government, non-governmental organizations, and the private sector. BITS welcomes applications from senior undergraduate students from across the University.

Barbados Interdisciplinary Tropical Studies Field Semester - Required Courses

15 credits

| | | |
|----------|-----|------------------------------------|
| AEBI 421 | (3) | Tropical Horticultural Ecology |
| AEBI 423 | (3) | Sustainable Land Use |
| AEBI 425 | (3) | Tropical Energy and Food |
| AEBI 427 | (6) | Barbados Interdisciplinary Project |

Panama Field Study Semester (15 credits)

This program is offered in Panama with the support of the Smithsonian Tropical Research Institute (STRI).

Hands-on experience is gained through research projects organized around multidisciplinary environmental issues. The nature of these projects will centre on practical environmental problems/questions important for Panama. Students will form teams that will work with Panamanian institutions (NGO, governmental, or researchonian

Associate Professors

S. Breau; M.A.(Laval), Ph.D.(Calif.-LA)

B. Forest; A.B.(Chic.), Ph.D.(Calif.-LA)

M. Kalacska; M.Sc., Ph.D.(Alta.)

M.F. Lapointe; M.Sc.(McG.), Ph.D.(Br. Col.)

B. Lehner; M.Sc.(Freiburg), Ph.D.(Frankfurt)

K. Manaugh; B.A.(Naropa), M.U.P., Ph.D.(McG.)

T.C. Meredith; M.Sc., Dip.Cons.(Lond.), Ph.D.(Camb.)

S. Moser; Ph.D.(NUS)

B. Robinson; B.Sc.(Georgia Tech.), M.Eng., MCP(MIT), Ph.D.(Wisc. Madison)

R. Sengupta; M.Sc., Ph.D.(Ill.) (*joint appt. with Bieler School of Environment*)

R. Sieber; M.P.A.(W. Mich.), 568.36 gt322.163 568.36 Tm())Tj1 0 .u3ue63 56j1 Mich.), 568.364Tj1 0 0guer; M.P

9 credits at a 300 and 400 level from any Geography course.

13.17.6 Bachelor of Science (B.Sc.) - Minor GIS & Remote Sensing (18 credits)

The B.Sc. Minor GIS & Remote Sensing focuses on the fundamentals of geospatial tools and technologies.

Required Course (3 credits)

| | | |
|----------|-----|--------------------------------------|
| GEOG 201 | (3) | Introductory Geo-Information Science |
|----------|-----|--------------------------------------|

Complementary Courses (15 credits)

3 credits selected from:

| | | |
|----------|-----|--|
| COMP 202 | (3) | Foundations of Programming |
| GEOG 333 | (3) | Introduction to Programming for Spatial Sciences |

3 credits selected from

| | | |
|-----------|-----|-----------------------------------|
| GEOG 306* | (3) | Raster Geo-Information Science |
| GEOG 307* | (3) | Socioeconomic Applications of GIS |

6 credits selected from:

| | | |
|-----------|-----|---|
| GEOG 308* | (3) | Principles of Remote Sensing |
| GEOG 384* | (3) | Principles of Geospatial Web |
| GEOG 506* | (3) | Advanced Geographic Information Science |
| GEOG 535* | (3) | Remote Sensing and Interpretation |

3 credits selected from:

| | | |
|-----------|-----|---|
| ATOC 309 | (3) | Weather Radars and Satellites |
| COMP 250 | (3) | Introduction to Computer Science |
| ESYS 300 | (3) | Investigating the Earth System |
| GEOG 306* | (3) | Raster Geo-Information Science |
| GEOG 307* | (3) | Socioeconomic Applications of GIS |
| GEOG 308* | (3) | Principles of Remote Sensing |
| GEOG 384* | (3) | Principles of Geospatial Web |
| GEOG 506* | (3) | Advanced Geographic Information Science |
| GEOG 535* | (3) | Remote Sensing and Interpretation |

* may be taken in either list of complementary courses, but credits from one group may not be doubled-counted in the other.

13.17.7 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Geography (49 credits)

This is the Core Science Component in Geography for the B.Sc. Liberal. Required courses provide a foundation in Geography (which takes a holistic approach to environmental sciences, distinguished by its incorporation of human and climatic elements). By completing these courses, students will be armed with

| | | |
|----------|-----|------------------------------|
| GEOG 203 | (3) | Environmental Systems |
| GEOG 272 | (3) | Earth's Changing Surface |
| GEOG 290 | (1) | Local Geographical Excursion |
| GEOG 351 | (3) | Quantitative Methods |

Complementary Courses (36 credits)

3 credits of statistics*

* Note: Credit given for statistics courses is subject to certain restrictions. Students in Science should consult the "Course Overlap" information in the "Course Requirements" section for the Faculty of Science.

| | | |
|----------|-----|--|
| BIOL 373 | (3) | Biometry |
| GEOG 202 | (3) | Statistics and Spatial Analysis |
| MATH 203 | (3) | Principles of Statistics 1 |
| PSYC 204 | (3) | Introduction to Psychological Statistics |
| SOCI 350 | (3) | Statistics in Social Research |

9 credits of systematic physical geography

| | | |
|----------|-----|----------------------------|
| GEOG 305 | (3) | Soils and Environment |
| GEOG 321 | (3) | Climatic Environments |
| GEOG 322 | (3) | Environmental Hydrology |
| GEOG 372 | (3) | Running Water Environments |
| GEOG 373 | (3) | Arctic Geomorphology |
| GEOG 470 | (3) | Wetlands |

Students must take a total of 9 credits from the next 2 blocks; they will choose 6 credits from one block and 3 credits from the other, depending on their training focus.

3 to 6 credits of 300 level environmental analysis/techniques

| | | |
|----------|-----|-----------------------------------|
| GEOG 306 | (3) | Raster Geo-Information Science |
| GEOG 307 | (3) | Socioeconomic Applications of GIS |
| GEOG 308 | (3) | Principles of Remote Sensing |
| GEOG 384 | (3) | Principles of Geospatial Web |

3 or 6 credits (In Environment, Earth System and Sustainability Sciences)

| | | |
|----------|-----|---|
| ENVR 200 | (3) | The Global Environment |
| ENVR 201 | (3) | Society, Environment and Sustainability |
| ENVR 202 | (3) | The Evolving Earth |
| ESYS 200 | (3) | Earth System Processes |
| ESYS 300 | (3) | Investigating the Earth System |
| GEOG 302 | (3) | Environmental Management 1 |
| GEOG 360 | (3) | Analyzing Sustainability |
| GEOG 460 | (3) | Research in Sustainability |

9 credits on human-en

Complementary Courses (45 credits)

3 credits of statistics:

Note: Credit given for statistics courses is subject to certain restrictions. Students in Science should consult the "Course Overlap" information in the "Course Requirements" section for the Faculty of Science.

| | | |
|----------|-----|---------------------------------|
| BIOL 373 | (3) | Biometry |
| GEOG 202 | (3) | Statistics and Spatial Analysis |
| MATH 203 | (3) | Principles of Statistics 1 |

GEOG 460 (3) Research in Sustainability

9 credits on human-environment linkages

GEOG 210 (3) Global Places and Peoples
 GEOG 216 (3) Geography of the World Economy
 GEOG 217 (3) Cities in the Modern World
 GEOG 221 (3) Environment and Health
 GEOG 303 (3) Health Geography
 GEOG 310 (3) Development and Livelihoods
 GEOG 311 (3) Economic Geography
 GEOG 315 (3) Urban Transportation Geography

6 credits of approved advanced courses in Geography, or elsewhere in the Faculty of Science that have been approved by the Program Adviser, including any geography courses from the above complementary lists.

Admission to 500-level courses in Geography requires the instructor's permission. It is not advisable to take more than one 500-level course in a term.

Geography Approved Course List - Major, Honours and Liberal Programs

GEOG 401 (3) Socio-Environmental Systems: Theory and Simulation
 GEOG 404 (3) Environmental Management 2
 GEOG 505 (3) Global Biogeochemistry
 GEOG 506 (3) Advanced Geographic Information Science
 GEOG 523 (3) Global Ecosystems and Climate
 GEOG 530 (3) Global Land and Water Resources
 GEOG 535 (3) Remote Sensing and Interpretation
 GEOG 536 (3) Geocryology
 GEOG 537 (3) Advanced Fluvial Geomorphology
 GEOG 550 (3) Historical Ecology Techniques
 GEOG 555 (3) Ecological Restoration

13.17.9 Bachelor of Science (B.Sc.) - Honours Geography (66 credits)

The Honours program provides specialized systematic training in physical geography. In addition to the Faculty of Science 3.00 CGPA requirement, students in a Geography Honours program must maintain a program GPA of 3.30 and complete a 6-credit Honours thesis.

Required Courses (21 credits)

GEOG 201 (3) Introductory Geo-Information Science
 GEOG 203 (3) Environmental Systems
 GEOG 272 (3) Earth's Changing Surface
 GEOG 351 (3) Quantitative Methods
 GEOG 381 (3) Geographic Thought and Practice
 GEOG 491D1 (3) Honours Research
 GEOG 491D2 (3) Honours Research

Complementary Courses (45 credits)

| | | |
|----------|-----|---|
| ENVR 200 | (3) | The Global Environment |
| ENVR 201 | (3) | Society, Environment and Sustainability |
| ENVR 202 | (3) | The Evolving Earth |
| ESYS 200 | (3) | Earth System Processes |
| ESYS 300 | (3) | Investigating the Earth System |
| GEOG 302 | (3) | Environmental Management 1 |
| GEOG 360 | (3) | Analyzing Sustainability |
| GEOG 460 | (3) | Research in Sustainability |

6 credits of approved advanced courses in Geography, or elsewhere in the Faculty of Science that have been approved by the Program Adviser, including any geography courses from the above complementary lists.

For more information, see [section 13.11: Earth System Science \(ESYS\)](#).

13.17.10.5 Sustainability, Science and Society – Bachelor of Arts and Science (B.A. & Sc.)

The Interfaculty Program in Sustainability, Science and Society as well as the Honours in Sustainability, Science and Society is open only to students in the B.A. & Sc. degree.

Students in the Department of Geography interested in this program should contact:

Michelle Maillet
Email: advisor.geog@mcgill.ca

For more information about these programs, see [Bachelor of Arts & Science](#) > [Undergraduate](#) > [Browse Academic Units & Programs](#) > : [Sustainability, Science and Society](#).

13.18 Immunology

13.18.1 Location

McGill University Health Centre – Glen Site
1001 Decarie Boulevard, Bloc E, Office EM23248
Montreal QC H3G 1A4

or

McIntyre Medical Sciences Building, Room 1136
3655 Promenade Sir-William-Osler
Montreal QC H3G 1Y6

13.18.2 About Immunology

Three departments offer the **Honours** program in Immunology, combining elements of each:

- [section 13.4: Biochemistry \(BIOC\)](#)
- [section 13.23: Microbiology and Immunology \(MIMM\)](#)
- [section 13.31: Physiology \(PHGY\)](#)

The program is a demanding one which will prepare students for graduate work in immunology.

Students who do not maintain Honours standing must transfer their registration to a program in one of the three participating departments.

Apply to:

Dr. Monroe Cohen
Physiology
McIntyre Medical Sciences Building, Room 1136
3655 Promenade Sir-William-Osler, Montreal QC H3G 1Y6
Telephone: 514-398-4342
Email: monroe.cohen@mcgill.ca

or

Dr. C. Piccirillo
Microbiology and Immunology
McGill University Health Centre – Glen Site
1001 Decarie Boulevard, Bloc E, Office EM23248
Montreal QC H3G 1A4
Telephone: 514-934-1934, ext. 76143
Email: ciro.piccirillo@mcgill.ca

plus 3 credits selected from the following:

* Students take either PHGY 209 or MIMM 211.

** Students take either CHEM 203 or CHEM 204.

| | | |
|------------|-----|--|
| ANAT 214 | (3) | Systemic Human Anatomy |
| ANAT 262 | (3) | Introductory Molecular and Cell Biology |
| BIOL 202 | (3) | Basic Genetics |
| BIOL 205 | (3) | Functional Biology of Plants and Animals |
| BIOL 304 | (3) | Evolution |
| CHEM 203** | (3) | Survey of Physical Chemistry |
| CHEM 204** | (3) | Physical Chemistry/Biological Sciences 1 |
| COMP 204 | (3) | Computer Programming for Life Sciences |
| COMP 250 | (3) | Introduction to Computer Science |
| MATH 204 | (3) | Principles of Statistics 2 |
| MIMM 211** | (3) | Introductory Microbiology |
| MIMM 212 | (3) | Laboratory in Microbiology |
| PHGY 209** | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |

U2 Complementary Courses

12 credits chosen as follows:

6 credits selected from:

Students may take

* BIOC 220 and BIOC 320, or

** MIMM 384 and MIMM 385, or

*** PHGY 212 and PHGY 213 and BIOL 301

| | | |
|-------------|-----|--|
| BIOC 220* | (3) | Laboratory Methods in Biochemistry and Molecular Biology 1 |
| BIOC 320* | (3) | Laboratory Methods in Biochemistry and Molecular Biology 2 |
| BIOL 301*** | (4) | Cell and Molecular Laboratory |
| MIMM 384** | (3) | Molecular Microbiology Laboratory |
| MIMM 385** | (3) | Laboratory in Immunology |
| PHGY 212*** | (1) | Introductory Physiology Laboratory 1 |
| PHGY 213*** | (1) | Introductory Physiology Laboratory 2 |

plus 6 credits, selected from:

* Students tak

| | | |
|----------|-----|--|
| MIMM 323 | (3) | Microbial Physiology |
| MIMM 324 | (3) | Fundamental Virology |
| PATH 300 | (3) | Human Disease |
| PHAR 300 | (3) | Drug Action |
| PHAR 301 | (3) | Drugs and Disease |
| PHAR 303 | (3) | Principles of Toxicology |
| PHGY 311 | (3) | Channels, Synapses and Hormones |
| PHGY 312 | (3) | Respiratory, Renal, & Cardiovascular Physiology |
| PHGY 313 | (3) | Blood, Gastrointestinal, & Immune Systems Physiology |
| PHGY 314 | (3) | Integrative Neuroscience |

U3 Complementary Courses

9 credits of U3 complementary courses chosen in the following manner:

3 credits selected from:

| | | |
|----------|-----|------------------------------|
| BIOC 503 | (3) | Immunochemistry |
| MIMM 509 | (3) | Inflammatory Processes |
| PHGY 531 | (3) | Topics in Applied Immunology |

plus 6 credits selected from:

* Students take either ANAT 458 or BIOC 458, but not both.

| | | |
|-----------|-----|---|
| ANAT 458* | (3) | Membranes and Cellular Signaling |
| BIOC 404 | (3) | Biophysical Methods in Biochemistry |
| BIOC 450 | (3) | Protein Structure and Function |
| BIOC 454 | (3) | Nucleic Acids |
| BIOC 458* | (3) | Membranes and Cellular Signaling |
| BIOC 503 | (3) | Immunochemistry |
| BIOL 520 | (3) | Gene Activity in Development |
| EXMD 504 | (3) | Biology of Cancer |
| MIMM 413 | (3) | Parasitology |
| MIMM 465 | (3) | Bacterial Pathogenesis |
| MIMM 466 | (3) | Viral Pathogenesis |
| MIMM 509 | (3) | Inflammatory Processes |
| NEUR 502 | (3) | Basic and Clinical Aspects of Neuroimmunology |
| PHAR 503 | (3) | Drug Discovery and Development 1 |
| PHAR 504 | (3) | Drug Discovery and Development 2 |
| PHGY 488 | (3) | Stem Cell Biology |
| PHGY 531 | (3) | Topics in Applied Immunology |
| PHGY 552 | (3) | Cellular and Molecular Physiology |

13.19 Interdisciplinary Life Sciences

13.19.1 Location

Interdisciplinary Programs Adviser
Ryan Bouma
Telephone: 514-398-7330
Email: ryan.bouma@mcgill.ca

13.19.2 About the Interdisciplinary Life Sciences Minor

The Interdisciplinary Life Sciences Minor allows students to obtain exposure to Life Sciences and life science related areas. Students must consult with the Adviser to review course selection.



Please note: Students studying in Anatomy and Cell Biology; Biochemistry; Honours Immunology; Microbiology and Immunology; Neuroscience; Pharmacology; and Physiology are not permitted to complete this Minor.

Bachelor og1so 567.r to re.bo416n940 1 327.d life scie(24 credits)3.52 594.431 Tm (13n940 1 327..023 T3f 1 0 0 1 136.017 551.4 cm 1 4

| | | |
|----------|-----|--|
| BIOC 450 | (3) | Protein Structure and Function |
| BIOC 458 | (3) | Membranes and Cellular Signaling |
| BIOL 200 | (3) | Molecular Biology |
| BIOL 201 | (3) | Cell Biology and Metabolism |
| BIOL 202 | (3) | Basic Genetics |
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| BIOL 303 | (3) | Developmental Biology |
| BIOL 306 | (3) | Neural Basis of Behaviour |
| BIOL 314 | (3) | Molecular Biology of Cancer |
| BIOL 320 | (3) | Evolution of Brain and Behaviour |
| BIOL 370 | (3) | Human Genetics Applied |
| CHEM 212 | (4) | Introductory Organic Chemistry 1 |
| CHEM 222 | (4) | Introductory Organic Chemistry 2 |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| CHEM 502 | (3) | Advanced Bio-Organic Chemistry |
| CHEM 503 | (3) | Drug Discovery |
| CHEM 504 | (3) | Drug Design |
| EXMD 401 | (3) | Physiology and Biochemistry Endocrine Systems |
| MIMM 211 | (3) | Introductory Microbiology |
| MIMM 214 | (3) | Introductory Immunology: Elements of Immunity |
| MIMM 314 | (3) | Intermediate Immunology |
| MIMM 323 | (3) | Microbial Physiology |
| MIMM 324 | (3) | Fundamental Virology |
| MIMM 387 | (3) | The Business of Science |
| MIMM 465 | (3) | Bacterial Pathogenesis |
| MIMM 466 | (3) | Viral Pathogenesis |
| NSCI 201 | (3) | Introduction to Neuroscience 2 |
| NUTR 307 | (3) | Metabolism and Human Nutrition |
| PATH 300 | (3) | Human Disease |
| PHAR 300 | (3) | Drug Action |
| PHAR 301 | (3) | Drugs and Disease |
| PHAR 303 | (3) | Principles of Toxicology |
| PHAR 503 | (3) | Drug Discovery and Development 1 |
| PHAR 504 | (3) | Drug Discovery and Development 2 |
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |
| PHGY 311 | (3) | Channels, Synapses and Hormones |
| PHGY 312 | (3) | Respiratory, Renal, & Cardiovascular Physiology |
| PHGY 313 | (3) | Blood, Gastrointestinal, & Immune Systems Physiology |
| PHGY 314 | (3) | Integrative Neuroscience |
| PSYC 211 | (3) | Introductory Behavioural Neuroscience |
| PSYC 311 | (3) | Human Cognition and the Brain |

| | | |
|----------|-----|----------------------------|
| PSYC 317 | (3) | Genes and Behaviour |
| PSYC 318 | (3) | Behavioural Neuroscience 2 |
| PSYC 342 | (3) | Hormones and Behaviour |

Health Social Science

At least 3 credits from:

| | | |
|----------|-----|--|
| ANTH 204 | (3) | Anthropology of Meaning |
| ANTH 227 | (3) | Medical Anthropology |
| ANTH 302 | (3) | New Horizons in Medical Anthropology |
| ANTH 314 | (3) | Psychological Anthropology 01 |
| ECON 440 | (3) | Health Economics |
| GEOG 221 | (3) | Environment and Health |
| GEOG 303 | (3) | Health Geography |
| HIST 249 | (3) | Health and the Healer in Western History |
| HIST 335 | (3) | Science and Medicine in Canada |
| HIST 350 | (3) | Science and the Enlightenment |
| HIST 381 | (3) | Colonial Africa |
| HIST 424 | (3) | Gender, Sexuality & Medicine |
| HSEL 308 | (3) | Issues in Women's Health |
| HSEL 309 | (3) | Women's Reproductive Health |
| PHIL 237 | (3) | Contemporary Moral Issues |
| PHIL 343 | (3) | Biomedical Ethics |
| POLI 417 | (3) | Health Care in Canada |
| PSYC 215 | (3) | Social Psychology |
| PSYC 304 | (3) | Child Development |
| PSYC 333 | (3) | Personality and Social Psychology |
| PSYC 412 | (3) | Developmental Psychopathology |
| PSYC 413 | (3) | Cognitive Development |
| PSYC 414 | (3) | Social Development |
| SOCI 225 | (3) | Medicine and Health in Modern Society |
| SOCI 309 | (3) | Health and Illness |
| SOCI 310 | (3) | Sociology of Mental Disorder |
| SOCI 338 | (3) | Introduction to Biomedical Knowledge |
| SOCI 365 | (3) | Health and Development |
| SOCI 390 | (3) | Gender and Health |
| SOCI 515 | (3) | Medicine and Society |
| SOCI 525 | (3) | Health Care Systems in Comparative Perspective |
| SOCI 538 | (3) | Selected Topics in Sociology of Biomedical Knowledge |

Empirical Science and Technology

At least 3 credits from:

* Students who have already received credit for MATH 324 will NOT receive credit for GEOG 202, MATH 203, PSYC 204, BIOL 373, MATH 204, or PSYC 305.

Credit given for statistics courses is subject to certain restrictions. Students should consult the "Course Overlap" information in the "Course Requirements" section for the Faculty of Science.

| | | |
|---------------------|-----|----------------------------------|
| BIOL 309 | (3) | Mathematical Models in Biology |
| BIOL 373 | (3) | Biometry |
| COMP 202 | (3) | Foundations of Programming |
| COMP 364 | (3) | Computer Tools for Life Sciences |
| COMP 462 | (3) | Computational Biology Methods |
| GEOG 202 | (3) | Statistics and Spatial Analysis |
| MATH 203 | (3) | Principles of Statistics 1 |
| MATH 204 | (3) | Principles of Statistics 2 |
| MA(3r52 718o 0 1 MA | (3) | Probability |

| | | |
|----------|-----|---|
| FINE 445 | (3) | Real Estate Finance |
| FINE 446 | (3) | Behavioural Finance |
| FINE 447 | (3) | Venture Capital and Entrepreneurial Finance |
| FINE 448 | (3) | Financial Derivatives |
| | | Market Risk Mode5 Deri |

** 3 credits of statistics: Students who have taken an equivalent Statistics course in another faculty may not count those credits towards the Minor; an additional 3-credit complementary course must be chosen from the course list above.

*** Students who have taken an equivalent Economics course in another faculty may not count those credits toward the Minor; an additional 3-credit complementary course must be chosen from the course list above.

Note: Students should select their Statistics course only after consulting the "Course Overlap" section in the Faculty of Arts, the "Course Overlap" section in the Faculty of Science, and the "Course Overlap" section in the Desautels Faculty of Management to avoid overlapping Statistics courses.

13.21.3 Bachelor of Commerce (B.Com.) - Minor Marketing (For Non-Management Students) (18 credits)

The Minor Marketing consists of 18 credits of Management courses and is currently offered to non-Management students in the Faculties of Arts, Engineering, Science, and the Schulich School of Music.

This Minor is designed to provide students with an understanding of the fundamental concepts in marketing and a framework for applying marketing in a decision-making context. Students will be introduced to the basic concepts in marketing. The use of marketing theory and concepts for decision making will be covered. Marketing research methods for marketing decisions is introduced. Subsequently, students will be able to specialize by choosing from the list of complementary courses.

Required Courses (9 credits)

| | | |
|----------|-----|-------------------------|
| MGCR 352 | (3) | Principles of Marketing |
| MRKT 354 | (3) | Marketing Strategy |
| MRKT 451 | (3) | Marketing Research |

Complementary Courses (9 credits)

3 credits:

| | | |
|-----------|-----|---------------------|
| MGCR 271* | (3) | Business Statistics |
|-----------|-----|---------------------|

6 credits selected from:

| | | |
|----------|-----|------------------------------------|
| MRKT 357 | (3) | Marketing Planning 1 |
| MRKT 365 | (3) | New Products |
| MRKT 438 | (3) | Brand Management |
| MRKT 452 | (3) | Consumer Behaviour |
| MRKT 453 | (3) | Advertising and Media |
| MRKT 455 | (3) | Sales Management |
| MRKT 459 | (3) | Retail Management |
| MRKT 483 | (3) | International Marketing Management |

or other appropriate 300- or 400-level MRKT courses with the approval of the Program Adviser.

* Students who have taken an equivalent Statistics course in another faculty may not count those credits toward the Minor; an additional 3-credit complementary course must be chosen from the course list above.

Note: Students should select their Statistics course only after consulting the "Course Overlap" section in the Faculty of Arts, the "Course Overlap" section in the Faculty of Science, and the "Course Overlap" section in the Desautels Faculty of Management to avoid overlapping Statistics courses.

13.21.4 Bachelor of Commerce (B.Com.) - Minor Operations Management (For Non-Management Students) (18 credits)

The Minor Operations Management consists of 18 credits of Management courses and is currently offered to non-Management students in the Faculties of Arts, Engineering, Science, and Agricultural & Environmental Sciences.

It provides non-Management students with the opportunity to pursue a career that involves decision making at the operational level. Graduates will be able to find employment in consulting, manufacturing, supply chain, distribution, retail operations, healthcare management and environmental management for profit and non-profit corporations. This Minor has been designed to provide students with an understanding of the key concepts in operations management theory and practice.

Required Courses (6 credits)

Statistics is motivated by the need to extract information from data, to quantify uncertainty, and to make predictions about random phenomena. To do this effectively, sophisticated mathematical and probabilistic techniques and computational tools are needed. Core areas of expertise include Bayesian inference, biostatistics, computational statistics, extreme-value analysis, high-dimensional data modeling, multivariate analysis, and survival analysis.

13.22.3 Undergraduate Program Options

Our programs provide a broad and solid mathematical and statistical education that paves the way to many interesting career options in academia, government, and industry. Top students typically get admitted to prestigious graduate schools around the world and often become leaders in their areas of research in academic or industrial settings. Our graduates at all levels are in high demand in government departments, health research centers, banks, insurance and pharmaceutical companies, statistical agencies, and multinational high-technology industries.

There are two popular undergraduate

Emeritus Professors

Marta Bunge; M.A., Ph.D.(Penn.)

Ian Connell; B.Sc., M.Sc.(Manit.), Ph.D.(McG.)

Stephen Drury; Ph.D (Camb.)

Kohur N. GowriSankaran; B.A., M.A.(Madr.), Ph.D.(Bom.)

Paul Koosis; B.A., Ph.D.(Calif., Berk.)

Michael Makkai; M.A., Ph.D.(ELTE) (*Peter Redpath Professor of Pure Mathematics*)

Sherwin Maslowe; B.Sc.(Wayne), M.Sc., Ph.D.(Calif.)

Arak M. Mathai; M.Sc.(Kerala), M.A., Ph.D.(Tor.)

Karl Peter Russell; Vor.Dip.(Hambur)

Associate Professors

Jean-Christophe Nave; B.Sc., Ph.D.(Calif., Santa Barbara)

Sergey Norin; M.S.(SPbU), Ph.D.(Georgia Tech.)

Mikael Pichot; B.Sc.(Lyon), M.S., Ph.D.(ENS Lyon)

Piotr Przytycki; M.Sc., Ph.D.(Warsaw)

Marcin Sabok; M.Sc., Ph.D.(Warsaw)

Russell Steele; B.S., M.S.(Carn. Mell), Ph.D.(Wash.)

Gantumur Tsogtgerel; B.Sc.(NUM), M.Sc., Ph.D.(Utrecht)

Jérôme Vétois; Ph.D.(Cergy-Pontoise)

Assistant Professors

Patrick Allen; BMath (Wat.), MMath (Wat.), Ph.D.(Calif., Los Angeles)

Linan Chen; B.S.(Tsinghua), Ph.D.(MIT)

Sarah Harrison; B.Sc.(MIT), Ph.D.(Stan.) (*joint appt. with Physics*) (*Canada Research Chair*)

Tim Hoheisel; Dipl., Ph.D.(Wurzburg)

Jessica Lin; B.A.(NYU), Ph.D.(Chic.)(*Canada Research Chair*)

Michael Lipnowski; B.Sc.(Wat.), Ph.D.(Stan.)

Courtney Paquette; Ph.D (Wash.)

Elliot Paquette; Ph.D (Wash.)

Brent Pym; B.Sc.E.(Qu.), M.Sc., Ph.D.(Tor.)

Anush Tserunyan; B.S., M.S. (YSMU), Ph.D (Calif., Los Angeles)

Yi Yang; B.S.(Sichuan), M.S., Ph.D.(Minn.)

Associate Members

Xiao-Wen Chang (*Computer Science*)

Pierre R.L. Dutilleul (*Plant Science*)

Leon Glass (*Physiology*)

James A. Hanley (*Epidemiology and Biostatistics*)

Hamed Hatami (*Computer Science*)

Anmar Khadra (*Physiology*)

Xue Liu (*Computer Science*)

Michael Mackey (*Physiology*)

Erica E.M. Moodie (*Epidemiology and Biostatistics*)

Prakash Panangaden (*Computer Science*)

Robert W. Platt (*Epidemiology and Biostatistics*)

James O. Ramsay (*Psychology*)

Alexandra Schmidt (*Epidemiology and Biostatistics*)

Kaleem Siddiqi (*Computer Science*)

Christina Wolfson (*Epidemiology and Biostatistics*)

Adjunct Professors

Renato C. Calleja; B.S.(ITAM), Ph.D.(Texas-Austin)

Eliot Freid; B.S.(Cal Poly), M.S., Ph.D.(Calif. Tech.)

Andrew Granville; B.A., CASM(Camb.), Ph.D.(Qu.)

Adrian Iovita; B.S.(Bucharest), Ph.D.(Boston)

Adjunct Professors

Dimitris Koukouloupoulos; M.Sc., Ph.D.(Ill.-Chic.)

Xin Yang Lu; B.Sc., M.Sc., Ph.D.(Pisa)

Etienne Marceau; B.Sc., M.Sc.(Laval); Ph.D.(Louvain)

Ming Mei; B.Sc., M.Sc.(JXNU), Ph.D.(Kanazawa)

M. Ram Murty; B.Sc.(Car.), Ph.D.(MIT), F.R.S.C.

Claude-Alain Pillet; M.Sc., Ph.D.(ETH Zurich)

Iosif Polterovich; M.Sc.(Moscow St.), Ph.D.(Weizmann Inst.)

Maksym Radziwill; B.Sc.(McG.), Ph.D.(Stan.)

Robert A.G. Seely; B.Sc.(McG.), Ph.D.(Camb.)

F. Bruce Shepherd; B.Sc.(Vic., Tor.), M.Sc., Ph.D.(Wat.)

Armen Shirikyan; M.Sc., Ph.D.(Moscow St.); Habilitation(Paris-Sud XI)

Pedro A. Valdes-Sosa; B.Sc.(Havana), Ph.D.(National Center for Scientific Research, Cuba)

Johannes Walcher; Dip., Ph.D.(ETH Zurich) (*joint appt. with Physics*)

Senior Faculty Lecturer

Axel Hundemer; M.Sc., Ph.D.(Munich)

Armel Djivede Kelome; M.Sc.(Benin), M.Sc.(McG.), Ph.D.(Georgia Tech.)

Faculty Lecturers

Rosalie Bélanger-Rioux; B.Sc.(McG.), Ph.D.(MIT)

José A. Correa; M.Sc.(Wat.), Ph.D.(Car.)

Jérôme Fortier; B.Sc., M.Sc.(Laval), Ph.D.(UQAM)

Jeremy Macdonald; B.Sc., M.Sc.(Alta.), Ph.D.(McG.)

Sidney Trudeau; Ph.D.(McG.)

Alia Sajjad; Ph.D. (QAU)

13.22.7 Bachelor of Science (B.Sc.) - Minor Mathematics (24 credits)

The Minor may be taken in conjunction with any primary program in the Faculty of Science (other than programs in Mathematics). Students should declare their intention to follow the Minor Mathematics at the beginning of the penultimate year and should obtain approval for the selection of courses to fulfil the requirements for the Minor from the Departmental Chief Adviser (or delegate).

It is strongly recommended that students in the Minor program take MATH 323. The remaining credits may be freely chosen from the required and complementary courses for majors and honours students in Mathematics, with the obvious exception of courses that involve duplication of material. Alternatively, up to 6 credits may be allowed for appropriate courses from other departments.

Generally, no more than 6 credits of overlap are permitted between the Minor and the primary program. However, with an approved choice of substantial courses, the overlap restriction may be relaxed to 9 credits for students whose primary program requires 60 credits or more, and to 12 credits when the primary program requires 72 credits or more.

Required Courses (9 credits)

* MATH 223 may be replaced by MATH 235 and MATH 236. In this case, the complementary credit requirement is reduced by 3 credits.

| | | |
|-----------|-----|---------------------------------|
| MATH 222 | (3) | Calculus 3 |
| MATH 223* | (3) | Linear Algebra |
| MATH 315 | (3) | Ordinary Differential Equations |

Complementary Courses (15 credits)

15 credits selected from the required and complementary courses for majors and honours students in Mathematics, with MATH 323 strongly recommended; alternatively, up to 6 credits may be allowed for appropriate courses from other departments.

13.22.8 Bachelor of Science (B.Sc.) - Minor Statistics (24 credits)

The Minor may be taken in conjunction with any primary program in the Faculty of Science. Students should declare their intention to follow the Minor Statistics at the beginning of the penultimate year and must obtain approval for the selection of courses to fulfil the requirements for the Minor from the Departmental Chief Adviser (or delegate).

All courses counted towards the Minor must be passed with a grade of C or better. Generally, no more than 6 credits of overlap are permitted between the Minor and the primary program. However, with an approved choice of substantial courses, the overlap restriction may be relaxed to 9 credits for students whose primary program requires 60 credits or more, and to 12 credits when the primary program requires 72 credits or more.

Required Courses (15 credits)

* MATH 223 may be replaced by MATH 235 and MATH 236. In this case the complementary credit requirement is reduced by 3 credits.

| | | |
|-----------|-----|--------------------|
| MATH 222 | (3) | Calculus 3 |
| MATH 223* | (3) | Linear Algebra |
| MATH 323 | (3) | Probability |
| MATH 324 | (3) | Statistics |
| MATH 423 | (3) | Applied Regression |

Complementary Courses (9 credits)

9 credits selected from:

| | | |
|----------|-----|---------------------------------------|
| CHEM 593 | (3) | Statistical Mechanics |
| GEOG 351 | (3) | Quantitative Methods |
| MATH 208 | (3) | Introduction to Statistical Computing |
| MATH 308 | (3) | Fundamentals of Statistical Learning |
| MATH 427 | (3) | Statistical Quality Control |
| MATH 447 | (3) | Introduction to Stochastic Processes |
| MATH 523 | (4) | Generalized Linear Models |
| MATH 525 | (4) | Sampling Theory and Applications |
| MATH 545 | (4) | Introduction to Time Series Analysis |
| MATH 556 | (4) | Mathematical Statistics 1 |
| MATH 557 | (4) | Mathematical Statistics 2 |
| PHYS 362 | (3) | Statistical Mechanics |
| PHYS 559 | (3) | Advanced Statistical Mechanics |
| SOCI 504 | (3) | Quantitative Methods 1 |

No more than 6 credits may be taken outside the Department of Mathematics and Statistics.

Further credits (if needed) may be freely chosen from the required and complementary courses for majors and honours students in Mathematics, with the obvious exception of courses that involve duplication of material.

13.22.9 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Mathematics (45 credits)**Program Prerequisites**

Students entering the Core Science Component in Mathematics are normally expected to have completed the courses below or their equivalents. Otherwise, they will be required to make up any deficiencies in these courses over and above the 45 credits required for the program.

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 140 | (3) | Calculus 1 |
| MATH 141 | (4) | Calculus 2 |

Guidelines for Selection of Courses

The following informal guidelines should be discussed with the student's adviser. Where appropriate, Honours courses may be substituted for equivalent Major courses. Students planning to pursue graduate studies are encouraged to make such substitutions.

Students interested in computer science are advised to choose courses from the following: MATH 317, MATH 318, MATH 327, MATH 328, MATH 335, MATH 340, MATH 407, MATH 417 and to complete the Computer Science Minor.

Students interested in probability and statistics are advised to take MATH 204, MATH 324, MATH 407, MATH 423, MATH 447, MATH 523, MATH 525.

Students interested in applied mathematics should take MATH 317, MATH 319, MATH 324, MATH 326, MA

| | | |
|----------|-----|---------------------------------------|
| MATH 338 | (3) | History and Philosophy of Mathematics |
| MATH 346 | (3) | Number Theory |
| MATH 348 | (3) | Euclidean Geometry |
| MATH 352 | (1) | Problem Seminar |
| MATH 407 | (3) | Dynamic Programming |
| MATH 410 | (3) | Majors Project |
| MATH 417 | (3) | Linear Optimization |
| MATH 423 | (3) | Applied Regression |
| MATH 430 | (3) | Mathematical Finance |
| MATH 447 | (3) | Introduction to Stochastic Processes |
| MATH 523 | (4) | Generalized Linear Models |
| MATH 524 | (4) | Nonparametric Statistics |
| MATH 525 | (4) | Sampling Theory and Applications |
| MATH 545 | (4) | Introduction to Time Series Analysis |

13.22.10 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Statistics (48 credits)

(45 or 48 credits)

This program provides training in statistics, with a solid mathematical core, and basic training in computing. With strong performance in an appropriate selection of courses, this program can lead to "A.Stat." professional accreditation from the Statistical Society of Canada, which is regarded as the entry level requirement for Statisticians practising in Canada.

Students may complete this program with a minimum of 45 credits or a maximum of 48 credits depending on whether or not they are required to take MATH 203.

Program Prerequisites

Students entering the Core Science Component in Statistics are normally expected to have completed the courses below or their equivalents. Otherwise they will be required to make up any deficiencies in these courses over and above the 45 credits required for the program.

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 140 | (3) | Calculus 1 |
| MATH 141 | (4) | Calculus 2 |

In addition, a student who has not completed the equivalent of MATH 203 on entering the program must consult an academic adviser and take MATH 203 in the first semester, increasing the total number of program credits from 45 to 48.

Required Courses (27 credits)

* Students who have successfully completed a course equivalent to MATH 222 with a grade of C or better may omit MATH 222, but must replace it with 3 credits of complementary courses.

** Students who have sufficient knowledge in a programming language do not need to take COMP 202, but must replace it by either COMP 250 or COMP 350.

***MATH 236 is an equivalent prerequisite to MATH 223 for required and complementary Computer Science courses listed below.

+ Students have to take MATH 204 prior to MATH 324.

| | | |
|-------------|-----|----------------------------|
| COMP 202** | (3) | Foundations of Programming |
| MATH 204+ | (3) | Principles of Statistics 2 |
| MATH 222* | (3) | Calculus 3 |
| MATH 235 | (3) | Algebra 1 |
| MATH 236*** | (3) | Algebra 2 |
| MATH 242 | (3) | Analysis 1 |
| MATH 323 | (3) | Probability |

| | | |
|-----------|-----|--------------------|
| MATH 324+ | (3) | Statistics |
| MATH 423 | (3) | Applied Regression |

Complementary Cour

| | | |
|----------|-----|--------------------------------------|
| MATH 557 | (4) | Mathematical Statistics 2 |
| MATH 598 | (4) | Topics in Probability and Statistics |

13.22.11 Bachelor of Science (B.Sc.) - Major Mathematics (54 credits)

Program Prerequisites

Students entering the Major program are normally expected to have completed the courses below or their equivalents. Otherwise, they will be required to make up any deficiencies in these courses over and above the 54 credits of required courses.

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 140 | (3) | Calculus 1 |
| MATH 141 | (4) | Calculus 2 |

Guidelines for Selection of Courses in the Major Program

The following informal guidelines should be discussed with the student's adviser. Where appropriate, Honours courses may be substituted for equivalent Major courses. Students planning to pursue graduate studies are encouraged to make such substitutions.

Students interested in computer science are advised to choose courses from the following: MATH 317, MATH 318, MATH 327, MATH 335, MATH 340, MATH 407, MATH 417 and to complete the Computer Science Minor.

Students interested in probability and statistics are advised to take MATH 204, MATH 317, MATH 407, MATH 423, MATH 447, MATH 523

Students interested in applied mathematics should take MATH 317, MATH 319, MATH 326, MATH 327, MATH 328, MATH 338, MATH 346, MATH 348.

Students considering a career in teaching are advised to take MATH 317, MATH 338, MATH 346, MATH 348.

Students interested in careers in business, industry or government are advised to select courses from the following list:

MATH 317, MATH 319, MATH 327, MATH 328, MATH 407, MATH 417, MATH 423, MATH 430, MATH 447, MATH 523, MATH 525

Required Courses (27 credits)

Note: Students who have done well in MATH 235 and MATH 242 should consider entering the Honours stream by registering in MATH 251 and MATH 255 instead of MATH 236 and MATH 243.

* Students may select either MATH 490 or MATH 450.21816uf elect either MATH 860.804 Tm(* Students may select either MATH 860.8043160 or MATH 860.8043160.176.465 43)Tj3 Tmei maytr860.ut no

| | | |
|----------|-----|-----------------------|
| MATH 335 | (3) | Computational Algebra |
| MATH 340 | (3) | Discrete Mathematics |

15-21 credits selected from the following: at least 6 credits must be at the 400 or 500 level.

| | | |
|----------|-----|--|
| MATH 204 | (3) | Principles of Statistics 2 |
| MATH 208 | (3) | Introduction to Statistical Computing |
| MATH 308 | (3) | Fundamentals of Statistical Learning |
| MATH 318 | (3) | Mathematical Logic |
| MATH 319 | (3) | Introduction to Partial Differential Equations |
| MATH 320 | (3) | Differential Geometry |
| MATH 326 | (3) | Nonlinear Dynamics and Chaos |

| | | |
|-------------|-----|-------------------------------------|
| COMP 302 | (3) | Programming Languages and Paradigms |
| COMP 330 | (3) | Theory of Computation |
| COMP 350** | (3) | Numerical Computing |
| COMP 360 | (3) | Algorithm Design |
| MATH 222 | (3) | Calculus 3 |
| MATH 223*** | (3) | Linear Algebra |
| MATH 235 | (3) | Algebra 1 |
| MATH 236*** | (3) | Algebra 2 |
| MATH 242 | (3) | Analysis 1 |
| MATH 314 | (3) | Advanced Calculus |
| MATH 317** | (3) | Numerical Analysis |
| MATH 323 | (3) | Probability |
| MATH 324 | (3) | Statistics |
| MATH 423 | (3) | Applied Regression |

Complementary Courses (21 credits)

12 credits in Mathematics selected from:

* Students take either MATH 340 or MATH 350, but not both.

** MATH 578 and COMP 540 cannot both be taken for program credit.

+ In order to receive credit for MATH 204, students must take it before MATH 324.

| | | |
|-----------|-----|---------------------------------------|
| MATH 204+ | (3) | Principles of Statistics 2 |
| MATH 208 | (3) | Introduction to Statistical Computing |
| MATH 308 | (3) | Fundamentals of Statistical Learning |
| MA | (3) | Matrix Numerical Analysis |

| | | |
|------------|-----|---|
| COMP 540** | (4) | Matrix Computations |
| COMP 547 | (4) | Cryptography and Data Security |
| COMP 551 | (4) | Applied Machine Learning |
| COMP 564 | (3) | Advanced Computational Biology Methods and Research |
| COMP 566 | (3) | Discrete Optimization 1 |
| COMP 567 | (3) | Discrete Optimization 2 |

The remaining Computer Science credits are selected from COMP courses at the 300 level or above (except COMP 396) and ECSE 508.

13.22.14 Bachelor of Science (B.Sc.) - Honours Applied Mathematics (63 credits)

Applied Mathematics is a very broad field and students are encouraged to choose a coherent program of complementary courses. Most students specialize in "continuous" or "discrete" applied mathematics, but there are many sensible combinations of courses, and the following informal guidelines should be discussed with the student's adviser. Also, aside from seeking to develop a sound basis in Applied Mathematics, one of the objectives of the program is to kindle the students' interest in possible areas of application. To develop an appreciation of the diversity of Applied Mathematics, students are advised to develop some depth (e.g., by completing a minor) in a field related to Applied Mathematics such as Atmospheric and Oceanic Sciences, Biology, Biochemistry, Chemistry, Computer Science, Earth and Planetary Sciences, Economics, Engineering, Management, Physics, Physiology, and Psychology.

Students may complete this program with a minimum of 60 credits or a maximum of 63 credits depending if they are exempt from MATH 222.

Program Prerequisites

The minimum requirement for entry into the Honours program is that the student has completed with high standing the following courses below or their equivalents:

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 150 | (4) | Calculus A |
| MATH 151 | (4) | Calculus B |

In particular, MATH 150/151 and MATH 140/222 are considered equivalent.

Students who have not completed an equivalent of MATH 222 on entering the program must consult an academic adviser and take MATH 222 as a required course in the first semester, increasing the total number of program credits from 60 to 63. Students who have successfully completed MATH 150/151 are not required to take MATH 222.

Note: COMP 202—or an equivalent introduction to computer programming course—is a program prerequisite. U0 students may take COMP 202 as a Freshman Science course; new U1 students should take it as an elective in their first semester.

Students who transfer to Honours in Applied Mathematics from other programs will have credits for previous courses assigned, as appropriate, by the Department.

To be awarded the Honours degree, the student must have, at time of graduation, a CGPA of at least 3.00 in the required and complementary Mathematics courses of the program, as well as an overall CGPA of at least 3.00.

Required Courses

(39-42 credits)

* Students with limited programming experience should take COMP 202 or COMP 204 or COMP 208 or equivalent before COMP 250.

** Students select either MATH 251 or MATH 247, but not both.

*** Students who have successfully completed MATH 150/151 or an equivalent of MATH 222 on entering the program are not required to take MATH 222.

| | | |
|-------------|-----|--|
| COMP 250* | (3) | Introduction to Computer Science |
| COMP 252 | (3) | Honours Algorithms and Data Structures |
| MATH 222*** | (3) | Calculus 3 |
| MATH 235 | (3) | Algebra 1 |
| MATH 247** | (3) | Honours Applied Linear Algebra |
| MATH 251** | (3) | Honours Algebra 2 |

| | | |
|----------|-----|---|
| MATH 255 | (3) | Honours Analysis 2 |
| MATH 325 | (3) | Honours Ordinary Differential Equations |
| MATH 350 | (3) | Honours Discrete Mathematics |
| MATH 356 | (3) | Honours Probability |
| MATH 357 | (3) | Honours Statistics |
| MATH 358 | (3) | Honours Advanced Calculus |
| MATH 376 | (3) | Honours Nonlinear Dynamics |
| MATH 470 | (3) | Honours Research Project |
| MATH 475 | (3) | Honours Partial Differential Equations |

Complementary Courses (21 credits)

3 credits selected from:

| | | |
|-----------|-----|--------------------|
| MATH 242 | (3) | Analysis 1 |
| MATH 254+ | (3) | Honours Analysis 1 |

+ It is strongly recommended that students take MATH 254.

Advising Notes:

Students interested in continuous applied mathematics are urged to choose these as part of their Complementary Courses: MATH 454, MATH 455 and MATH 478, and are advised to choose additional courses from MATH 387, MATH 397, MATH 555, MATH 560, MATH 574, MATH 578, MATH 579, MATH 580, MATH 581.

Students interested in discrete applied mathematics are advised to choose from these as part of their Complementary Courses: COMP 362, COMP 490, MATH 456, MATH 457, MATH 407, MATH 517, MATH 547, MATH 550, MATH 552, MATH 560.

3 credits selected from:

| | | |
|----------|-----|---------------------------|
| MATH 249 | (3) | Honours Complex Variables |
| MATH 466 | (3) | Honours Complex Analysis |

at least 3 credits selected from:

| | | |
|----------|-----|-----------------------------------|
| MATH 387 | (3) | Honours Numerical Analysis |
| MATH 397 | (3) | Honours Matrix Numerical Analysis |

0-6 credits from the following courses for which no Honours equivalent exists.

| | | |
|----------|-----|--|
| MATH 204 | (3) | Principles of Statistics 2 |
| MATH 208 | (3) | Introduction to Statistical Computing |
| MATH 308 | (3) | Fundamentals of Statistical Learning |
| MATH 329 | (3) | Theory of Interest |
| MATH 338 | (3) | History and Philosophy of Mathematics |
| MATH 407 | (3) | Dynamic Programming |
| MATH 430 | (3) | Mathematical Finance |
| MATH 478 | (3) | Computational Methods in Applied Mathematics |

and the remainder of credits selected from:

| | | |
|----------|-----|--------------------------|
| COMP 362 | (3) | Honours Algorithm Design |
|----------|-----|--------------------------|

| | | |
|------------|-----|-------------------------------|
| MATH 352 | (1) | Problem Seminar |
| MATH 377 | (3) | Honours Number Theory |
| MATH 398 | (3) | Honours Euclidean Geometry |
| MATH 454++ | (3) | Honours Analysis 3 |
| MATH 455 | (3) | Honours Analysis 4 |
| MATH 456 | (3) | Honours Algebra 3 |
| MATH 457 | (3) | Honours Algebra 4 |
| MATH 458 | (3) | Honours Differential Geometry |
| MATH 480 | (3) | Honours Independent Study |
| MATH 488 | (3) | Honours Set Theory |

++ Not open to students who have taken MATH 354.

All MATH 500-level courses.

Other courses with the permission of the Department.

13.22.15 Bachelor of Science (B.Sc.) - Honours Mathematics (63 credits)

Students may complete this program with a minimum of 60 credits or a maximum of 63 credits depending if they are exempt from MATH 222.

Program Prerequisites

The minimum requirement for entry into the Honours program is that the student has completed with high standing the following courses below or their equivalents.

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 150 | (4) | Calculus A |
| MATH 151 | (4) | Calculus B |

In particular, MATH 150/151 and MATH 140/141/222 are considered equivalent.

Students who have not completed an equivalent of MATH 222 on entering the program must consult an academic adviser and take MATH 222 as a required course in the first semester, increasing the total number of program credits from 60 to 63. Students who have successfully completed MATH 150/151 are not required to take MATH 222.

Students who transfer to Honours in Mathematics from other programs will have credits for previous courses assigned, as appropriate, by the Department.

To be awarded the Honours degree, the student must have, at time of graduation, a CGPA of at least 3.00 in the required and complementary Mathematics courses of the program, as well as an overall CGPA of at least 3.00.

| | | |
|----------|-----|--|
| MATH 456 | (3) | Honours Algebra 3 |
| MATH 457 | (3) | Honours Algebra 4 |
| MATH 458 | (3) | Honours Differential Geometry |
| MATH 466 | (3) | Honours Complex Analysis |
| MATH 470 | (3) | Honours Research Project |
| MATH 475 | (3) | Honours Partial Differential Equations |

Complementary Courses (15 credits)

3 credits selected from:

| | | |
|------------|-----|--------------------|
| MATH 242 | (3) | Analysis 1 |
| MATH 254** | (3) | Honours Analysis 1 |

** It is strongly recommended that students take MATH 254.

0-6 credits from the following courses for which no Honours equivalent exists:

| | | |
|----------|-----|---------------------------------------|
| MATH 204 | (3) | Principles of Statistics 2 |
| MATH 208 | (3) | Introduction to Statistical Computing |
| MATH 308 | (3) | Fundamentals of Statistical Learning |
| MATH 329 | (3) | Theory of Interest |
| MATH 338 | (3) | History and Philosophy of Mathematics |
| MATH 407 | (3) | Dynamic Programming |
| MATH 430 | (3) | Mathematical Finance |

6-12 credits selected from:

| | | |
|------------|-----|--|
| COMP 250++ | (3) | Introduction to Computer Science |
| COMP 252 | (3) | Honours Algorithms and Data Structures |
| MATH 350 | (3) | Honours Discrete Mathematics |
| MATH 352 | (1) | Problem Seminar |
| MATH 376 | (3) | Honours Nonlinear Dynamics |
| MATH 377 | (3) | Honours Number Theory |
| MATH 387 | (3) | Honours Numerical Analysis |
| MATH 397 | (3) | Honours Matrix Numerical Analysis |
| MATH 398 | (3) | Honours Euclidean Geometry |
| MATH 480 | (3) | Honours Independent Study |
| MATH 488 | (3) | Honours Set Theory |

all MATH 500-level courses.

++ Students with limited programming experience should take COMP 202 or COMP 204 or COMP 208 or equivalent before COMP 250.

Students may select other courses with the permission of the Department.

13.22.16 Bachelor of Science (B.Sc.) - Honours Probability and Statistics (63 credits)

The program provides training in probability and statistics, with a solid mathematical core, and basic training in computing. It prepares students for graduate school in probability, statistics, or data science. It also offers a path to a variety of careers in industry or government in the statistical sciences. With a suitable selection of complementary courses, students can focus on probability, mathematical statistics, applied statistics, actuarial science and finance, or data science.

- Students with interest in actuarial science are advised to choose from the following as part of their Complementary Courses: MATH 329, MATH 430, MATH 524, MATH 540, MATH 541, MATH 545, MATH 547.

- Students with interest in data science and machine learning are advised to choose from the following as part of their Complementary Courses: COMP 206, COMP 251, COMP 424, COMP 551, MATH 350, and MATH 517.

Part 1: 3 credits selected from:

* It is strongly recommended that students take MATH 254.

Analysis 1

At least 7 credits selected from:

+++ Students must take MATH 204 before taking MATH 357 or MATH 533. Moreover, it is advisable to take MATH 203 as a Freshman Science course or as an elective before taking MATH 204.

| | | |
|-------------|-----|--------------------------------------|
| MATH 204+++ | (3) | Principles of Statistics 2 |
| MATH 523 | (4) | Generalized Linear Models |
| MATH 525 | (4) | Sampling Theory and Applications |
| MATH 545 | (4) | Introduction to Time Series Analysis |

0-3 credits from the following courses for which no Honours equivalent exists:

| | | |
|----------|-----|-----------------------------|
| MATH 329 | (3) | Theory of Interest |
| MATH 427 | (3) | Statistical Quality Control |

The remaining credits selected from:

+++ Students may select either MATH 594 or MATH 598 but not both.

| | | |
|-------------|-----|--------------------------------------|
| COMP 424 | (3) | Artificial Intelligence |
| COMP 451 | (3) | Fundamentals of Machine Learning |
| COMP 551 | (4) | Applied Machine Learning |
| MATH 430 | (3) | Mathematical Finance |
| MATH 540 | (4) | Life Actuarial Mathematics |
| MATH 541 | (4) | Nonlife Actuarial Models |
| MATH 594+++ | (4) | Topics in Mathematics and Statistics |
| MATH 598+++ | (4) | Topics in Probability and Statistics |

13.22.17 Bachelor of Science (B.Sc.) - Honours Statistics and Computer Science (79 credits)

This is a challenging program providing students with a solid training in both computer science and statistics suitable for entry into graduate school in either discipline.

Students may complete this program with a minimum of 76 credits or a maximum of 79 credits depending on whether or not they are exempt from taking COMP 202.

Program Prerequisites

Students entering the Joint Honours in Statistics and Computer Science are normally expected to have completed the courses below or their equivalents. Otherwise, they will be required to make up any deficiencies in these courses over and above the 76-79 credits of courses in the program.

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 140 | (3) | Calculus 1 |
| MATH 141 | (4) | Calculus 2 |

Required Courses (46 credits)

* Students who have sufficient knowledge in a programming language are not required to take COMP 202.

** Students take either MATH 251 or MATH 247, but not both.

| | | |
|-----------|-----|----------------------------------|
| COMP 202* | (3) | Foundations of Programming |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |

COMP 252

(3)

Honours Algorithms and Data Structures
Introduction to Computer Systems

15 credits in Computer Science selected as follows:

At least 6 credits selected from:

| | | |
|------------|-----|---|
| COMP 424 | (3) | Artificial Intelligence |
| COMP 462 | (3) | Computational Biology Methods |
| COMP 526 | (3) | Probabilistic Reasoning and AI |
| COMP 540** | (3) | Matrix Computations |
| COMP 547 | (4) | Cryptography and Data Security |
| COMP 551 | (4) | Applied Machine Learning |
| COMP 552 | (4) | Combinatorial Optimization |
| COMP 564 | (3) | Advanced Computational Biology Methods and Research |
| COMP 566 | (3) | Discrete Optimization 1 |
| COMP 567 | (3) | Discrete Optimization 2 |

The remaining Computer Science credits are selected from COMP courses at the 300 level or above excluding COMP 396.

13.22.18 Bachelor of Science (B.Sc.) - Honours Mathematics and Computer Science (78 credits)

Students may complete this program with a minimum of 72 credits or a maximum of 78 credits depending if they are exempt from COMP 202/204/208 and/or MATH 222.

Program Prerequisites

Students must consult an Honours adviser in both departments to ensure that they have sufficient background to enter the program. The minimum requirements are the following courses or their equivalencies:

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 150 | (4) | Calculus A |
| MATH 151 | (4) | Calculus B |

In particular, MATH 150/151 and MATH 140/141/222 are considered equivalent.

To be awarded the Honours degree, the student must have, at time of graduation, a CGPA of at least 3.00 in the required and complementary Mathematics courses of the program, as well as an overall CGPA of at least 3.00.

Required Courses

(36-39 credits)

* Students who have successfully completed MATH 150/151 or an equivalent of MATH 222 on entering the program are not required to take MATH 222.

| | | |
|--------------|-----|--|
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| COMP 252 | (3) | Honours Algorithms and Data Structures |
| COMP 273 | (3) | Introduction to Computer Systems |
| COMP 302 | (3) | Programming Languages and Paradigms |
| COMP 310 | (3) | Operating Systems |
| COMP 330 | (3) | Theory of Computation |
| COMP 362 | (3) | Honours Algorithm Design |
| MATH 222* | (3) | Calculus 3 |
| MATH 235 | (3) | Algebra 1 |
| MATH 251/252 | (3) | Honours Algebra 2 |

| | | |
|----------|-----|------------------------------|
| MATH 255 | (3) | Honours Analysis 2 |
| MATH 350 | (3) | Honours Discrete Mathematics |

Complementary Courses

36-39 credits

0-3 credits selected from:

| | | |
|------------|-----|--|
| COMP 202** | (3) | Foundations of Programming |
| COMP 204** | (3) | Computer Programming for Life Sciences |
| COMP 208** | (3) | Computer Programming for Physical Sciences and Engineering |

** Students who have sufficient knowledge of computer programming are not required to take COMP 202/204/208.

3 credits selected from:

| | | |
|-------------|-----|--------------------|
| MATH 242 | (3) | Analysis 1 |
| MATH 254*** | (3) | Honours Analysis 1 |

*** It is strongly recommended that students take MA

13.22.19.3 Honours Program in Mathematics and Physics

For more information, see [section 13.30: Physics \(PHYS\)](#) > [section 13.30.15: Bachelor of Science \(B.Sc.\) - Honours Mathematics and Physics \(81 credits\)](#).

13.23 Microbiology and Immunology (MIMM)

13.23.1 Location

Duff Medical Building, Room 511
3775 University Street
Montreal QC H3A 2B4
Telephone: 514-398-3915
Fax: 514-398-7052
Email: undergrad.microimm@mcgill.ca

Professors

J. Archambault; Ph.D.(Tor.)
 A. Berghuis; B.Sc., M.Sc.(Groningen), Ph.D.(Br. Col.)
 S. Gruenheid; B.Sc.(Br. Col.), Ph.D.(McG.)
 G.J. Matlashewski; B.Sc.(C'dia), Ph.D.(Ohio)
 R.A. Murgita; B.Sc.(Maine), M.S.(Vermont), Ph.D.(McG.)
 M. Olivier; B.Sc.(Montr.), Ph.D.(McG.)
 C. Piccirillo; B.Sc., Ph.D.(McG.)
 D. Sheppard; M.D.(Tor.)
 M. Stevenson; M.Sc., Ph.D.(CUA)

Associate Professors

D.J. Briedis; B.A., M.D.(Johns Hop.)
 B. Cousineau; B.Sc., M.Sc., Ph.D.(Montr.)
 S. Fournier; Ph.D.(Montr.)
 J. Fritz; Ph.D.(Vienna)
 G.T. Marczynski; B.Sc., Ph.D.(Ill.)
 S. Sagan; B.Sc.(McG.), Ph.D.(Ott.)

Assistant Professors

I. King; B.A.(Ohio), M.Sc.(Pitt.), Ph.D.(Roch.)
 C. Maurice; M.S., Ph.D.(Montpellier)
 M. Richer; B.Sc.(McG.), M.Sc.(Montr.), Ph.D.(Br. Col.)

Associate Members

Dentistry: E. Emami, S. Tran
Epidemiology and Infectious Diseases: M. Behr, A. Dascal, V. Loo
Genetics: E. Schurr
Immunology, Autoimmunity, Host Defense: J. Antel, M. Burnier, I. Colmegna, P. Gros, A. Kristof, J. Mandl, A. Orthwein, J. Rauch, M. Saleh, J. Spicer, C. Tsoukas, S. Vidal
Immunology and Parasitology: B. Brenner, C.T. Costiniuk, M. Ndao, P. Rohrbach, B. Ward, J. Zhang
Microbiology: D. Cuong Vinh, M. Divangahi, C. Liang, D. Nguyen, M. Reed
Molecular Biology: N. Cermakian, S. Hussain, A. Jardim, D. Langlais, A. Mouland, K. Pantopoulos, M. Tremblay, B. Turcotte, J. Xia
Virology: A. Gatignol, A.E. Koromilas, R. Lin, T. Mesplede, J. Teodoro
Immunology and Virology: M-A. Jenabian

Adjunct Professors

A. Bar-Or; B.Sc.(McM.), M.D.,C.M.(McG.)
 E. Cohen; B.Sc.(McG.), Ph.D.(Montr.)
 A. Descoteaux; B.Sc., M.Sc.(Montr.), Ph.D.(McG.)
 J.M. Di Noia; Ph.D.(Buenos Aires)
 A. Finzi; Ph.D.(Montr.)
 N. Grandvaux; Ph.D.(Grenoble)
 C. Krawczyk; Ph.D.(Tor.)
 G. Kukolj; Ph.D.(McG.)
 P. Lau; Ph.D.(Ott.)

Adjunct Professors

S. Lesage; B.Sc., Ph.D.(McG.)

S.L. Liu; Ph.D.(Wash.)

J. Madrenas; M.D.(Barcelona), M.Sc.(Autonoma, Barcelona), Ph.D.(Alta.)

R. Moutih; Ph.D.(McG.)

C. P

| | | |
|----------|-----|-------------------------|
| MIMM 387 | (3) | The Business of Science |
| MIMM 413 | (3) | Parasitology |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 465 | (3) | Bacterial Pathogenesis |
| MIMM 466 | (3) | Viral Pathogenesis |
| MIMM 509 | (3) | Inflammatory Processes |

U1, U2 or U3 Complementary Courses (3 credits)

3 credits selected from:

* Students who have taken CHEM 212 or CHEM 222 in CEGEP must replace it with another complementary course.

| | | |
|------------|-----|--|
| ANAT 261 | (4) | Introduction to Dynamic Histology |
| ANAT 262 | (3) | Introductory Molecular and Cell Biology |
| ANAT 365 | (3) | Cellular Trafficking |
| ANAT 458 | (3) | Membranes and Cellular Signaling |
| BIOC 311 | (3) | Metabolic Biochemistry |
| BIOC 312 | (3) | Biochemistry of Macromolecules |
| BIOC 450 | (3) | Protein Structure and Function |
| BIOC 454 | (3) | Nucleic Acids |
| BIOC 458 | (3) | Membranes and Cellular Signaling |
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 309 | (3) | Mathematical Models in Biology |
| BIOL 314 | (3) | Molecular Biology of Cancer |
| BIOT 505 | (3) | Selected Topics in Biotechnology |
| CHEM 203 | (3) | Survey of Physical Chemistry |
| CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |
| CHEM 222* | (4) | Introductory Organic Chemistry 2 |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| COMP 204 | (3) | Computer Programming for Life Sciences |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| EXMD 504 | (3) | Biology of Cancer |
| MIMM 387 | (3) | The Business of Science |
| MIMM 413 | (3) | Parasitology |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 465 | (3) | Bacterial Pathogenesis |
| MIMM 466 | (3) | Viral Pathogenesis |
| MIMM 496D1 | (3) | Microbiology Advanced Research Project |
| MIMM 496D2 | (3) | Microbiology Advanced Research Project |
| MIMM 497D1 | (3) | Immunology Advanced Research Project |
| MIMM 497D2 | (3) | Immunology Advanced Research Project |
| MIMM 509 | (3) | Inflammatory Processes |
| PATH 300 | (3) | Human Disease |

Drug A

6 credits selected from:

| | | |
|----------|-----|------------------------|
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 465 | (3) | Bacterial Pathogenesis |
| MIMM 466 | (3) | Viral Pathogenesis |

Complementary Courses (9 credits)

9 credits selected from:

* Students may select either ANAT 458 or BIOC 458, but not both.

| | | |
|------------|-----|--|
| ANAT 261 | (4) | Introduction to Dynamic Histology |
| ANAT 262 | (3) | Introductory Molecular and Cell Biology |
| ANAT 365 | (3) | Cellular Trafficking |
| ANAT 458* | (3) | Membranes and Cellular Signaling |
| BIOC 312 | (3) | Biochemistry of Macromolecules |
| BIOC 450 | (3) | Protein Structure and Function |
| BIOC 454 | (3) | Nucleic Acids |
| BIOC 458* | (3) | Membranes and Cellular Signaling |
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 309 | (3) | Mathematical Models in Biology |
| BIOL 314 | (3) | Molecular Biology of Cancer |
| BIOT 505 | (3) | Selected Topics in Biotechnology |
| CHEM 203 | (3) | Survey of Physical Chemistry |
| CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| COMP 204 | (3) | Computer Programming for Life Sciences |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| EXMD 504 | (3) | Biology of Cancer |
| MIMM 387 | (3) | The Business of Science |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 465 | (3) | Bacterial Pathogenesis |
| MIMM 466 | (3) | Viral Pathogenesis |
| MIMM 496D1 | (3) | Microbiology Advanced Research Project |
| MIMM 496D2 | (3) | Microbiology Advanced Research Project |
| MIMM 497D1 | (3) | Immunology Advanced Research Project |
| MIMM 497D2 | (3) | Immunology Advanced Research Project |
| MIMM 509 | (3) | Inflammatory Processes |
| PATH 300 | (3) | Human Disease |
| PHAR 300 | (3) | Drug Action |
| PHAR 301 | (3) | Drugs and Disease |
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |

13.23.6 Bachelor of Science (B.Sc.) - Honours Microbiology and Immunology (72 credits)

The Honours program is designed to offer, in addition to the substantial background given by the Major program, a significant research experience in a laboratory within the Department during the U3 year. Students are prepared for this independent research project by following an advanced laboratory course in U2. This program is intended to prepare students for graduate study in microbiology and immunology or related fields, but could also be chosen by students intending to enter medical research after medical school, or intending to enter the job market in a laboratory research environment.

Students intending to apply to Honours must follow the Major program in U1 and U2 and must obtain a CGPA of at least 3.50 at the end of their U2 year. For graduation in Honours, students must pass all required courses with a C or better, and achieve a sessional GPA of at least 3.30 in the U3 year.

U1 Required Courses (26 credits)

* Students who have taken CHEM 212 in CEGEP are exempt and must replace these credits with an elective course(s).

** Students who have taken CHEM 222 in CEGEP are exempt and must replace these credits with an elective course(s).

| | | |
|------------|-----|---|
| BIOL 200 | (3) | Molecular Biology |
| BIOL 202 | (3) | Basic Genetics |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| CHEM 222** | (4) | Introductory Organic Chemistry 2 |
| MIMM 211 | (3) | Introductory Microbiology |
| MIMM 212 | (3) | Laboratory in Microbiology |
| MIMM 214 | (3) | Introductory Immunology: Elements of Immunity |

One of:

| | | |
|----------|-----|---------------------------------------|
| BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOL 201 | (3) | Cell Biology and Metabolism |

U1, U2, or U3 Required Course (3 credits)

One of:

| | | |
|----------|-----|--|
| BIOL 373 | (3) | Biometry |
| MATH 203 | (3) | Principles of Statistics 1 |
| PSYC 204 | (3) | Introduction to Psychological Statistics |

U2 Required Courses (19 credits)

| | | |
|----------|-----|-----------------------------------|
| BIOC 311 | (3) | Metabolic Biochemistry |
| MIMM 301 | (1) | Scientific Writing Skills in MIMM |
| MIMM 314 | (3) | Intermediate Immunology |
| MIMM 323 | (3) | Microbial Physiology |
| MIMM 324 | (3) | Fundamental Virology |
| MIMM 384 | (3) | Molecular Microbiology Laboratory |
| MIMM 385 | (3) | Laboratory in Immunology |

U3 Required Courses (12 credits)

| | | |
|-------------|-----|--|
| MIMM 413 | (3) | Parasitology |
| MIMM 501D1* | (6) | Honours Research Project in Immunology |
| MIMM 501D2* | (6) | Honours Research Project in Immunology |

| | | |
|-------------|-----|--|
| MIMM 502D1* | (6) | Honours Research Project in Microbiology |
| MIMM 502D2* | (6) | Honours Research Project in Microbiology |
| MIMM 503* | (3) | Honours Research Project in Immunology 1 |
| MIMM 504* | (6) | Honours Research Project in Immunology 2 |
| MIMM 505* | (3) | Honours Research Project in Molecular Microbiology 1 |
| MIMM 506* | (6) | Honours Research Project in Molecular Microbiology 2 |

*Please note for the 2020-2021 academic year students need to take both MIMM 503 and MIMM 504 OR MIMM 505 and MIMM 506. MIMM 501D1/D2 and MIMM 502D1/D2 will not be offered in 2020-2021.

U3 Complementary Courses (6 credits)

6 credits selected from:

| | | |
|----------|-----|------------------------|
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 465 | (3) | Bacterial Pathogenesis |
| MIMM 466 | (3) | Viral Pathogenesis |

Complementary Courses (6 credits)

6 credits selected from:

| | | |
|----------|-----|--|
| ANAT 261 | (4) | Introduction to Dynamic Histology |
| ANAT 262 | (3) | Introductory Molecular and Cell Biology |
| ANAT 365 | (3) | Cellular Trafficking |
| ANAT 458 | (3) | Membranes and Cellular Signaling |
| BIOC 312 | (3) | Biochemistry of Macromolecules |
| BIOC 404 | (3) | Biophysical Methods in Biochemistry |
| BIOC 450 | (3) | Protein Structure and Function |
| BIOC 454 | (3) | Nucleic Acids |
| BIOC 458 | (3) | Membranes and Cellular Signaling |
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 309 | (3) | Mathematical Models in Biology |
| BIOL 314 | (3) | Molecular Biology of Cancer |
| BIOL 520 | (3) | Gene Activity in Development |
| BIOT 505 | (3) | Selected Topics in Biotechnology |
| CHEM 203 | (3) | Survey of Physical Chemistry |
| CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| COMP 204 | (3) | Computer Programming for Life Sciences |
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| EXMD 504 | (3) | Biology of Cancer |
| MIMM 387 | (3) | The Business of Science |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 465 | (3) | Bacterial Pathogenesis |
| MIMM 466 | (3) | Viral Pathogenesis |
| MIMM 509 | (3) | Inflammatory Processes |

| | | |
|----------|-----|------------------------|
| PATH 300 | (3) | Human Disease |
| PHAR 300 | (3) | Drug Action |
| PHAR 301 | (3) | Drugs and Disease |
| PHAR 562 | (3) | Neuropharmacology |
| PHAR 563 | (3) | Endocrine Pharmacology |
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |
| PSYT 455 | (3) | Neurochemistry |

Microbiology and Immunology (MIMM) Re(3)

Department of Performance Chair

Stéphane Lemelin; B.Mus., M.Mus.(Peabody), D.M.A.(Yale)

Advisers (B.A./B.Sc. Music programs)

Adelina Lameiras
Telephone: 514-398-4541
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Diana (Dino) Dutz; B.Mus.(UWO), Grad.Dip.(C'dia)
Telephone: 514-398-6337
Email: dino.dutz@mcgill.ca

13.24.4 Music Related Programs

13.24.4.1 Minor in Musical Applications of Technology and Minor in Musical Science and Technology

Science students may apply for admission to:

- **Minor in Musical Applications of Technology** – see [Schulich School of Music > Undergraduate > Browse Academic Units & Programs > Department of Music Research: Composition; Music Education; Music History; Theory; Faculty Program > : Bachelor of Music \(B.Mus.\) - Minor Musical Applications of Technology \(18 credits\)](#)
- **Minor in Musical Science and Technology** – see [Schulich School of Music > Undergraduate > Browse Academic Units & Programs > Department of Music Research: Composition; Music Education; Music History; Theory; Faculty Program > : Bachelor of Music \(B.Mus.\) - Minor Musical Science and Technology \(18 credits\)](#)

Enrolment in Music Technology programs is highly restricted. Interested applicants must submit an [online application](#) via the Schulich School of Music website by May 15 of each academic year. Late applications will not be accepted and no students will be admitted in January. Successful applicants will be notified by email before the end of June. Registration will be limited to available lab space.

13.25 Neurology and Neurosurgery (NEUR)

13.25.1 Location

Montreal Neurological Institute and Hospital
3801 University Street, Room 140
Montreal QC H3A 2B4
Website: mcgill.ca/neuro

13.25.2 About Neurology and Neurosurgery

There are no B.Sc. programs in Neurology and Neurosurgery, but the course NEUR 310 *Cellular Neurobiology*, which is part of the Minor in Neuroscience, is taught by the Faculty of Science.

Students wishing to obtain more information about Neurology and Neurosurgery can refer to the Faculty of Medicine and Health Science's [: Neurology and Neurosurgery](#) page.

Neuro: NeurLocationLo16.8s

Montreal QC H3G 1Y6

Website: mcgill.ca/neuroscience

Interdisciplinary Programs Adviser

Ryan Bouma

Email: ryan.bouma@mcgill.ca

Telephone: 514-398-7330

13.26.2 About Neuroscience

Neuroscience is a multidisciplinary science devoted to understanding the nervous system. The brain is one of the most complex systems in the universe, and understanding how it functions is among the most challenging questions in science. Scientists are investigating the brain at many levels, from the molecules at synapses to complex forms of behaviour, and use methods of inquiry that are dra

| | | |
|------------|-----|----------------------------------|
| CHEM 212 | (4) | Introductory Organic Chemistry 1 |
| LING 390 | (3) | Neuroscience of Language |
| NEUR 310 | (3) | Cellular Neurobiology |
| PHGY 311 | (3) | Channels, Synapses and Hormones |
| PHGY 314** | (3) | Integrative Neuroscience |
| PSYC 302 | (3) | The Psychology of Pain |
| PSYC 311 | (3) | Human Cognition and the Brain |
| PSYC 315 | (3) | Computational Psychology |
| PSYC 317 | (3) | Genes and Behaviour |
| PSYC 318 | (3) | Behavioural Neuroscience 2 |
| PSYC 342 | (3) | Hormones and Behaviour |

6-15 credits from the following list of 400- and 500-level courses:

| | | |
|----------|-----|---|
| BIOL 530 | (3) | Advances in Neuroethology |
| BIOL 532 | (3) | Developmental Neurobiology Seminar |
| BIOL 580 | (3) | Genetic Approaches to Neural Systems |
| BIOL 588 | (3) | Advances in Molecular/Cellular Neurobiology |
| NEUR 502 | (3) | Basic and Clinical Aspects of Neuroimmunology |
| PHGY 425 | (3) | Analyzing Physiological Systems |
| PHGY 451 | (3) | Advanced Neurophysiology |
| PHGY 520 | (3) | Ion Channels |
| PHGY 524 | (3) | Chronobiology |
| PHGY 556 | (3) | Topics in Systems Neuroscience |
| PSYC 410 | (3) | Special Topics in Neuropsychology |
| PSYC 427 | (3) | Sensorimotor Neuroscience |
| PSYC 433 | (3) | Cognitive Science |
| PSYC 444 | (3) | Sleep Mechanisms and Behaviour |
| PSYC 470 | (3) | Memory and Brain |
| PSYC 501 | (3) | Auditory Perception |
| PSYC 506 | (3) | Cognitive Neuroscience of Attention |
| PSYC 514 | (3) | Neurobiology of Memory |
| PSYC 522 | (3) | Neurochemistry and Behaviour |
| PSYC 526 | (3) | Advances in Visual Perception |
| PSYT 455 | (3) | Neurochemistry |
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |
| PSYT 505 | (3) | Neurobiology of Schizophrenia |

13.26.4 Bachelor of Science (B.Sc.) - Major Neuroscience (65 credits)

The Neuroscience Major is a focused program for students interested in how the nervous system functions. It is highly interdisciplinary and borrows principles and methodologies from a number of fields including: biology, biochemistry, physiology, psychology, mathematics, physics, computer science, and immunology. To ensure that they have the appropriate foundation, students are required to take 29 credits in lower-level courses from physiology, biology, mathematics, computer science, psychology, and ethics. The program offers students a concentrated selection of 15 credits to be taken from one of three areas of current scientific activities in the neurosciences: Cell/Molecular, Neurophysiology/Computation, or Cognition/Behaviour. In addition, students select 21 credits from a wide array of complementary courses to obtain more specialized training in areas of neuroscience that best suit their interests.

Enrolment in the Neuroscience Major is limited to a total of 50 students per year. UO students seeking admission to this program should consult the neuroscience website for admissions requirements and should have completed the courses listed below or their equivalents.

Program Prerequisites

Notes on admission to the Neuroscience Major program: Enrolment in the Neuroscience Major is limited to a total of 50 students per year. UO students seeking admission to this program should consult the neuroscience website for admissions requirements and should have completed the courses listed below or equivalent.

3 credits from:

| | | |
|----------|-----|--|
| COMP 202 | (3) | Foundations of Programming |
| COMP 204 | (3) | Computer Programming for Life Sciences |

3 credits from:

Note: Students who have successfully completed an equivalent to MATH 222 at CEGEP or elsewhere, must replace these credits with a 3-credit elective course to satisfy the total credit requirement for the Neuroscience Major.

| | | |
|----------|-----|--------------------------------|
| BIOL 309 | (3) | Mathematical Models in Biology |
| MATH 222 | (3) | Calculus 3 |

Streams

15 credits selected from one of the following streams:

A. Cell and Molecular Stream

15 credits selected as follows:

9 credits as follows:

| | | |
|----------|-----|---------------------------------|
| BIOC 311 | (3) | Metabolic Biochemistry |
| BIOL 202 | (3) | Basic Genetics |
| PHGY 311 | (3) | Channels, Synapses and Hormones |

3 credits from:

| | | |
|----------|-----|---------------------------------------|
| BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOL 201 | (3) | Cell Biology and Metabolism |

3 credits from:

| | | |
|----------|-----|---|
| MIMM 214 | (3) | Introductory Immunology: Elements of Immunity |
| PHAR 300 | (3) | Drug Action |

B. Neurophysiology/Neural Computation Stream

15 credits selected as follows:

3 credits as follows:

| | | |
|----------|-----|---------------------------------|
| PHGY 311 | (3) | Channels, Synapses and Hormones |
|----------|-----|---------------------------------|

3 credits as follows:

| | | |
|----------|-----|---------------------------------------|
| BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOL 201 | (3) | Cell Biology and Metabolism |

3 credits from:

| | | |
|----------|-----|---------------------------|
| BIOL 306 | (3) | Neural Basis of Behaviour |
| PHGY 314 | (3) | Integrative Neuroscience |

6 credits from:

Note: Students who have successfully completed an equivalent to MATH 222 at CEGEP or elsewhere, must replace these credits with a 3-credit elective course to satisfy the total credit requirement for the Neuroscience Major.

| | | |
|-----|-----|------------------------------|
| ANA | (3) | Circuitry of the Human Brain |
|-----|-----|------------------------------|

* Students take either BIOL 201 OR BIOC 212, but not both.

** Students take either COMP 206 or COMP 250, but not both.

| | | |
|------------|-----|---|
| ANAT 321 | (3) | Circuitry of the Human Brain |
| BIOC 212* | (3) | Molecular Mechanisms of Cell Function |
| BIOC 311 | (3) | Metabolic Biochemistry |
| BIOL 201* | (3) | Cell Biology and Metabolism |
| BIOL 202 | (3) | Basic Genetics |
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 306 | (3) | Neural Basis of Behaviour |
| BIOL 320 | (3) | Evolution of Brain and Behaviour |
| CHEM 222 | (4) | Introductory Organic Chemistry 2 |
| COMP 206** | (3) | Introduction to Software Systems |
| COMP 250** | (3) | Introduction to Computer Science |
| MATH 223 | (3) | Linear Algebra |
| MATH 315 | (3) | Ordinary Differential Equations |
| MATH 323 | (3) | Probability |
| MATH 324 | (3) | Statistics |
| MIMM 214 | (3) | Introductory Immunology: Elements of Immunity |
| MIMM 314 | (3) | Intermediate Immunology |
| NEUR 310 | (3) | Cellular Neurobiology |
| PHAR 300 | (3) | Drug Action |
| PHGY 210 | (3) | Mammalian Physiology 2 |
| PHGY 311 | (3) | Channels, Synapses and Hormones |
| PHGY 314 | (3) | Integrative Neuroscience |
| PSYC 213 | (3) | Cognition |
| PSYC 302 | (3) | The Psychology of Pain |
| PSYC 315 | (3) | Computational Psychology |
| PSYC 317 | (3) | Genes and Behaviour |
| PSYC 318 | (3) | Behavioural Neuroscience 2 |
| PSYC 342 | (3) | Hormones and Behaviour |

400- and 500-level courses:

| | | |
|----------|-----|---|
| BIOL 530 | (3) | Advances in Neuroethology |
| BIOL 532 | (3) | Developmental Neurobiology Seminar |
| BIOL 580 | (3) | Genetic Approaches to Neural Systems |
| BIOL 588 | (3) | Advances in Molecular/Cellular Neurobiology |
| BMDE 519 | (3) | Biomedical Signals and Systems |
| COMP 546 | (4) | Computational Perception |
| MATH 437 | (3) | Mathematical Methods in Biology |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 509 | (3) | Inflammatory Processes |
| NEUR 502 | (3) | Basic and Clinical Aspects of Neuroimmunology |

| | | |
|----------|-----|--|
| NEUR 503 | (3) | Computational Neuroscience |
| NEUR 507 | (3) | Topics in Radionuclide Imaging |
| NEUR 550 | (3) | Free Radical Biomedicine |
| PHAR 562 | (3) | Neuropharmacology |
| PHGY 425 | (3) | Analyzing Physiological Systems |
| PHGY 451 | (3) | Advanced Neurophysiology |
| PHGY 513 | (3) | Translational Immunology |
| PHGY 520 | (3) | Ion Channels |
| PHGY 524 | (3) | Chronobiology |
| PHGY 556 | (3) | Topics in Systems Neuroscience |
| PSYC 410 | (3) | Special Topics in Neuropsychology |
| PSYC 427 | (3) | Sensorimotor Neuroscience |
| PSYC 433 | (3) | Cognitive Science |
| PSYC 444 | (3) | Sleep Mechanisms and Behaviour |
| PSYC 470 | (3) | Memory and Brain |
| PSYC 502 | (3) | Psychoneuroendocrinology |
| PSYC 506 | (3) | Cognitive Neuroscience of Attention |
| PSYC 513 | (3) | Human Decision-Making |
| PSYC 514 | (3) | Neurobiology of Memory |
| PSYC 522 | (3) | Neurochemistry and Behaviour |
| PSYC 526 | (3) | Advances in Visual Perception |
| PSYC 529 | (3) | Music Cognition |
| PSYT 455 | (3) | Neurochemistry |
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |

13.26.5 Bachelor of Science (B.Sc.) - Honours Neuroscience (74 credits)

The Honours program is intended for students who are interested in laboratory-based research and in acquiring a foundation in each of the 3 streams of the Neuroscience Major Program (cell and molecular; neurophysiology and computational; and cognition and behaviour). Students are admitted to the program after one year in a major.

Applicants must have taken a minimum of 27 graded credits in their U1 year, must have a CGPA of at least 3.5, and must have obtained minimum grades of B+ in both NSCI 200 and NSCI 201, as well as a minimum grade of C in BIOL 200, BIOC 212 or BIOL 201, and CHEM 212. Additional requirements for applying are provided on the Neuroscience website: (www.mcgill.ca/neuroscience). Meeting the minimum requirements does not guarantee admission to the Honours Neuroscience program.

To graduate from the program, students must have a CGPA of 3.30 and a minimum grade of B+ in NCSI 300, NCSI 400, and NCSI 430D1/D2.

"First Class Honours" is awarded

| | | |
|------------|-------|---------------------------------|
| NSCI 400D1 | (.5) | Neuroscience Seminar |
| NSCI 400D2 | (.5) | Neuroscience Seminar |
| NSCI 430D1 | (4.5) | Honours Research Project |
| NSCI 430D2 | (4.5) | Honours Research Project |
| PHGY 311 | (3) | Channels, Synapses and Hormones |
| PSYC 311 | (3) | Human Cognition and the Brain |
| PSYC 318 | (3) | Behavioural Neuroscience 2 |

Complementary Courses (36 credits)

3 credits from:

| | | |
|----------|-----|---------------------------------------|
| BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOL 201 | (3) | Cell Biology and Metabolism |

3 credits from:

| | | |
|----------|-----|--|
| COMP 202 | (3) | Foundations of Programming |
| COMP 204 | (3) | Computer Programming for Life Sciences |

3 credits from:

| | | |
|----------|-----|------------------------------------|
| BIOL 373 | (3) | Biometry |
| MATH 324 | (3) | Statistics |
| PSYC 305 | (3) | Statistics for Experimental Design |

3 credits from:

Note: Students who have successfully completed an equivalent to MATH 222 at CEGEP or elsewhere, must replace these credits with a 3-credit elective course to satisfy the total credit requirement for Honours Neuroscience.

| | | |
|----------|-----|--------------------------------|
| BIOL 309 | (3) | Mathematical Models in Biology |
| MATH 222 | (3) | Calculus 3 |

3 credits from:

| | | |
|----------|-----|------------------------------|
| ANAT 321 | (3) | Circuitry of the Human Brain |
| BIOL 306 | (3) | Neural Basis of Behaviour |
| PHGY 314 | (3) | Integrative Neuroscience |

The remaining 21 credits should be taken from the following lists. At least 15 of the 21 credits must be taken at the 400- or 500-level.

200- and 300-level courses:

*Students may take either COMP 206 or COMP 250, but not both.

| | | |
|----------|-----|-------------------------------|
| BIOL 202 | (3) | Basic Genetics |
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| BIOL 306 | (3) | Neural Basis of Behaviour |

| | | |
|-----------|-----|---|
| BIOL 320 | (3) | Evolution of Brain and Behaviour |
| BIOL 389 | (3) | Laboratory in Neurobiology |
| CHEM 222 | (4) | Introductory Organic Chemistry 2 |
| COMP 206* | (3) | Introduction to Software Systems |
| COMP 250* | (3) | Introduction to Computer Science |
| MATH 223 | (3) | Linear Algebra |
| MATH 315 | (3) | Ordinary Differential Equations |
| MATH 323 | (3) | Probability |
| MATH 324 | (3) | Statistics |
| | (3) | Introductory Immunology: Elements of Immunity |

| | | |
|----------|-----|--|
| PSYC 410 | (3) | Special Topics in Neuropsychology |
| PSYC 427 | (3) | Sensorimotor Neuroscience |
| PSYC 433 | (3) | Cognitive Science |
| PSYC 444 | (3) | Sleep Mechanisms and Behaviour |
| PSYC 470 | (3) | Memory and Brain |
| PSYC 502 | (3) | Psychoneuroendocrinology |
| PSYC 506 | (3) | Cognitive Neuroscience of Attention |
| PSYC 513 | (3) | Human Decision-Making |
| PSYC 514 | (3) | Neurobiology of Memory |
| PSYC 522 | (3) | Neurochemistry and Behaviour |
| PSYC 526 | (3) | Advances in Visual Perception |
| PSYC 529 | (3) | Music Cognition |
| PSYT 455 | (3) | Neurochemistry |
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |

13.27 Nutrition (NUTR)

13.27.1 Location

School of Human Nutrition
 Macdonald-Stewart Building, Room MS2-045
 21,111 Lakeshore Road
 Sainte-Anne-de-Bellevue QC H9X 3V9
 Website: mcgill.ca/nutrition

13.27.2 About Nutrition

The School of Human Nutrition offers a **Minor in Human Nutrition** which can be taken by Science students; see *Faculty of Agricultural and Environmental Sciences > Undergraduate > Overview of Programs Offered > : Bachelor of Science in Nutritional Sciences – B.Sc.(Nutr.Sc.) (Overview)*.

NUTR 307 is considered as a course taught by the Faculty of Science.

13.28 Pathology (PATH)

13.28.1 Location

Department of Pathology
 Duff Medical Building, B wing
 3775 University Street
 Montreal QC H3A 2B4
 Telephone: 514-398-3045
 Website: mcgill.ca/pathology

13.28.2 About Pathology

Pathology is a branch of medical science that involves the study and diagnosis of disease through the examination of surgically removed organs, tissues (biopsy samples), bodily fluids, and in some cases the whole body (autopsy). Aspects of a bodily specimen that may be considered include its gross anatomical make up, appearance of the cells using immunological markers, and chemical signatures in the cells. Pathology also includes the related scientific study of disease processes whereby the causes, mechanisms, and extent of disease are examined. Areas of study include cellular adaptation to injury, necrosis (death of li

including cancer and the vast majority of cancer diagnoses are made by pathologists.

Professors

Daniel Bernard; Ph.D.(Johns Hop.)

Derek Bowie; B.Sc., Ph.D.(Lond.)

Paul B.S. Clark

Adjunct Professors

Fabrice Le Boeuf; Ph.D. (Laval)

Laura Stone; Ph.D. (Minn.)

Affiliate Members

Mathieu Boucher; Ph.D.(Montr.)

Lionel Breton; Ph.D.(Paris V)

Lorella Garofalo; Ph.D.(McG.)

John Gillard; Ph.D.(Tasmania)

Joseph Mancini; M.Sc., Ph.D.(McG.)

Karen Meerovitch; Ph.D.(McG.)

Christopher Wright; M.D (Harvard), Ph.D. (Amsterdam).

13.29.4 Bachelor of Science (B.Sc.) - Minor Pharmacology (24 credits)

The Minor Pharmacology is intended for students registered in a complementary B.Sc. program who are interested in a focused introduction to specialized topics in pharmacology to prepare them for professional schools, graduate education, or entry into jobs in industry or research institutes.

Students should declare their intent to enter the Minor in Pharmacology at the beginning of their U2 year. They must consult with, and obtain the approval of, the Coordinator for the Minor Program in the Department of Pharmacology and Therapeutics. Please contact the Student Affairs Coordinator: Chantal Grignon (undergradstudies.pharmacology@mcgill.ca; 514-398-3622).

All courses in the Minor program must be passed with a minimum grade C or better. Generally, no more than 6 credits of overlap are permitted between the Minor and the primary program.

Required Courses (6 credits)

| | | |
|----------|-----|-------------------|
| PHAR 300 | (3) | Drug Action |
| PHAR 301 | (3) | Drugs and Disease |

Complementary Courses (18 credits)

18 credits selected as follows:

3 credits from:

| | | |
|----------|-----|---------------------------------------|
| BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOL 200 | (3) | Molecular Biology |
| BIOL 201 | (3) | Cell Biology and Metabolism |

3 credits from:

| | | |
|----------|-----|------------------------|
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |

3 credits from:

| | | |
|----------|-----|----------------------------------|
| PHAR 503 | (3) | Drug Discovery and Development 1 |
| PHAR 505 | (3) | Structural Pharmacology |

3 credits from:

| | | |
|----------|-----|------------------------|
| PHAR 562 | (3) | Neuropharmacology |
| PHAR 563 | (3) | Endocrine Pharmacology |

6 credits from:

| | | |
|----------|-----|----------------------------------|
| PHAR 303 | (3) | Principles of Toxicology |
| PHAR 504 | (3) | Drug Discovery and Development 2 |
| PHAR 508 | (3) | Drug Discovery and Development 3 |
| PHAR 562 | (3) | Neuropharmacology |
| PHAR 563 | (3) | Endocrine Pharmacology |
| PHAR 565 | (3) | Epigenetic Drugs and Targets |
| PHAR 599 | (6) | Pharmacology Research Project |

13.29.5 Bachelor of Science (B.Sc.) - Major Pharmacology (67 credits)

This program incorporates extensive studies in Pharmacology with a strong component of related biomedical sciences, providing a solid preparation for employment opportunities or for entry into graduate or professional training programs. Students must consult the Student Affairs Coordinator upon entering the program and every year thereafter to verify courses and progress.

U1 Required Courses (24 credits)

| | | |
|-----------|-----|--------------------------------------|
| BIOL 200 | (3) | Molecular Biology |
| BIOL 202 | (3) | Basic Genetics |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| CHEM 222* | (4) | Introductory Organic Chemistry 2 |
| PHAR 200 | (1) | Introduction to Pharmacology 1 |
| PHAR 201 | (1) | Introduction to Pharmacology 2 |
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |
| PHGY 212 | (1) | Introductory Physiology Laboratory 1 |
| PHGY 213 | (1) | Introductory Physiology Laboratory 2 |

* Students who have taken the equivalent of CHEM 212, CHEM 222, and/or MATH 203 in CEGEP (as defined at: <http://www.mcgill.ca/students/transferecredit/prospective/cegep>) are exempt and may not take these courses at McGill. Students must replace these credits with appropriate complementary course credits to satisfy the total credit requirements for their degree.

U2 Required Courses (16 credits)

| | | |
|----------|-----|-------------------------------|
| BIOC 311 | (3) | Metabolic Biochemistry |
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| PHAR 300 | (3) | Drug Action |
| PHAR 301 | (3) | Drugs and Disease |
| PHAR 303 | (3) | Principles of Toxicology |

Complementary Courses (27 credits)

15 credits selected as follows:

3 credits, one of (highly recommended in Year 1):

| | | |
|----------|-----|---------------------------------------|
| ANAT 212 | (3) | Molecular Mechanisms of Cell Function |
|----------|-----|---------------------------------------|

| | | |
|----------|-----|---------------------------------------|
| BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOL 201 | (3) | Cell Biology and Metabolism |

3 credits, one of (usually in Year 2):

| | | |
|----------|-----|--|
| CHEM 203 | (3) | Survey of Physical Chemistry |
| CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |

3 credits, one of (usually in Year 2):

| | | |
|-----------|-----|--|
| BIOL 373 | (3) | Biometry |
| COMP 204 | (3) | Computer Programming for Life Sciences |
| MATH 203* | (3) | Principles of Statistics 1 |
| PSYC 204 | (3) | Introduction to Psychological Statistics |

3 credits, one of (usually in Year 3):

| | | |
|----------|-----|----------------------------------|
| PHAR 503 | (3) | Drug Discovery and Development 1 |
| PHAR 505 | (3) | Structural Pharmacology |

3 credits, one of (usually in Year 3):

| | | |
|----------|-----|------------------------|
| PHAR 562 | (3) | Neuropharmacology |
| PHAR 563 | (3) | Endocrine Pharmacology |

12 credits selected from the following upper-level science courses:

Committee approval is required to substitute an upper-level science course not in the list below.

PHAR 599D1 and PHAR 599D2 are taken together.

| | | |
|-------------|-----|----------------------------------|
| ANAT 321 | (3) | Circuitry of the Human Brain |
| ANAT 322 | (3) | Neuroendocrinology |
| ANAT 365 | (3) | Cellular Trafficking |
| ANAT 381*** | (3) | Experimental Embryology |
| ANAT 458* | (3) | Membranes and Cellular Signaling |

| | | |
|-------------|-----|---|
| BIOT 505 | (3) | Selected Topics in Biotechnology |
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| CHEM 334 | (3) | Advanced Materials |
| CHEM 462*** | (3) | Green Chemistry |
| CHEM 482 | (3) | Organic Chemistry: Natural Products |
| CHEM 502 | (3) | Advanced Bio-Organic Chemistry |
| CHEM 503 | (3) | Drug Discovery |
| CHEM 504 | (3) | Drug Design |
| CHEM 522 | (3) | Stereochemistry |
| CHEM 552 | (3) | Physical Organic Chemistry |
| EXMD 401 | (3) | Physiology and Biochemistry Endocrine Systems |
| EXMD 504 | (3) | Biology of Cancer |
| EXMD 509** | (3) | Gastrointestinal Physiology and Pathology |
| EXMD 511 | (3) | Joint Venturing with Industry |
| HGEN 400** | (3) | Genetics in Medicine |
| MIMM 387 | (3) | The Business of Science |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 466+ | (3) | Viral Pathogenesis |
| NEUR 310 | (3) | Cellular Neurobiology |
| PARA 410 | (3) | Environment and Infection |
| PATH 300 | (3) | Human Disease |
| PHAR 504 | (3) | Drug Discovery and Development 2 |

Drug Discovery and Development T(TH 300)Tj1 0 0 0 1 298.m(ery and D9.72 Tm71 78.52 395.44 Tm(PHAR 5))Tj1 9

| | | |
|----------|-----|--|
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |
| REDM 410 | (3) | Writing Research Articles |

Note: * Students may take either ANAT 458 or BIOC 458

** Access to these courses is not guaranteed

*** Open to students who have the Prerequisites

+ Access to these courses is not guaranteed. Open to students who have the Pre-requisites

Bac76 credits(3)

| | | |
|----------|-----|---------------------------------------|
| BIOC 212 | (3) | Molecular Mechanisms of Cell Function |
| BIOL 201 | (3) | Cell Biology and Metabolism |

3 credits, one of (usually in Year 2):

| | | |
|----------|-----|--|
| CHEM 203 | (3) | Survey of Physical Chemistry |
| CHEM 204 | (3) | Physical Chemistry/Biological Sciences 1 |

(3) 3 credits, one of (usually in Year 2):

| | | |
|-----------|-----|--|
| BIOL 373 | (3) | Biometry |
| COMP 204 | (3) | Computer Programming for Life Sciences |
| MATH 203* | (3) | Principles of Statistics 1 |
| PSYC 204 | (3) | Introduction to Psychological Statistics |

3 credits, one of (usually in Year 2):

| | | |
|---------------|-----|--|
| (3) BIOL 373 | (3) | Biometry |
| (3) COMP 204 | (3) | Computer Programming for Life Sciences |
| (3) MATH 203* | (3) | Principles of Statistics 1 |
| (3) PSYC 204 | (3) | Introduction to Psychological Statistics |

| | | |
|-------------|-----|--|
| CHEM 302 | (3) | Introductory Organic Chemistry 3 |
| CHEM 334 | (3) | Advanced Materials |
| CHEM 462*** | (3) | Green Chemistry |
| CHEM 482 | (3) | Organic Chemistry: Natural Products |
| CHEM 502 | (3) | Advanced Bio-Organic Chemistry |
| CHEM 503 | (3) | Drug Discovery |
| CHEM 504 | (3) | Drug Design |
| CHEM 522 | (3) | Stereochemistry |
| CHEM 552 | (3) | Physical Organic Chemistry |
| EXMD 401 | (3) | Physiology and Biochemistry Endocrine Systems |
| EXMD 504 | (3) | Biology of Cancer |
| EXMD 509** | (3) | Gastrointestinal Physiology and Pathology |
| EXMD 511 | (3) | Joint Venturing with Industry |
| HGEN 400** | (3) | Genetics in Medicine |
| MIMM 387 | (3) | The Business of Science |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 466+ | (3) | Viral Pathogenesis |
| NEUR 310 | (3) | Cellular Neurobiology |
| PARA 410 | (3) | Environment and Infection |
| PATH 300 | (3) | Human Disease |
| PHAR 390 | (3) | Laboratory in Pharmacology |
| PHAR 504 | (3) | Drug Discovery and Development 2 |
| PHAR 508 | (3) | Drug Discovery and Development 3 |
| PHAR 562 | (3) | Neuropharmacology |
| PHAR 563 | (3) | Endocrine Pharmacology |
| PHAR 565 | (3) | Epigenetic Drugs and Targets |
| PHGY 311 | (3) | Channels, Synapses and Hormones |
| PHGY 312 | (3) | Respiratory, Renal, & Cardiovascular Physiology |
| PHGY 313 | (3) | Blood, Gastrointestinal, & Immune Systems Physiology |
| PHGY 314 | (3) | Integrative Neuroscience |
| PHGY 425*** | (3) | Analyzing Physiological Systems |

Note: * Students may take either ANAT 458 or BIOC 458

** Access to these courses is not guaranteed

*** Open to students who have the Pre-requisites

+ Access to these courses is not guaranteed. Open to students who have the Pre-requisites

13.30 Physics (PHYS)

13.30.1 Location

Rutherford Physics Building, Room 108

3600 University Street

Montreal QC H3A 2T8

Telephone: 514-398-6477

Email: chairsec.physics@mcgill.ca

Website: physics.mcgill.ca

13.30.2 About Physics

Physics is in many ways the parent of the other natural sciences and its discoveries and laws continually affect their development. Its range and scope extend in space and time from subnuclear particles to the universe itself. The subfields of physics such as mechanics, thermodynamics, electricity, atomic physics, and quantum mechanics, to mention but a few, permeate all other scientific disciplines. People trained in physics are employed in industry, government, and educational systems where they find man

13.30.3 Internship Year in Science (IYS)

IYS is a pregraduate work experience program available to eligible students and normally taken between their U2 and U3 years. For more information, see [section 12: Science Internships and Field Studies](#).

The following programs are also available with an internship component:

- Major in Physics
- Major Program in Atmospheric Science and Physics
- Major Program in Physics and Computer Science
- Major Program in Physics and Geophysics
- Honours in Physics
- Honours Program in Physics and Chemistry
- Honours Program in Physics and Computer Science
- Honours Program in Physics and Mathematics

13.30.4 Science Freshman Program

Students entering McGill with a Quebec CEGEP profile in Science will normally begin their programs in Physics with courses at the 200 level.

Students without this profile should normally take courses PHYS 131 and PHYS 142 if they have previously taken physics at the high school level and should be taking differential calculus concurrently with PHYS 131 and integral calculus concurrently with PHYS 142. Those students who have not previously

Professors

M. Dobbs; B.Sc.(McG.), Ph.D.(Vic., BC)

C. Gale; B.Sc.(Ott.), M.Sc., Ph.D.(McG.) (*James McGill Professor*)

One of:

| | | |
|----------|-----|------------------------|
| PHYS 241 | (3) | Signal Processing |
| PHYS 258 | (3) | Experimental Methods 2 |

One of:

| | | |
|----------|-----|-------------------------------|
| PHYS 224 | (3) | Physics of Music |
| PHYS 228 | (3) | Energy and the Environment |
| PHYS 260 | (3) | Modern Physics and Relativity |
| PHYS 320 | (3) | Introductory Astrophysics |
| PHYS 346 | (3) | Majors Quantum Physics |

One of:

| | | |
|----------|-----|-----------------------------------|
| PHYS 340 | (3) | Majors Electricity and Magnetism |
| PHYS 350 | (3) | Honours Electricity and Magnetism |

13.30.7 Bachelor of Science (B.Sc.) - Minor Electrical Engineering (24 credits)

[Program registration done by Student Affairs Office]

The Minor program does not carry professional recognition. Only students who satisfy the requirements of the Major Physics are eligible for this Minor. Students registered for this option cannot count PHYS 241 toward the requirements of the Major in Physics, and should replace this course by another Physics or Mathematics course. Students who select ECSE 334 in the Minor cannot count PHYS 328 toward the requirements of the Major in Physics, and should replace this course by another Physics or Mathematics course.

Required Courses (12 credits)

| | | |
|----------|-----|-----------------------------|
| ECSE 200 | (3) | Electric Circuits 1 |
| ECSE 210 | (3) | Electric Circuits 2 |
| ECSE 303 | (3) | Signals and Systems 1 |
| ECSE 330 | (3) | Introduction to Electronics |

Complementary Courses (12 credits)

3 credits from the following and 9 credits of ECSE courses at the 200, 300, or 400 level subject to approval by the Department of Electrical and Computer Engineering.

| | | |
|----------|-----|----------------------------------|
| ECSE 305 | (3) | Probability and Random Signals 1 |
| ECSE 334 | (3) | Introduction to Microelectronics |

13.30.8 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Physics (45 credits)

Program Prerequisites

Students entering Physics programs from the Freshman program must have successfully completed the courses below or their equivalents. Quebec students must have completed the DEC with appropriate science and mathematics courses.

| | | |
|----------|-----|-----------------------------|
| CHEM 110 | (4) | General Chemistry 1 |
| CHEM 120 | (4) | General Chemistry 2 |
| PHYS 131 | (4) | Mechanics and Waves |
| PHYS 142 | (4) | Electromagnetism and Optics |

One of:

| | | |
|----------|-----|--------------------------------|
| BIOL 111 | (3) | Principles: Organismal Biology |
| BIOL 112 | (3) | Cell and Molecular Biology |

MATH 133 and either MATH 140/141 or MATH 150/151.

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 140 | (3) | Calculus 1 |
| MATH 141 | (4) | Calculus 2 |
| MATH 150 | (4) | Calculus A |
| MATH 151 | (4) | Calculus B |

Required Courses (36 credits)

| | | |
|----------|-----|----------------------------------|
| MATH 222 | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 314 | (3) | Advanced Calculus |
| MATH 315 | (3) | Ordinary Differential Equations |
| PHYS 230 | (3) | Dynamics of Simple Systems |
| PHYS 232 | (3) | Heat and Waves |
| PHYS 241 | (3) | Signal Processing |
| PHYS 257 | (3) | Experimental Methods 1 |
| PHYS 258 | (3) | Experimental Methods 2 |
| PHYS 333 | (3) | Thermal and Statistical Physics |
| PHYS 340 | (3) | Majors Electricity and Magnetism |
| PHYS 346 | (3) | Majors Quantum Physics |

Complementary Courses (9 credits)

9 credits selected from:

| | | |
|----------|-----|--|
| PHYS 328 | (3) | Electronics |
| PHYS 331 | (3) | Topics in Classical Mechanics |
| PHYS 339 | (3) | Measurements Laboratory in General Physics |
| PHYS 342 | (3) | Majors Electromagnetic Waves |
| PHYS 434 | (3) | Optics |
| PHYS 439 | (3) | Majors Laboratory in Modern Physics |
| PHYS 447 | (3) | Applications of Quantum Mechanics |

13.30.9 Bachelor of Science (B.Sc.) - Major Physics (63 credits)

60-63 credits

Program Prerequisites

Students entering Physics programs from the Freshman program must have successfully completed the courses below or their equivalents. Quebec students must have completed the DEC with appropriate science and mathematics courses.

| | | |
|----------|-----|-----------------------------|
| CHEM 110 | (4) | General Chemistry 1 |
| CHEM 120 | (4) | General Chemistry 2 |
| PHYS 131 | (4) | Mechanics and Waves |
| PHYS 142 | (4) | Electromagnetism and Optics |

One of:

| | | |
|----------|-----|--------------------------------|
| BIOL 111 | (3) | Principles: Organismal Biology |
| BIOL 112 | (3) | Cell and Molecular Biology |

MATH 133 and either MATH 140/141 or MATH 150/151.

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 140 | (3) | Calculus 1 |
| MATH 141 | (4) | Calculus 2 |
| MATH 150 | (4) | Calculus A |
| MATH 151 | (4) | Calculus B |

Required Courses

(48-51 credits)

* Students who have successfully completed MATH 150/151 or an equivalent of MATH 222 on entering the program are not required to take MATH 222, reducing the total number of program credits from 63 to 60.

** Students coming into the program with sufficient knowledge of computer programming may replace COMP 208 with PHYS 512 or another 3-credit COMP course at the 200 level or above after consulting with an adviser.

| | | |
|------------|-----|--|
| COMP 208** | (3) | Computer Programming for Physical Sciences and Engineering |
|------------|-----|--|

| | | |
|----------|-----|---|
| PHYS 329 | (3) | Statistical Physics with Biophysical Applications |
| PHYS 333 | (3) | Thermal and Statistical Physics |

9 credits from:

| | | |
|----------|-----|---|
| PHYS 319 | (3) | Introduction to Biophysics |
| PHYS 320 | (3) | Introductory Astrophysics |
| PHYS 321 | (3) | Data Science and Observational Astrophysics |
| PHYS 328 | (3) | Electronics |
| PHYS 404 | (3) | Climate Physics |
| PHYS 432 | (3) | Physics of Fluids |
| PHYS 434 | (3) | Optics |
| PHYS 439 | (3) | Majors Laboratory in Modern Physics |
| PHYS 479 | (3) | Physics Research Project |
| PHYS 512 | (3) | Computational Physics with Applications |
| PHYS 519 | (3) | Advanced Biophysics |
| PHYS 521 | (3) | Astrophysics |

Note: It is possible for students to transfer from the Major to the Honours program after U1 year if they have passed all the 200-level required courses listed above and MATH 314 and MATH 315 with a C or better, and obtained a cumulative GPA of 3.5 or better in these courses. The written permission of an adviser is required for this change of program. The missing MATH 249 and PHYS 260 from the U1 Honours year should be taken in U2.

13.30.10 Bachelor of Science (B.Sc.) - Major Physics: Biological Physics (82 credits)

The B.Sc. Major Physics: Biological Physics program keeps a strong core of foundational physics and specializes through courses in biology, mathematics, physiology, computer science, and chemistry. Complementary courses provide background in molecular and cell biology, computer science, and organic chemistry, whereas introductory and advanced biophysics courses offered by the Physics Department as integrative courses. This program provides students with the skills necessary to continue on to graduate studies in biophysics/biological physics, or for research careers in hospital, industrial, or university settings.

Required Courses (63 credits)

Bio-Physical Science Core (27 credits)

| | | |
|-----------|-----|---|
| BIOL 219 | (4) | Introduction to Physical Molecular and Cell Biology |
| BIOL 395 | (1) | Quantitative Biology Seminar |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| MATH 222* | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 315 | (3) | Ordinary Differential Equations |
| MATH 323 | (3) | Probability |
| PHYS 319 | (3) | Introduction to Biophysics |
| PHYS 329 | (3) | Statistical Physics with Biophysical Applications |

* Students who have taken the equivalent of CHEM 212 or MATH 222 can make up the credits with complementary 3 or 4 credits courses in consultation with the program adviser.

Biology and Mathematics (6 credits)

| | | |
|----------|-----|-------------------|
| BIOL 202 | (3) | Basic Genetics |
| MATH 314 | (3) | Advanced Calculus |

| | | |
|----------|-----|--------------------------------|
| BIOL 316 | (3) | Biomembranes and Organelles |
| BIOL 551 | (3) | Principles of Cellular Control |

13.30.11 Bachelor of Science (B.Sc.) - Major Physics and Geophysics (69 credits)

This joint program in Physics and Geophysics provides a firm basis for graduate work in geophysics and related fields as well as a sound preparation for those who wish to embark on a career directly after the B.Sc.

Program Prerequisites

Students entering Physics programs from the Freshman program must have successfully completed the courses below or their equivalents. Quebec students must have completed the DEC with appropriate science and mathematics courses.

| | | |
|----------|-----|-----------------------------|
| CHEM 110 | (4) | General Chemistry 1 |
| CHEM 120 | (4) | General Chemistry 2 |
| PHYS 131 | (4) | Mechanics and Waves |
| PHYS 142 | (4) | Electromagnetism and Optics |

One of:

| | | |
|----------|-----|--------------------------------|
| BIOL 111 | (3) | Principles: Organismal Biology |
| BIOL 112 | (3) | Cell and Molecular Biology |

MATH 133 and either MATH 140/141 or MATH 150/151.

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 140 | (3) | Calculus 1 |
| MATH 141 | (4) | Calculus 2 |
| MATH 150 | (4) | Calculus A |
| MATH 151 | (4) | Calculus B |

Required Courses (57 credits)

| | | |
|----------|-----|---------------------------------|
| EPSC 231 | (3) | Field School 1 |
| EPSC 240 | (3) | Geology in the Field |
| EPSC 303 | (3) | Structural Geology |
| EPSC 320 | (3) | Elementary Earth Physics |
| MATH 222 | (3) | Calculus 3 |
| MATH 223 | (3) | Linear Algebra |
| MATH 314 | (3) | Advanced Calculus |
| MATH 315 | (3) | Ordinary Differential Equations |
| PHYS 230 | (3) | Dynamics of Simple Systems |
| PHYS 232 | (3) | Heat and Waves |
| PHYS 241 | (3) | Signal Processing |
| PHYS 257 | (3) | Experimental Methods 1 |
| PHYS 258 | (3) | Experimental Methods 2 |
| PHYS 331 | (3) | Topics in Classical Mechanics |
| PHYS 333 | (3) | Thermal and Statistical Physics |

(3)(3)

Majors Electricity and Magnetism

One of:

| | | |
|----------|-----|--------------------------------|
| BIOL 111 | (3) | Principles: Organismal Biology |
| BIOL 112 | (3) | Cell and Molecular Biology |

MATH 133 and either MATH 140/141 or MATH 150/151.

| | | |
|----------|-----|-----------------------------|
| MATH 133 | (3) | Linear Algebra and Geometry |
| MATH 140 | (3) | Calculus 1 |
| MATH 141 | (4) | Calculus 2 |
| MATH 150 | (4) | Calculus A |
| MATH 151 | (4) | Calculus B |

U1 Required Courses (27 credits)

| | | |
|----------|-----|---|
| MATH 247 | (3) | Honours Applied Linear Algebra |
| MATH 248 | (3) | Honours Vector Calculus |
| MATH 249 | (3) | Honours Complex Variables |
| MATH 325 | (3) | Honours Ordinary Differential Equations |
| PHYS 241 | (3) | Signal Processing |
| PHYS 251 | (3) | Honours Classical Mechanics 1 |
| PHYS 257 | (3) | Experimental Methods 1 |
| PHYS 258 | (3) | Experimental Methods 2 |
| PHYS 260 | (3) | Modern Physics and Relativity |

U2 Required Courses (24 credits)

| | | |
|----------|-----|--|
| MATH 475 | (3) | Honours Partial Differential Equations |
| PHYS 253 | (3) | Thermal Physics |
| PHYS 350 | (3) | Honours Electricity and Magnetism |
| PHYS 351 | (3) | Honours Classical Mechanics 2 |
| PHYS 357 | (3) | Honours Quantum Physics 1 |
| PHYS 359 | (3) | Honours Laboratory in Modern Physics 1 |
| PHYS 362 | (3) | Statistical Mechanics |
| PHYS 457 | (3) | Honours Quantum Physics 2 |

U3 Required Courses (6 credits)

| | | |
|----------|-----|-------------------------------|
| PHYS 352 | (3) | Honours Electromagnetic Waves |
| PHYS 551 | (3) | Quantum Theory |

U3 Complementary Courses (21 credits)

6 credits selected from:

Note: PHYS 459D1 and PHYS 459D2 are taken together.

| | | |
|------------|-----|-------------------------|
| PHYS 459D1 | (3) | Honours Research Thesis |
|------------|-----|-------------------------|

| | | |
|------------|-----|--|
| PHYS 459D2 | (3) | Honours Research Thesis |
| PHYS 469 | (3) | Honours Laboratory in Modern Physics 2 |
| PHYS 479 | (3) | Physics Research Project |

15 credits selected from the list below (students may substitute one or more courses with any 3-credit course approved by the Department of Physics):

| | | |
|----------|-----|---|
| PHYS 432 | (3) | Physics of Fluids |
| PHYS 434 | (3) | Optics |
| PHYS 479 | (3) | Physics Research Project |
| PHYS 512 | (3) | Computational Physics with Applications |
| PHYS 514 | (3) | General Relativity |
| | | Advanced Biophysics |

| | | |
|------------|-----|-----------------------------------|
| PHYS 241 | (3) | Signal Processing |
| PHYS 251 | (3) | Honours Classical Mechanics 1 |
| PHYS 253 | (3) | Thermal Physics |
| PHYS 257 | (3) | Experimental Methods 1 |
| PHYS 258 | (3) | Experimental Methods 2 |
| PHYS 346 | (3) | Majors Quantum Physics |
| PHYS 350 | (3) | Honours Electricity and Magnetism |
| PHYS 352 | (3) | Honours Electromagnetic Waves |
| PHYS 459D1 | (3) | Honours Research Thesis |
| PHYS 459D2 | (3) | Honours Research Thesis |
| PHYS 519 | (3) | Advanced Biophysics |

Complementary Courses

(18-19 credits)

3 credits selected from:

| | | |
|----------|-----|----------------------------------|
| COMP 202 | (3) | Foundations of Programming |
| COMP 250 | (3) | Introduction to Computer Science |

3 credits selected from:

| | | |
|----------|-----|-------------------------------|
| PHYS 328 | (3) | Electronics |
| PHYS 351 | (3) | Honours Classical Mechanics 2 |

3 credits selected from:

| | | |
|----------|-----|--|
| PHYS 339 | (3) | Measurements Laboratory in General Physics |
| PHYS 359 | (3) | Honours Laboratory in Modern Physics 1 |

3 credits selected from:

| | | |
|----------|-----|-----------------------------------|
| CHEM 514 | (3) | Biophysical Chemistry |
| MATH 437 | (3) | Mathematical Methods in Biology |
| PHGY 425 | (3) | Analyzing Physiological Systems |
| PHYS 432 | (3) | Physics of Fluids |
| PHYS 434 | (3) | Optics |
| PHYS 447 | (3) | Applications of Quantum Mechanics |

6 to 7 credits selected from:

| | | |
|----------|-----|-------------------------------|
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| BIOL 303 | (3) | Developmental Biology |
| BIOL 306 | (3) | Neural Basis of Behaviour |
| BIOL 313 | (3) | Eukaryotic Cell Biology |
| BIOL 316 | (3) | Biomembranes and Organelles |

13.30.15 Bachelor of Science (B.Sc.) - Honours Mathematics and Physics (81 credits)

This is a specialized and demanding program intended for students who wish to develop a strong basis in both Mathematics and Physics in preparation for graduate work and a professional or academic career.

| | | |
|----------|-----|--|
| MATH 255 | (3) | Honours Analysis 2 |
| MATH 475 | (3) | Honours Partial Differential Equations |
| PHYS 253 | (3) | Thermal Physics |
| PHYS 350 | (3) | Honours Electricity and Magnetism |
| PHYS 351 | (3) | Honours Classical Mechanics 2 |
| PHYS 357 | (3) | Honours Quantum Physics 1 |
| PHYS 362 | (3) | Statistical Mechanics |
| PHYS 457 | (3) | Honours Quantum Physics 2 |

U3 Required Courses (12 credits)

| | | |
|----------|-----|--|
| MATH 454 | (3) | Honours Analysis 3 |
| MATH 458 | (3) | Honours Differential Geometry |
| PHYS 352 | (3) | Honours Electromagnetic Waves |
| PHYS 359 | (3) | Honours Laboratory in Modern Physics 1 |

Complementary Courses (18 credits)

U1 Complementary Course (3 credits)

| | | |
|----------|-----|--------------------------------|
| MATH 247 | (3) | Honours Applied Linear Algebra |
| MATH 251 | (3) | Honours Algebra 2 |

U2 Complementary Courses (3 credits)

| | | |
|------------|-----|--------------------|
| MATH 242 | (3) | Analysis 1 |
| MATH 254** | (3) | Honours Analysis 1 |

** It is strongly recommended that students take MATH 254.

U3 Complementary Courses (12 credits)

12 credits are selected as follows:

3 credits from:

| | | |
|----------|-----|--------------------|
| MATH 455 | (3) | Honours Analysis 4 |
| MATH 456 | (3) | Honours Algebra 3 |

6 credits selected from:

| | | |
|----------|-----|---|
| PHYS 432 | (3) | Physics of Fluids |
| PHYS 479 | (3) | Physics Research Project |
| PHYS 512 | (3) | Computational Physics with Applications |
| PHYS 514 | (3) | General Relativity |
| PHYS 519 | (3) | Advanced Biophysics |
| PHYS 521 | (3) | Astrophysics |
| PHYS 551 | (3) | Quantum Theory |
| PHYS 557 | (3) | Nuclear Physics |
| PHYS 558 | (3) | Solid State Physics |

| | | |
|----------|-----|--|
| COMP 208 | (3) | Computer Programming for Physical Sciences and Engineering |
| MATH 247 | (3) | Honours Applied Linear Algebra Honours Vector Calculus |

Required Courses (63 credits)

*Note: A student who has not taken MATH 222 (or equivalent) prior to entering the program must take it in their first semester, increasing the program credits from 78 to 81. The student must then take MATH 314 in their second semester instead of MATH 248, if scheduling requires it.

| | | |
|----------|-----|--|
| COMP 206 | (3) | Introduction to Software Systems |
| COMP 250 | (3) | Introduction to Computer Science |
| COMP 252 | (3) | Honours Algorithms and Data Structures |
| COMP 273 | (3) | Introduction to Computer Systems |
| COMP 302 | (3) | Programming Languages and Paradigms |
| COMP 350 | (3) | Numerical Computing |
| MATH 240 | (3) | Discrete Structures |
| MATH 247 | (3) | Honours Applied Linear Algebra |
| | | Honours |

The **programs** offered in Physiology differ in their orientation but they all have a common core of material covering:

- cardiovascular;
- respiratory;
- gastrointestinal and renal physiology;
- neurophysiology;
- endocrinology;
- immunology.

The specified U1 courses are identical for all programs except the Joint Major programs in Physiology and Physics, Physiology and Mathematics, and the

Associate Professor Post-Retirement

Ann Wechsler; B.A.(Tor.), M.Sc., Ph.D.(McG.)

Faculty Lecturer

Céline Aguer; M.Sc., Ph.D.(France), Outaouais campus

13.31.4 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Physiology (50 credits)

Required Courses (38 credits)

* Students who have taken CHEM 212 and/or CHEM 222 in CEGEP are exempted and must replace these credits with 4 or 8 credits of elective course(s).

| | | |
|-----------|-----|--------------------------------------|
| BIOL 200 | (3) | Molecular Biology |
| BIOL 202 | (3) | Basic Genetics |
| BIOL 301 | (4) | Cell and Molecular Laboratory |
| CHEM 212* | (4) | Introductory Organic Chemistry 1 |
| CHEM 222* | (4) | Introductory Organic Chemistry 2 |
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |
| PHGY 212 | (1) | Introductory Physiology Laboratory 1 |
| PHGY 213 | (1) | Introductory Physiology Laboratory 2 |
| PHGY 311 | (3) | Channels, Synapses and Hormones |

| | | |
|--------------|-------|--|
| BMDE 505 | (3) | Cell and Tissue Engineering |
| BMDE 519 | (3) | Biomedical Signals and Systems |
| EXMD 502 | (3) | Advanced Endocrinology 1 |
| EXMD 503 | (3) | Advanced Endocrinology 02 |
| EXMD 506 | (3) | Advanced Applied Cardiovascular Physiology |
| EXMD 507 | (3) | Advanced Applied Respiratory Physiology |
| EXMD 508 | (3) | Advanced Topics in Respiration |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 509 | (3) | Inflammatory Processes |
| PHGY 425 | (3) | Analyzing Physiological Systems |
| PHGY 451 | (3) | Advanced Neurophysiology |
| PHGY 459D1* | (3) | Physiology Seminar |
| PHGY 459D2* | (3) | Physiology Seminar |
| PHGY 461D1** | (4.5) | Experimental Physiology |
| PHGY 461D2** | (4.5) | Experimental Physiology |
| PHGY 488 | (3) | Stem Cell Biology |
| PHGY 502 | (3) | Exercise Physiology |
| PHGY 508 | (3) | Advanced Renal Physiology |
| PHGY 513 | (3) | Translational Immunology |
| PHGY 515 | (3) | Blood-Brain Barrier in Health and Disease |
| PHGY 516 | (3) | Physiology of Blood |
| PHGY 518 | (3) | Artificial Cells |
| PHGY 520 | (3) | Ion Channels |
| PHGY 524 | (3) | Chronobiology |
| PHGY 531 | (3) | Topics in Applied Immunology |
| PHGY 550 | (3) | Molecular Physiology of Bone |
| PHGY 552 | (3) | Cellular and Molecular Physiology |
| PHGY 556 | (3) | Topics in Systems Neuroscience |
| PHGY 560 | (3) | Light Microscopy-Life Science |
| PSYC 470 | (3) | Memory and Brain |
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |

13.31.5 Bachelor of Science (B.Sc.) - Major Physiology (65 credits)

The Major program includes, in addition to some intensive studies in Physiology

PHGY 210 (3)

Mammalian Physiology 2

PHGY 2121M1.949i2Y 212 (1)

Introductory Physiology Laboratory 1

| | | |
|--------------|-------|--|
| EXMD 503 | (3) | Advanced Endocrinology 02 |
| EXMD 506 | (3) | Advanced Applied Cardiovascular Physiology |
| EXMD 507 | (3) | Advanced Applied Respiratory Physiology |
| EXMD 508 | (3) | Advanced Topics in Respiration |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 509 | (3) | Inflammatory Processes |
| PHGY 425 | (3) | Analyzing Physiological Systems |
| PHGY 451 | (3) | Advanced Neurophysiology |
| PHGY 459D1* | (3) | Physiology Seminar |
| PHGY 459D2* | (3) | Physiology Seminar |
| PHGY 461D1** | (4.5) | Experimental Physiology |
| PHGY 461D2** | (4.5) | Experimental Physiology |
| PHGY 488 | (3) | Stem Cell Biology |
| PHGY 502 | (3) | Exercise Physiology |
| PHGY 508 | (3) | Advanced Renal Physiology |
| PHGY 513 | (3) | Translational Immunology |
| PHGY 515 | (3) | Blood-Brain Barrier in Health and Disease |
| PHGY 516 | (3) | Physiology of Blood |
| PHGY 518 | (3) | Artificial Cells |
| PHGY 520 | (3) | Ion Channels |
| PHGY 524 | (3) | Chronobiology |
| PHGY 531 | (3) | Topics in Applied Immunology |
| PHGY 550 | (3) | Molecular Physiology of Bone |
| PHGY 552 | (3) | Cellular and Molecular Physiology |
| PHGY 556 | (3) | Topics in Systems Neuroscience |
| PHGY 560 | (3) | Light Microscopy-Life Science |
| PSYC 470 | (3) | Memory and Brain |
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |

* the 6-credit course equals 3 credits of ULP and 6 credits of electives.

** the 9-credit course equals 3 credits of ULP and 6 credits of electives.

6 credits selected from the Upper-Level Science (ULS)

Note: For Chemistry, Neurology, and Neurosurgery: select from all courses 300 level and above

| | | |
|-----------|-----|---|
| ANAT 565 | (3) | Diseases-Membrane Trafficking |
| BIOC 458* | (3) | Membranes and Cellular Signaling |
| BIOL 300 | (3) | Molecular Biology of the Gene |
| BIOL 303 | (3) | Developmental Biology |
| BIOL 309 | (3) | Mathematical Models in Biology |
| BIOL 313 | (3) | Eukaryotic Cell Biology |
| BIOL 314 | (3) | Molecular Biology of Cancer |
| BIOL 324 | (3) | Ecological Genetics |
| BIOL 370 | (3) | Human Genetics Applied |
| BIOL 373 | (3) | Biometry |
| BIOL 389 | (3) | Laboratory in Neurobiology |
| BIOL 416 | (3) | Genetics of Mammalian Development |
| BIOL 468 | (6) | Independent Research Project 3 |
| BIOL 518 | (3) | Advanced Topics in Cell Biology |
| BIOL 520 | (3) | Gene Activity in Development |
| BIOL 524 | (3) | Topics in Molecular Biology |
| BIOL 532 | (3) | Developmental Neurobiology Seminar |
| BIOL 544 | (3) | Genetic Basis of Life Span |
| BIOL 546 | (3) | Genetics of Model Systems |
| BIOL 551 | (3) | Principles of Cellular Control |
| BIOL 575 | (3) | Human Biochemical Genetics |
| BIOL 588 | (3) | Advances in Molecular/Cellular Neurobiology |
| CHEM 214 | (3) | Physical Chemistry/Biological Sciences 2 |
| EXMD 401 | (3) | Physiology and Biochemistry Endocrine Systems |
| EXMD 502 | (3) | Advanced Endocrinology 1 |
| EXMD 503 | (3) | Advanced Endocrinology 02 |
| EXMD 504 | (3) | Biology of Cancer |
| EXMD 506 | (3) | Advanced Applied Cardiovascular Physiology |
| EXMD 507 | (3) | Advanced Applied Respiratory Physiology |
| EXMD 508 | (3) | Advanced Topics in Respiration |
| EXMD 510 | (3) | Bioanalytical Separation Methods |
| NEUR 310 | (3) | Cellular Neurobiology |
| PHAR 503 | (3) | Drug Discovery and Development 1 |
| PHAR 504 | (3) | Drug Discovery and Development 2 |
| PHAR 562 | (3) | Neuropharmacology |
| PHAR 563 | (3) | Endocrine Pharmacology |
| PPHS 501 | (3) | Population Health and Epidemiology |
| PSYC 302 | (3) | The Psychology of Pain |
| PSYC 311 | (3) | Human Cognition and the Brain |
| PSYC 317 | (3) | Genes and Behaviour |
| PSYC 318 | (3) | Behavioural Neuroscience 2 |
| PSYC 342 | (3) | Hormones and Behaviour |
| PSYC 410 | (3) | Special Topics in Neuropsychology |

| | | |
|----------|-----|--|
| PSYC 427 | (3) | Sensorimotor Neuroscience |
| PSYC 470 | (3) | Memory and Brain |
| PSYC 522 | (3) | Neurochemistry and Behaviour |
| PSYC 526 | (3) | Advances in Visual Perception |
| PSYT 500 | (3) | Advances: Neurobiology of Mental Disorders |

* Students may take ANAT 458 or BIOC 458 but not both.

Note: Students may opt to replace 3 credits of the 6 credits of Upper Level Science with 3 credits selected from the follo

| | | |
|------------|-------|--|
| PHGY 212 | (1) | Introductory Physiology Laboratory 1 |
| PHGY 213 | (1) | Introductory Physiology Laboratory 2 |
| PHGY 312 | (3) | Respiratory, Renal, & Cardiovascular Physiology |
| PHGY 313 | (3) | Blood, Gastrointestinal, & Immune Systems Physiology |
| PHGY 461D1 | (4.5) | Experimental Physiology |
| PHGY 461D2 | (4.5) | Experimental Physiology |

*** Students may take either MATH 248 or MATH 314.

Complementary Courses (9 credits)

3 credits, one of:

| | | |
|----------|-----|--|
| COMP 204 | (3) | Computer Programming for Life Sciences |
| COMP 250 | (3) | Introduction to Computer Science |

3 credits, one of:

| | | |
|----------|-----|---------------------------------|
| PHGY 311 | (3) | Channels, Synapses and Hormones |
| PHGY 314 | (3) | Integrative Neuroscience |

3 credits, one of:

| | | |
|----------|-----|------------------------------|
| PHYS 413 | (3) | Physical Basis of Physiology |
| PHYS 519 | (3) | Advanced Biophysics |

13.31.7 Bachelor of Science (B.Sc.) - Major Physiology and Physics (82 credits)

This program provides a firm foundation in physics, mathematics, and physiology. It is appropriate for students interested in applying methods of the physical sciences to problems in physiology and allied biological sciences.

Required Courses (76 credits)

Bio-Physical Sciences Core

| | | |
|------------|-----|---|
| BIOL 219 | (4) | Introduction to Physical Molecular and Cell Biology |
| BIOL 395 | (1) | Quantitative Biology Seminar |
| MATH 222 | (3) | Calculus 3 |
| MATH 223* | (3) | Linear Algebra |
| MATH 247* | (3) | Honours Applied Linear Algebra |
| MATH 315** | (3) | Ordinary Differential Equations |
| MATH 325** | (3) | Honours Ordinary Differential Equations |
| PHYS 329 | (3) | Statistical Physics with Biophysical Applications |

* Students may take either MATH 223 or MATH 247.

** Students may take either MATH 315 or MATH 325.

Physiology and Physics Core

| | | |
|-------------|-----|--------------------------------|
| BMDE 519 | (3) | Biomedical Signals and Systems |
| MATH 248*** | (3) | Honours Vector Calculus |
| MATH 314*** | (3) | Advanced Calculus |

| | | |
|----------|-----|---|
| MATH 326 | (3) | Nonlinear Dynamics and Chaos |
| MATH 437 | (3) | Mathematical Methods in Biology |
| PHGY 209 | (3) | Mammalian Physiology 1 |
| PHGY 210 | (3) | Mammalian Physiology 2 |
| PHGY 212 | (1) | Introductory Physiology Laboratory 1 |
| PHGY 213 | (1) | Introductory Physiology Laboratory 2 |
| PHGY 312 | (3) | Respiratory, Renal, & Cardiovascular Physiology |

| | | |
|----------|-----|--|
| BMDE 519 | (3) | Biomedical Signals and Systems |
| EXMD 502 | (3) | Advanced Endocrinology 1 |
| EXMD 503 | (3) | Advanced Endocrinology 02 |
| EXMD 506 | (3) | Advanced Applied Cardiovascular Physiology |
| EXMD 507 | (3) | Advanced Applied Respiratory Physiology |
| EXMD 508 | (3) | Advanced Topics in Respiration |
| MIMM 414 | (3) | Advanced Immunology |
| MIMM 509 | (3) | Inflammatory Processes |
| PHGY 425 | (3) | Analyzing Physiological Systems |
| PHGY 451 | (3) | Advanced Neurophysiology |
| PHGY 488 | (3) | Stem Cell Biology |
| PHGY 502 | (3) | Exercise Physiology |
| PHGY 508 | (3) | Advanced Renal Physiology |
| PHGY 513 | (3) | Translational Immunology |
| PHGY 515 | (3) | Blood-Brain Barrier in Health and Disease |
| PHGY 516 | (3) | Physiology of Blood |
| PHGY 518 | (3) | Artificial Cells |

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13.32 Psychiatry (PSYT)

13.32.1 Location

1033 Pine Avenue West, Room 104
Montreal QC H3A 1A1
Telephone: 514-398-4176
Website: mcgill.ca/psychiatry/education/graduate-program

13.32.2 About Psychiatry

There are no B.Sc. programs in Psychiatry, but the PSYT courses listed below are administered by the Faculty of Science and are open to Arts and Science students and to graduate students, subject to the regulations and restrictions of their home faculty.

Courses

| | |
|-----------------------|--|
| PSYT 199 | FYS: Mental Illness and the Brain |
| PSYT 301 | Issues in Drug Dependence |
| PSYT 400D1/PSYT 400D2 | Research Project in Psychiatry |
| PSYT 455 | Neurochemistry |
| PSYT 500 | Advances: Neurobiology of Mental Disorders |
| PSYT 502 | Brain Evolution and Psychiatry |
| PSYT 503 | Mental Health Services and Policy |
| PSYT 504 | Issues in Forensic Mental Health |
| PSYT 515 | Advanced Studies in Addiction |

13.33 Psychology (PSYC)

13.33.1 Location

2001 McGill College, Room 740
Montreal QC H3A 1G1
Telephone: 514-398-6100
Fax: 514-398-4896
Email: info@psych.mcgill.ca
Website: mcgill.ca/psychology

13.33.2 About Psychology

The Department of Psychology offers programs in both Arts and Science. All B.A. programs in Psychology can be found in [Faculty of Arts > Undergraduate > Browse Academic Units & Programs > : Psychology \(PSYC\)](#).

Psychology is the scientific study of mind and behaviour. It is both a **social** and a **biological** science.

- As a **social science**, psychology examines the social nature of human beings and the influence that culture, group membership, and relationships have on individual personality, thought, and behaviour.
- As a **biological science**, psychology seeks to identify the neural basis of human behaviour, both directly, through the study of humans, and indirectly, through the study of other species.

The data of psychology is collected within the psychological laboratory by the use of experimental methods in the study of behaviour, and outside the laboratory by systematic observation of the behaviour of humans and animals. The aim is to formulate general principles of perception, learning, motivation, cognition, and social psychology that are relevant to different aspects of human life. Experimentation, laboratory techniques, observational procedures, measurement, and statistical methods are important tools of the psychologist.

13.33.5 Psychology Faculty**Chair**

J. Lydon

Graduate Program Director

B. Knauper

D. Titone

Clinical Program Director

B. Ditto

Undergraduate Program Director

G. O'Driscoll

Emeritus Professors

F.E. Aboud; B.A.(Tor.), M.A., Ph.D.(McG.)

A.S. Bregman; B.A., M.A.(Tor.), Ph.D.(Yale)

D. Donderi; B.A., B.Sc.(Chic.), Ph.D.(Cornell)

K.B.J. Franklin; B.A., M.A.(Auck.), Ph.D.(Lond.)

F.H. Genesee; B.A.(UWO), M.A., Ph.D.(McG.)

D.J. Levitin; A.B.(Stan.), M.S., Ph.D.(Ore.) (*James McGill Professor*)

A.A.J. Marley; B.Sc.(Birm.), Ph.D.(Penn.)

D.S. Moskowitz; B.S.(Kirkland), M.A., Ph.D.(Conn.)

Y. Oshima-Takane; B.A.(TWCU.), M.A.(Tokyo), Ph.D.(McG.)

R.O. Pihl; B.A.(Lawrence), Ph.D.(Ariz.)

J.O. Ramsay; B.Ed.(Alta.), Ph.D.(Princ.)

B. Sherwin; B.A., M.A., Ph.D.(C' dia) (*Canada Research Chair in Hormones, Brain and Cognition*)

Y. Takane; B.L., M.A.(Tokyo), Ph.D.(N. Carolina)

D.M. Taylor; M.A., Ph.D.(UWO)

N. White; B.A.(McG.), M.A., Ph.D.(Pitt.)

RetiredRhonda Amsel; B.Sc., M.Sc.(McG.) (*Associate*)

Andrew G. Baker; B.A.(Br. Col.), M.A., Ph.D.(Dal.)

M.J. Mendelson; B.Sc.(McG.), M.A., Ph.D.(Harv.)

Professors

M. Baldwin; B.A.(Tor.), M.A., Ph.D.(Wat.)

I.M. Binik; B.A.(NYU), M.A., Ph.D.(Penn.)

M. Dirks; B.A.(McM.), M.S., M.Phil., Ph.D.(Yale)

B. Ditto; B.S.(Iowa St.), Ph.D.(Ind.)

H. Hwang; B.A.(Chung-Ang), Ph.D.(McG.)

B. Knäuper; D.Phil.(Mannheim)

R. Koestner; B.A., Ph.D.(Roch.)

J. Lydon; B.A.(Notre Dame), M.A., Ph.D.(Wat.)

J. Mogil; B.Sc.(Tor.), Ph.D.(Calif.-LA) (*E.P. Taylor Professor of Psychology*) (*Canada Research Chair in Genetics of Pain*)

Professors

K. Nader; B.Sc., Ph.D.(Tor.) (*James McGill Professor*)

D.J. Ostry; B.A.Sc., M.A.Sc., Ph.D.(Tor.)

C. Palmer; B.Sc.(Mich.), M.Sc.(Rutg.), Ph.D.(Cornell) (*Canada Research Chair in Cognitive Neuropsychology Performance*)

Associate Members

Douglas Mental Health University Institute Research Centre: S. King, N. Rajah, H. Steiger

Educational Counselling Psychology: V Talwar Jewish General Hospital: B Thombs, P. Zolkowitz

McGill Vision Research Centre: C. Baker, R. Hess, F.A.A. Kingdom, K. Mullen

Montreal Neurological Institute and Hospital: J. Armony, L.K. Fellows, D. Guitton, M. Jones-Gotman, M. Lepage, B. Milner, E. Ruthazer, W. Sossin, R. N. Spreng, V. Sziklas, R. Zatorre

Schulich School of Music: S. MacAdams

Psychiatry: D. Dunkley, F. Elgar, M. Leyton

Adjunct Professors

S. Hamad, P. Zelazo

Bac

| | | |
|----------|-----|-------------------|
| PSYC 212 | (3) | Perception |
| PSYC 213 | (3) | Cognition |
| PSYC 215 | (3) | Social Psychology |

List A

6 credits in Psychology from List A (Behavioural Neuroscience, Cognition and Quantitative Methods).

| | | |
|----------|-----|---|
| NSCI 201 | (3) | Introduction to Neuroscience 2 |
| PSYC 301 | (3) | Animal Learning and Theory |
| PSYC 302 | (3) | The Psychology of Pain |
| PSYC 310 | (3) | Intelligence |
| PSYC 311 | (3) | Human Cognition and the Brain |
| PSYC 315 | (3) | Computational Psychology |
| PSYC 317 | (3) | Genes and Behaviour |
| PSYC 318 | (3) | Behavioural Neuroscience 2 |
| PSYC 319 | (3) | Computational Models - Cognition |
| PSYC 329 | (3) | Introduction to Auditory Cognition |
| PSYC 340 | (3) | Psychology of Language |
| PSYC 341 | (3) | The Psychology of Bilingualism |
| PSYC 342 | (3) | Hormones and Behaviour |
| PSYC 352 | (3) | Cognitive Psychology Laboratory |
| PSYC 353 | (3) | Laboratory in Human Perception |
| PSYC 403 | (3) | Modern Psychology in Historical Perspective |
| PSYC 406 | (3) | Psychological Tests |
| PSYC 410 | (3) | Special Topics in Neuropsychology |
| PSYC 413 | (3) | Cognitive Development |
| PSYC 427 | (3) | Sensorimotor Neuroscience |
| PSYC 433 | (3) | Cognitive Science |
| PSYC 443 | (3) | Affective Neuroscience |
| PSYC 444 | (3) | Sleep Mechanisms and Behaviour |
| PSYC 451 | (3) | Human Factors Research and Techniques |
| PSYC 470 | (3) | Memory and Brain |
| PSYC 501 | (3) | Auditory Perception |
| PSYC 502 | (3) | Psychoneuroendocrinology |
| PSYC 506 | (3) | Cognitive Neuroscience of Attention |
| PSYC 513 | (3) | Human Decision-Making |
| PSYC 514 | (3) | Neurobiology of Memory |
| PSYC 522 | (3) | Neurochemistry and Behaviour |

nT.941 Tm((3))Tj Adaption in Visual Perception

| | | |
|----------|-----|--|
| PSYC 541 | (3) | Multilevel Modelling |
| PSYC 545 | (3) | Topics in Language Acquisition |
| PSYC 561 | (3) | Methods: Developmental Psycholinguistics |
| PSYC 562 | (3) | Measurement of Psychological Processes |
| RELG 443 | (3) | Japanese Esoteric Buddhism |

List B

6 credits in Psychology from List B (Social, Health, and Developmental Psychology).

| | | |
|------------|-----|--|
| PSYC 304 | (3) | Child Development |
| PSYC 316 | (3) | Psychology of Deafness |
| PSYC 328 | (3) | Health Psychology |
| PSYC 331 | (3) | Inter-Group Relations |
| PSYC 332 | (3) | Introduction to Personality |
| PSYC 333 | (3) | Personality and Social Psychology |
| PSYC 337 | (3) | Introduction to Psychopathology |
| PSYC 351 | (3) | Research Methods in Social Psychology |
| PSYC 408 | (3) | Principles and Applications of Psychotherapy |
| PSYC 409 | (3) | Positive Psychology |
| PSYC 412 | (3) | Developmental Psychopathology |
| PSYC 414 | (3) | Social Development |
| PSYC 436 | (3) | Human Sexuality and Its Problems |
| PSYC 471 | (3) | Human Motivation |
| PSYC 473 | (3) | Social Cognition and the Self |
| PSYC 474 | (3) | Interpersonal Relationships |
| PSYC 475 | (3) | Neuroscience of Social Psychology |
| PSYC 483 | (3) | Seminar in Experimental Psychopathology |
| PSYC 491D1 | (3) | Advanced Study: Behavioural Disorders |
| PSYC 491D2 | (3) | Advanced Study: Behavioural Disorders |
| PSYC 507 | (3) | Emotions, Stress, and Illness |
| PSYC 509 | (3) | Diverse Clinical Populations |
| PSYC 512 | (3) | Advanced Personality Seminar |
| PSYC 528 | (3) | Vulnerability to Depression and Anxiety |
| PSYC 530 | (3) | Applied Topics in Deafness |
| PSYC 533 | (3) | International Health Psychology |
| PSYC 535 | (3) | Advanced Topics in Social Psychology |
| PSYC 539 | (3) | Advanced Topics in Social Psychology 2 |

15 credits in Psychology at the 300 level or above.

6 credits in Psychology at the 400 or 500 level.

| | | |
|----------|-----|---|
| PSYC 433 | (3) | Cognitive Science |
| PSYC 443 | (3) | Affective Neuroscience |
| PSYC 444 | (3) | Sleep Mechanisms and Behaviour |
| PSYC 451 | (3) | Human Factors Research and Techniques |
| PSYC 470 | (3) | Memory and Brain |
| PSYC 501 | (3) | Auditory Perception |
| PSYC 502 | (3) | Psychoneuroendocrinology |
| PSYC 506 | (3) | Cognitive Neuroscience of Attention |
| PSYC 513 | (3) | Human Decision-Making |
| PSYC 514 | (3) | Neurobiology of Memory |
| PSYC 522 | (3) | Neurochemistry and Behaviour |
| PSYC 526 | (3) | Advances in Visual Perception |
| PSYC 529 | (3) | Music Cognition |
| PSYC 531 | (3) | Structural Equation Models |
| PSYC 536 | (3) | Correlational Techniques |
| PSYC 537 | (3) | Advanced Seminar in Psychology of Language |
| PSYC 538 | (3) | Categorization, Communication and Consciousness |
| PSYC 541 | (3) | Multilevel Modelling |
| PSYC 545 | (3) | Topics in Language Acquisition |
| PSYC 561 | (3) | Methods: Developmental Psycholinguistics |
| PSYC 562 | (3) | Measurement of Psychological Processes |

List B

6 credits in Psychology from List B (Social, Health, and Developmental Psychology).

| | | |
|----------|-----|---|
| PSYC 304 | (3) | Child Development Psychology of Deafness |
|----------|-----|---|

| | | |
|----------|-----|---|
| PSYC 507 | (3) | Emotions, Stress, and Illness |
| PSYC 509 | (3) | Diverse Clinical Populations |
| PSYC 512 | (3) | Advanced Personality Seminar |
| PSYC 528 | (3) | Vulnerability to Depression and Anxiety |
| PSYC 530 | (3) | Applied Topics in Deafness |
| PSYC 533 | (3) | International Health Psychology |
| PSYC 535 | (3) | Advanced Topics in Social Psychology |
| PSYC 539 | (3) | Advanced Topics in Social Psychology 2 |

6 credits at the 300 level or above.

9 credits in Psychology at the 400 or 500 level.

12 credits at the 300 level or above in any of the following disciplines: Psychology (PSYC), Anatomy and Cell Biology (ANAT), Biology (BIOL), Biochemistry (BIOC), Chemistry (CHEM), Computer Science (COMP), Mathematics (MATH), Physiology (PHGY), Psychiatry (PSYT).

13.33.9 Bachelor of Science (B.Sc.) - Honours Psychology (60 credits)

Honours in Psychology prepares students for graduate study, and so emphasizes practise in the research techniques which are used in graduate school and professionally later on. Students are normally accepted into Honours at the beginning of their U2 year, and the two-year sequence of Honours courses continues through U3.

Recommended Background

It is expected that most students who enter the Honours program in Psychology will have taken introductory psychology, biology, and statistics at the collegial level. Recommended CEGEP courses include Psychology 350-101 or 350-102 or equivalent; Biology CEGEP objective 00UK, 00XU or equivalent; and Statistics (Mathematics) 201-307 or 201-337 or equivalent. Students must obtain a minimum grade of 75% in their CEGEP-level statistics course. In the first year, those students who have not taken the recommended collegial-level statistics course, or those who have obtained a grade below 75%, must take Psychology PSYC 204. Those who have not taken the recommended collegial-level biology must take BIOL 111 or BIOL 112, and those who have not taken Introductory Psychology in CEGEP must take PSYC 100.

The application is available on the Psychology Dept website at:

<http://www.mcgill.ca/psychology/undergraduate/current-students/research-opportunities/research-courses>. The deadline is specified on the application form. Candidates will be informed of the Department's decision via email before classes begin in September.

Program Prerequisites

Admission to Honours is selective. Students with a cumulative grade point average (CGPA) of 3.00 or better are eligible to apply; however, since enrolment is limited, the usual CGPA for admission to this program is 3.50. Students must complete 27 graded credits in their U1 academic year to be eligible to apply to the Honours program.

Students must complete the following courses in their U1 year to be eligible to apply to the Honours program: PSYC 204, PSYC 211, PSYC 212, PSYC 213, and PSYC 215. Students are advised to complete PSYC 305 in their U1 year. Once in the Honours program, the student must obtain a GPA of 3.00 in the U2 year in order to continue in the program for U3. Honours students are encouraged to take at least 27 graded credits per academic year. This is also usually the minimum number of credits required to be eligible for fellowships and aw

| | | |
|----------|-----|---|
| PSYC 444 | (3) | Sleep Mechanisms and Behaviour |
| PSYC 451 | (3) | Human Factors Research and Techniques |
| PSYC 470 | (3) | Memory and Brain |
| PSYC 501 | (3) | Auditory Perception |
| PSYC 502 | (3) | Psychoneuroendocrinology |
| PSYC 506 | (3) | Cognitive Neuroscience of Attention |
| PSYC 513 | (3) | Human Decision-Making |
| PSYC 514 | (3) | Neurobiology of Memory |
| PSYC 522 | (3) | Neurochemistry and Behaviour |
| PSYC 526 | (3) | Advances in Visual Perception |
| PSYC 529 | (3) | Music Cognition |
| PSYC 531 | (3) | Structural Equation Models |
| PSYC 536 | (3) | Correlational Techniques |
| PSYC 537 | (3) | Advanced Seminar in Psychology of Language |
| PSYC 538 | (3) | Categorization, Communication and Consciousness |
| PSYC 541 | (3) | Multilevel Modelling |
| PSYC 545 | (3) | Topics in Language Acquisition |
| PSYC 561 | (3) | Methods: Developmental Psycholinguistics |
| PSYC 562 | (3) | Measurement of Psychological Processes |

List B

6 credits in Psychology from List B (Social, Health, and Developmental Psychology)

| | | |
|----------|-----|---|
| PSYC 304 | (3) | Child Development Psychology of Deafness |
|----------|-----|---|

| | | |
|----------|-----|---|
| PSYC 509 | (3) | Diverse Clinical Populations |
| PSYC 512 | (3) | Advanced Personality Seminar |
| PSYC 528 | (3) | Vulnerability to Depression and Anxiety |
| PSYC 530 | (3) | Applied Topics in Deafness |
| PSYC 533 | (3) | International Health Psychology |
| PSYC 535 | (3) | Advanced Topics in Social Psychology |
| PSYC 539 | (3) | Advanced Topics in Social Psychology 2 |

9 credits at the 300 level or above selected from:

Anatomy and Cell Biology (ANAT), Biochemistry (BIOC), Biology (BIOL), Chemistry (CHEM), Computer Science (COMP), Mathematics (MATH), Physiology (PHGY), Psychiatry (PYST), Psychology (PSYC).

13.34 Redpath Museum (REDM)

13.34.1 Location

Redpath Museum
859 Sherbrooke Street West
Montreal QC H3A 0C4
Telephone: 514-398-4086 ext. 3188
Fax: 514-398-3185
Email: redpath.museum@mcgill.ca
Website: mcgill.ca/redpath

13.34.2 About the Redpath Museum

The Redpath Museum fosters the study of the history and diversity of the natural world. Its mandate includes biological, geological, and cultural diversity, and science education. It conducts academic teaching and research activities and also provides academic services to other units. The Redpath Museum offers a B.Sc. **Minor** program in Natural History. REDM courses listed below are considered as ones taught by the Faculty of Science.

Redpath Museum Courses

| | |
|----------|--------------------------------|
| REDM 396 | Undergraduate Research Project |
| REDM 400 | Science and Museums |
| REDM 405 | Natural History of East Africa |
| REDM 511 | Advanced Museum-Based Science |

13.34.3 Redpath Museum Faculty

Director

Hans C.E. Larsson

Emeritus Professor

Robert L. Carroll; B.Sc.(Mich.), Ph.D.(Harv.), F.R.S.C., F.L.S.

Professors

David M. Green; B.Sc.(Br. Col.), M.Sc., Ph.D.(Guelph), F.L.S.

Andrew Hendry; B.Sc.(Vic., BC), M.Sc., Ph.D.(Wash.) (*joint appt. with Biology*)

Anthony Ricciardi; B.Sc.(Agr.), M.Sc., Ph.D.(McG.) (*joint appt. with Bieler School of Environment*)

| | | |
|------------|-----|--------------------------------|
| ENTO 350** | (3) | Insect Biology and Control |
| ENTO 440 | (3) | Insect Diversity |
| ENTO 535 | (3) | Aquatic Entomology |
| EPSC 334 | (3) | Invertebrate Paleontology |
| WILD 307 | (3) | Natural History of Vertebrates |
| WILD 350 | (3) | Mammalogy |
| WILD 420 | (3) | Ornithology |

List B: Botany

* Note: BIOL 205 and BIOL 215 may be applied to either List A or List B.

| | | |
|-----------|-----|--|
| AEBI 210 | (3) | Organisms 1 |
| BIOL 205* | (3) | Functional Biology of Plants and Animals |
| BIOL 215* | (3) | Introduction to Ecology and Evolution |
| BIOL 240 | (3) | Monteregian Flora |
| BIOL 355 | (3) | Trees: Ecology & Evolution |
| PLNT 304 | (3) | Biology of Fungi |
| PLNT 353 | (3) | Plant Structure and Function |
| PLNT 358 | (3) | Flowering Plant Diversity |
| PLNT 460 | (3) | Plant Ecology |

List C: Earth and Environmental Sciences

| | | |
|----------|-----|--------------------------------|
| BIOL 540 | (3) | Ecology of Species Invasions |
| ENVR 200 | (3) | The Global Environment |
| ENVR 202 | (3) | The Evolving Earth |
| EPSC 210 | (3) | Introductory Mineralogy |
| EPSC 233 | (3) | Earth and Life History |
| ESYS 200 | (3) | Earth System Processes |
| ESYS 300 | (3) | Investigating the Earth System |
| GEOG 203 | (3) | Environmental Systems |
| GEOG 272 | (3) | Earth's Changing Surface |
| GEOG 470 | (3) | Wetlands |
| GEOG 550 | (3) | Historical Ecology Techniques |

List D: Field Studies

* Note: Students may take either of the cross-listed courses NRSC 405 and REDM 405, but not both.

Students may also take other field courses with the permission of the Program Adviser.

| | | |
|----------|-----|---------------------------------------|
| BIOL 331 | (3) | Ecology/Behaviour Field Course |
| BIOL 334 | (3) | Applied Tropical Ecology |
| BIOL 335 | (3) | Marine Mammals |
| BIOL 573 | (3) | Vertebrate Palaeontology Field Course |
| ENTO 340 | (3) | Field Entomology |
| EPSC 231 | (3) | Field School 1 |

| | | |
|-----------|-----|--------------------------------|
| NRSC 405* | (3) | Natural History of East Africa |
| REDM 405* | (3) | Natural History of East Africa |
| WILD 475 | (3) | Desert Ecology |

13.35 Science or Mathematics for Teachers

13.35.1 Location

Dawson Hall, Room 405
 853 Sherbrooke Street West
 Montreal QC H3A 0G5
 Email: pete.barry@mcgill.ca
 Website: mcgill.ca/scienceforteachers

13.35.2 About Science or Mathematics for Teachers

The training and certification of school teachers has traditionally been the responsibility of the Faculty of Education and requires the completion of a Bachelor of Education, subject to regulations set by the Government of Quebec. The Faculties of Education and of Science offer the **Minor** in Education for Science Students for students in the B.Sc. who wish to combine Science or Mathematics with Education at McGill. The **Minor** allows Science students to develop or explore an interest in Education without committing themselves to completing a B.Ed. degree. Science students who have taken this Minor will have completed some of the necessary credits for the B.Ed. degree should they wish to enrol in that program. For details, see [section 13.35.4: Bachelor of Science \(B.Sc.\) - Minor Education for Science Students \(18 credits\)](#).

The traditional **Bachelor of Education**, Secondary Program, Science and Technology, or Secondary Program, Mathematics is available within the Faculty of Education; see [Faculty of Education > Undergraduate > Browse Academic Units & Programs > Department of Integrated Studies in Education > : Overview of Programs \(Integrated Studies in Education\)](#). Additionally, the **Master of Arts in Teaching and Learning** (MATL) is available in the Faculty of Education (see [Faculty of Education > Graduate > Browse Academic Units & Programs > : Integrated Studies in Education](#)).

13.35.3 Science or Mathematics for Teachers Faculty

Minor in Education for Science Students

Program Adviser: Jenna Prigioniero
 Faculty of Education
 Telephone: 514-398-7042
 Website: mcgill.ca/isa

13.35.4 Bachelor of Science (B.Sc.) - Minor Education for Science Students (18 credits)

This Minor allows Science students to develop or explore an interest in Education without committing themselves to completing a B.Ed. degree. Science students who have taken this Minor in Education will have completed some of the credits for the B.Ed. degree should they wish to enrol in that program. Students graduating with a B.Sc. should also consider the Master of Arts in Teaching and Learning (<http://www.mcgill.ca/dise/grad/>) if they are interested in obtaining a teaching license.

This minor program requires an application due to limited enrolment space. Please see <http://www.mcgill.ca/isa/faculty-advising/minor-programs> for procedures and deadlines.

For more information please contact:

Internships & Student Affairs Office, Faculty of Education

General Information: 514-398-7042

Website: <http://www.mcgill.ca/isa>

Required Courses (6 credits)

| | | |
|----------|-----|---------------------------|
| EDEC 260 | (3) | Philosophical Foundations |
| EDPE 300 | (3) | Educational Psychology |

Complementary Courses (12 credits)

3 credits from:

| | | |
|----------|-----|-------------------------------------|
| EDEC 233 | (3) | Indigenous Education |
| EDEC 248 | (3) | Equity and Education |
| EDEC 249 | (3) | Global Education and Social Justice |

3 credits from:

| | | |
|----------|-----|--|
| EDEC 247 | (3) | Policy Issues in Quebec and Indigenous Education |
| EDEM 220 | (3) | Contemporary Issues in Education |

6 credits from:

* Note: Students select either EDES 335 or EDES 353.

| | | |
|-----------|-----|----------------------------------|
| EDEC 262 | (3) | Media, Technology and Education |
| EDES 335* | (3) | Teaching Secondary Science 1 |
| EDES 353* | (3) | Teaching Secondary Mathematics 1 |
| EDPE 304 | (3) | Measurement and Evaluation |
| EDPI 341 | (3) | Instruction in Inclusive Schools |

6 credits from the list below:

* Note: Students select either EDES 335 or EDES 353.

| | | |
|-----------|-----|----------------------------------|
| EDEC 262 | (3) | Media, Technology and Education |
| EDES 335* | (3) | Teaching Secondary Science 1 |
| EDES 353* | (3) | Teaching Secondary Mathematics 1 |
| EDPE 304 | (3) | Measurement and Evaluation |
| EDPI 341 | (3) | Instruction in Inclusive Schools |