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

1 . McGill University reserves the right to mak

Publication Information

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14.30 Physiology (PHGY),

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, we are in the process of boldly transforming the way science is taught, with an increased emphasis on student/professor interaction and outreach. This new approach is reflected in the Faculty's slogan, *Learning Through Discovery*, which 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. In 2005, the Faculty opened its Office for Undergraduate Research in Science and launched a new Freshman Interest Groups program, which allows groups of 10 to 15 Freshman students to meet with a professor weekly.

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.

History of the Faculty of Science

The Concurrent B.Sc. and B.Ed. program is designed to provide you with the opportunity to obtain both a B.Sc. and a B.Ed. after a minimum of 135 credits of study. For more information, see *section 14.34: Science or Mathematics for Teachers* and *Programs, Courses and University Regulations > Faculties & Schools > Faculty of Education* .

In addition to the Major program in Software Engineering offered in the Faculty of Science, there is also a Bachelor of Software Engineering program offered jointly with the Faculty of Engineering (refer to *Programs, Courses and University Regulations > Faculties & Schools > Faculty of Engineering > Undergraduate > Academic Programs > : Department of Electrical and Computer Engineering*).

Finally, the Faculties of Arts and Science jointly offer the Bachelor of Arts and Science (B.A. & Sc.), which is described under *Programs, Courses and University Regulations > Faculties & Schools > Bachelor of Arts & Science* .

4 Revisions – Faculty of Science

Atmospheric and Oceanic Sciences

section 14.3.10: Atmospheric and Oceanic Sciences (ATOC) Related Programs

Biology

section 14.5.5: Biology (BIOL) Faculty

section 14.5.9: Bachelor of Science (B.Sc.) - Major Biology - Quantitative Biology (73 credits)

Chemistry

section 14.7.6: Bachelor of Science (B.Sc.) - Minor Chemical Engineering (24 credits)

Earth and Planetary Sciences

section 14.10.2: About Earth and Planetary Sciences

section 14.10.10: Earth and Planetary Sciences (EPSC) Related Progr

- Research budget of approximately $40 million, including $18 million from the Natural Sciences and Engineering Research Council of Canada, $5 million from Quebec and increasing annually. Approximately $150,000 generated annually per professor. Average of four papers per year.
- Faculty renewal: aided by a pool of innovative government initiatives such as the Canada Foundation for Innovation and its Canada Research Chairs program, as well as the Quebec Tax Holiday for technical workers; the Faculty has recruited 160 new professors since 2000.
- Canadian leader in Astrophysics and Cosmology, Climate Change and Extreme Weather, Green Chemistry, Life Sciences (developmental biology and cell information transfer), Earth Systems Science, Biodiversity and Conservation, Nanoscience and Social Neuroscience
- Lead faculty in the establishment of the multidisciplinary **McGill School of Environment** in 2000
- Offers top students an important **Field Studies Program**, which takes students out of the classroom and into the world to conduct research in biodiversity, climate change, volcanology, geology, and marine biology, and to work with native populations, governments, and NGOs in countries as wide-ranging as Africa, Panama, Barbados, the U.S., and Canada—all the way to Axel Heiberg Island, the University's Arctic research station.
- Established the **Reginald Fessenden Professorships and Prizes in Science Innovation**, the first such endowed program in Canada, to encourage and support the commercialization of research in Science conducted by world-class scholars.
- McGill's most multidisciplinary faculty, which conducts teaching and research in collaboration with many of the University's other faculties, including Medicine, Engineering, Music, Arts, Education, Management, and the Montreal Neurological Institute in neuroengineering and brain imaging
- Spearheaded the largest and most recent construction project at McGill, the **$120 million McGill Life Sciences Research Complex**, consisting of the **Francesco Bellini Building** and **Cancer Research Building**, which are physically linked to the McIntyre Medical and the Stewart Biology buildings.
- Established Canada's first comprehensive **Earth System Science Program** in 2006–2007, to study and research new forms of energy and gain a better understanding of climate change and natural hazards.
- Innovative: the **Tomlinson University Science Teaching Project** conducts groundbreaking university-level science education research, and develops innovative and effective teaching methods for science instructors.
- Inaugurated the **Office for Undergraduate Research** and the **Science Undergraduate Research Awards** to encourage top students to connect with professors during their degree program and pursue research projects in fields of interest, and established the **Freshman Interest Group** program, which provides an opportunity to meet other students, and help young students become more comfortable talking to and interacting with other professors.

5.1 Location

Dawson Hall
853 Sherbrooke Street West
Montreal, Quebec H3A 0G5
Canada

Telephone: 514-398-5442
Faculty website: *www.mcgill.ca/science*
Science Office for Undergraduate Student Advising (SOUSA): *www.mcgill.ca/science/student*

The Science Office for Undergraduate Student Advising (SOUSA) and the Office of the Director of Advising Services of the Faculty of Science are located in Dawson Hall, on the ground floor. SOUSA serves students in the B.Sc. and B.A. & Sc. degrees.

5.2 Administrative Officers

Dean

Martin Grant; B.Sc.(PEI), M.Sc., Ph.D.(Tor.)

Associate Dean (Academic)

Laurie Hendren; B.Sc., M.Sc.(Qu.), Ph.D.(C'nell)

Director of Advising Services

Nicole Allard; B.A.(W. Ont.), M.A.(Guelph), M.Ed.(McG.)

Associate Dean (Research and Graduate Education)

Peter Grütter; Ph.D.(Basel) (*James McGill Professor*)

Chief Academic Adviser

Pete Barry; B.Sc.(C'dia), M.Sc.(McG.)

Assistant to the Dean

Josie D'Amico

5.3 Science Office for Undergraduate Student Advising (SOUSA)

The Science Office for Undergraduate Student Advising (SOUSA) provides ongoing advice and guidance on academic issues related to programs, degree requirements, registration, course change, withdrawal, deferred exams, supplemental exams, academic standing, inter- and intra-faculty transfer, year or term away, transfer credits, second programs, second degrees, and graduation.

Every student in the B.Sc. degree is assigned an adviser in SOUSA. The adviser's name appears near the top of your Advising Transcript on Minerva. You can contact your adviser directly, or if you do not yet have a SOUSA adviser, at *adviser.science@mcgill.ca*.

SOUSA advisers provide assistance with degree planning and are a valuable referral source. They are a good place to start if you are not sure where to address your question. They also offer help managing academic situations during periods of personal, financial, or medical problems, by working with you to identify various possibilities and strategies for making informed decisions.

Special requests can be made, in writing, to the Director of Advising Services.

The Committee on Student Standing (CSS) will consider appeals of the Director of Advising Services' decisions. For information about CSS, see the Director of Advising Services' assistant.

6 Faculty Admission Requirements

For information about admission requirements for the B.Sc., please refer to the *Undergraduate Admissions Guide*, found at *www.mcgill.ca/applying*.

For information about inter-faculty transfers, refer to *Programs, Courses and University Regulations > University Regulations and Resources > Undergraduate > Registration > : Interfaculty Transfer* as well as the relevant information posted on the SOUSA website at *www.mcgill.ca/science/student/general/transfer*.

7 Faculty Degree Requirements

Each student in the Faculty of Science must be aware of the Faculty regulations as stated in this publication and on the McGill, Science, and SOUSA websites.

While departmental and faculty advisers and staff are always available to give advice and guidance, the ultimate responsibility for completeness and correctness of course selection and registration, for compliance with, and completion of, program and degree requirements, and for the observance of regulations and deadlines, *rests with you*. It is your responsibility to seek guidance from the Science Office for Undergraduate Student Advising (SOUSA) if in any doubt; misunderstanding or misapprehension will not be accepted as cause for dispensation from any regulation, deadline, program, or degree requirement.

To be eligible for a B.Sc. degree, you must fulfil all Faculty and program requirements as indicated below:

Faculty and program requirements

section 7.1: Minimum Credit Requirement

section 7.2: Residency Requirement

Programs, Courses and University Regulations > University Regulations and Resources > Undergraduate > Student Records > : Grading and Grade Point Averages (GPA)

section 7.3: Time and Credit Limit for the Completion of the Degree

section 7.4: About Program Requirements

section 7.5: Course Requirements

7.1 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.

7.1.1 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 credit, such as for Advanced Standing results.

AP Examination results with a score of 4 or 5 **must** be declared by you at the time of initial registration at the University.

For more information about Advanced Standing, consult: *www.mcgill.ca/students/transfercredit*.

7.1.2 Equivalencies for Non-Basic Science Courses

Note that equivalencies for some non-basic science courses, such as CHEM 212 and CHEM 222 and PSYC 204, are granted on a per-CEGEP basis. In some cases, a grade greater than the minimum passing grade may be required. For more information about equivalences for non-basic Science courses, please consult: *www.mcgill.ca/students/transfercredit/prospective/cegep*.

If the CEGEP and/or course is not listed on this website, you should refer to the SOUSA website and follow the instructions for Advanced Standing for students admitted to McGill from CEGEP: *www.mcgill.ca/science/student/newstudents/u1/orientation*.

7.1.3 Readmission after Interruption of Studies for a Period of Five Consecutive Years or More

If you are readmitted after interrupting your studies for a period of five consecutive years or more, you may be required to complete a minimum of 60 credits and satisfy the requirements of a program. In this case, a new CGPA will be calculated. The Director of Advising Services, in consultation with the appropriate department, may approve a lower minimum for students who had completed 60 credits or more before interrupting their studies.

If you are readmitted after a period of absence, you are subject to the program and degree requirements in effect at the time of readmission. The Director of Advising Services, in consultation with the department, may approve exemption from any new requirements.

7.2 Residency Requirement

To obtain a B.Sc. degree, you must satisfy the following residency requirements: a minimum of 60 credits of courses used to satisfy the B.Sc. degree requirements must be taken and passed at McGill, exclusive of any courses completed as part of the Science Freshman program; see *section 14.1: B.Sc. Freshman Program*. At least two-thirds of all departmental program requirements (Honours, Major, Core Science Components, or Minor) must normally be completed at McGill not including courses completed in a prior McGill degree. Exceptionally, students in major concentrations or interfaculty or honours programs who pursue an approved Study Away or Exchange program may, with prior approval from both their department and the Director of Advising Services, Faculty of Science, be exempted from the two-thirds rule. In addition, some departments may require that their students complete specific components of their program at McGill.

The residency requirement for diploma programs is 30 credits completed at McGill.

7.3 Time and Credit Limit for the Completion of the Degree

If you need 96 or fewer credits to complete your degree requirements, you are expected to complete your degree in no more than eight terms after your initial registration for the degree.

If you are a student in the Freshman Program, you become subject to these regulations one year after your initial registration. If you want to exceed this time limit, you must seek permission of the Director of Advising Services of the Faculty of Science.

If you are registered in the B.Sc., you are expected to complete the requirements of your program and your degree within 120 credits. You will receive credit for all courses (subject to degree regulations) taken up to and including the semester in which you obtain 120 credits. If you want to remain at McGill beyond that semester, you must also seek permission of the Director of Advising Services, Faculty of Science. Permission for exceeding the time and/or credit 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.

7.4 About 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: *www.mcgill.ca/science/programs*.

7.4.1 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:

7.5 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 examination in the course or do additional work for a supplemental grade, if these options are available, or repeat the course. Course substitution will be allowed only in special cases; you should consult your academic adviser.

Normally, you are permitted to repeat a failed course only once. (Failure is considered to be a grade of less than C or the administrative failures of J and KF.) If a required course is failed a second time, you must appeal to the Director of Advising Services for permission to take the course a third time. If permission is denied by the Director of Advising Services and/or by the Committee on Student Standing, on appeal, you must withdraw from the program. If the failed course is a complementary course required by the program, you may choose to replace it with another appropriate complementary course. If you choose to substitute another complementary course for a complementary course in which a D was received, credit for the first course will still be given, but as an elective. If you repeat a required course in which a D was received, credit will be given only once.

Full details of the course requirements for all programs offered are given in each unit's section together with the locations of departmental advisory offices, program directors, and telephone numbers should further information be required.

7.5.1 Course Overlap

You will not receive additional credit towards your degree for any course that overlaps in content with a course for which you have already received credit at McGill, at another university, at CEGEP, or for Advanced Placement, Advanced Level, International Baccalaureate, or French Baccalaureate results. It is your responsibility to consult the Science Office for Undergraduate Student Advising (SOUSA) or the department offering the course as to whether or not credit can be obtained and to be aware of exclusion clauses specified in the course description in this publication. Please refer to the following website for specific information about Advanced Standing credits and McGill course exemptions: *www.mcgill.ca/students/transfercredit*.

Sometimes the same course is offered by two different departments. Such courses are called "double-prefix" courses. When such courses are offered simultaneously, you should take the course offered by the department in which you are obtaining your degree. For example, in the case of double-prefix courses CHEM XYZ and PHYS XYZ, Chemistry students take CHEM XYZ and the Physics students take PHYS XYZ. If a double-prefix course is offered by different departments in alternate years, you may take whichever course best fits your schedule.

Credit for computer and statistics courses offered by faculties other than Science requires the permission of the Director of Advising Services and will be granted only under exceptional circumstances.

Credit for statistics courses will be given with the following stipulations:

- Credit will be given for ONLY ONE of the following introductory statistics courses: AEMA 310, BIOL 373, ECON 227D1/D2, ECON 257D1/D2, GEOG 202, MATH 203, MGCR 271, MGCR 273, PSYC 204, SOCI 350.
- 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.
- If you have already received credit for MATH 324 or MATH 357, you 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 j/o9PSY SOCI

- Students should consult the list of restricted courses outside of the Faculties of Arts and of Science on the SOUSA website (*www.mcgill.ca/science/student*).
- 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 requires the permission of the Director of Advising Services 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, the course will be flagged for no credit after the course change period.
- Credit will not be given for any "how to" courses offered by other faculties that are intended to provide you with only practical or professional training in specific applied areas. Examples include courses that teach the use of certain computer packages (databases, spreadsheets, etc.) or computer languages (SQL, COBOL, FORTRAN, etc.), machine shop or electronic shop courses, technical drawing courses, and professional practice courses.
- As a student in the **McGill School of Environment**, you may exceed the 18-credit limit for courses outside the Faculties of Arts and of Science, provided that all such courses are necessary to complete your program of study.
- As a student in the **Major in Software Engineering**, you may exceed the 18-credit limit for courses outside the Faculties of Arts and of Science, provided that all such courses are necessary to complete your program of study.
- As a student in the B.Sc. Liberal Program taking a **Major Concentration in Music**, you may exceed the 18-credit limit for courses outside the Faculties of Arts and of Science, provided that all such courses are necessary to complete your program of study, up to a maximum of 36 Music credits.
- If you registered in the **Minor in Management before September 2007**, you may take 21 credits of courses outside the Faculties of Arts and of Science.
- The 18-credit limit applies to students taking the **Minor in Nutrition**; equivalent courses in Science should be taken instead of courses in the Faculty of Agricultural and Environmental Sciences.

7.5.3 Correspondence, Distance Education, or Web-based Courses

As a Science student, you may obtain transfer credit for correspondence, distance education, or web-based courses if you receive prior approval from the appropriate McGill department for the course content **and** prior approval from the Director of Advising Services, Science, for the method of delivery and evaluation. Courses taught through distance education from institutions other than McGill will only be considered for transfer credits under the following conditions:

- The course is given by a government-accredited, degree-granting institution acceptable to McGill.
- The course counts for credit toward degrees granted at the institution giving the course.
- The combined total of regular course credits and distance education course credits do not exceed the permitted maximum number of credits per term according to Faculty regulations.
- Courses taught through distance education may not be used to complete program requirements, except on an individual basis when serious, documented circumstances warrant it.

7.5.4 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 at *www.mcgill.ca/science/student/continuingstudents/bsc/outside*.

7.5.5 Registration for First-Year Seminars

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 even 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 *Programs, Courses and University Regulations > Faculty of Arts > Undergraduate > Academic Programs > : First-Year Seminars*.

7.5.6 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.

Programs Offered

section 11.4: Bachelor of Arts and Science

section 7.4.5: Internship Year in Science (IYS)

section 13: Science Internships and Field Studies

section 11.6: Faculty of Arts Major and Minor Concentration Programs Available to Science Students

11.1 Bachelor of Science Program Groups

Science students admitted after September 2009 are limited to choosing liberal, majors, or honours programs within the Science group to which they were admitted, but may continue to choose freely from all available minor programs. Students pursuing a Liberal Science Program – Core Science Component (CSC) may also select a second CSC from any group. See *section 7.4.1: Liberal, Major, and Honours Programs*.

The groups within the B.Sc. are:

- Biological, Biomedical & Life Sciences
- Microbiology & Immunology
- Neuroscience
- Physical, Earth, Math & Computer Science
- Concurrent B.Sc./B.Ed. (Note that as of September 2011, no new students are being admitted to this group.)

For a list of specific programs in each group, see:

- *section 11.1.1: Biological, Biomedical & Life Sciences Group*
- *section 11.1.2: Microbiology and Immunology Group*
- *section 11.1.3: Neuroscience Group*
- *section 11.1.4: Physical, Earth, Math & Computer Science Group*
- *section 11.3: Concurrent B.Sc. and B.Ed. Program (Science or Mathematics for Teachers)* (Note that as of September 2011, no new students are being admitted to this group.)

To change to a major or honours program in another Science group, students must make an Intra-Faculty Transfer application.

See: *www.mcgill.ca/science/student/general/transfer*.

11.1.1 Biological, Biomedical & Life Sciences Group

11.1.1.1 Liberal Program – Core Science Components

- Anatomy and Cell Biology: *section 14.2.4: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Anatomy and Cell Biology (48 credits)*
- Biochemistry: *section 14.4.5: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Biochemistry (47 credits)*
- Biology: *section 14.5.7: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Biology (47 credits)*
- Physiology: *section 14.30.4: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Physiology (50 credits)*
- Psychology: *section 14.32.7: Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Psychology (45 credits)*

11.1.1.2 Major Programs

- Anatomy and Cell Biology: *section 14.2.5: Bachelor of Science (B.Sc.) - Major Anatomy and Cell Biology (67 credits)*
- Biochemistry: *section 14.4.6: Bachelor of Science (B.Sc.) - Major Biochemistry (67 credits)*
- Biology: *section 14.5.8: Bachelor of Science (B.Sc.) - Major Biology (59 credits)*
- Biology – Quantitative Biology: *section 14.5.9: Bachelor of Science (B.Sc.) - Major Biology - Quantitative Biology (73 credits)*
- Pharmacology: *section 14.28.5: Bachelor of Science (B.Sc.) - Major Pharmacology (65 credits)*
- Physiology: *section 14.30.5: Bachelor of Science (B.Sc.) - Major Physiology (65 credits)*
- Psychology: *section 14.32.8: Bachelor of Science (B.Sc.) - Major Psychology (54 credits)*

11.1.1.3 Joint Major Programs

- Biology and Mathematics: *section 14.5.10: Bachelor of Science (B.Sc.) - Major Biology and Mathematics (76 credits)*
- Computer Science and Biology: *section 14.9.11: Bachelor of Science (B.Sc.) - Major Computer Science and Biology (73 credits)*
- Physiology and Mathematics: *section 14.30.6: Bachelor of Science (B.Sc.) - Major Physiology and Mathematics (77 credits)*
- Physiology and Physics: *section 14.30.7: Bachelor of Science (B.Sc.) - Major Physiology and Physics (80 credits)*

11.1.1.4 Honours Programs

- Anatomy and Cell Biology: *section 14.2.6: Bachelor of Science (B.Sc.) - Honours Anatomy and Cell Biology (73 credits)*
- Biochemistry: *section 14.4.7: Bachelor of Science (B.Sc.) - Honours Biochemistry (76 credits)*
- Biology: *section 14.5.11: Bachelor of Science (B.Sc.) - Honours Biology (75 credits)*
- Pharmac0 0 1 67.52 5596.777 Tm(•)T2

- Chemistry – Physical option: *section 14.7.9: Bac*

- Physics and Geophysics: *section 14.29.10: Bachelor of Science (B.Sc.) - Major Physics and Geophysics (69 credits)*
- Physiology and Mathematics: *section 14.30.6: Bachelor of Science (B.Sc.) - Major Physiology and Mathematics (77 credits)*
- Physiology and Physics: *section 14.30.7: Bachelor of Science (B.Sc.) - Major Physiology and Physics (80 credits)*
- Statistics and Computer Science: *section 14.21.11: Bachelor of Science (B.Sc.) - Major Statistics and Computer Science (72 credits)*

11.1.4.4 Honours Programs

- Applied Mathematics: *section 14.21.12: Bachelor of Science (B.Sc.) - Honours Applied Mathematics (60 credits)*
- Atmospheric Science: *section 14.3.8: Bachelor of Science (B.Sc.) - Honours Atmospheric Science (73 credits)*
- Chemistry: *section 14.7.14: Bachelor of Science (B.Sc.) - Honours Chemistry (71 credits)*
- Chemistry – Bio-organic option: *section 14.7.16: Bachelor of Science (B.Sc.) - Honours Chemistry - Bio-organic (75 credits)*
- Chemistry – Atmosphere and Environment option: *section 14.7.15: Bachelor of Science (B.Sc.) - Honours Chemistry - Atmosphere and Environment (75 credits)*
- Chemistry – Materials: *section 14.7.17: Bachelor of Science (B.Sc.) - Honours Chemistry - Materials (74 credits)*
- Computer Science: *section 14.9.14: Bachelor of Science (B.Sc.) - Honours Computer Science (75 credits)*
- Earth Sciences: *section 14.10.8: Bachelor of Science (B.Sc.) - Honours Earth Sciences (75 credits)*
- Earth System Science: *section 14.11.5: Bachelor of Science (B.Sc.) - Honours Earth System Science (66 credits)*
- Environment: *section 14.12.15: Bachelor of Science (B.Sc.) - Honours Environment (72 credits)*
- Geography: *section 14.16.9: Bachelor of Science (B.Sc.) - Honours Geography (66 credits)*
- Mathematics: *section 14.21.13: Bachelor of Science (B.Sc.) - Honours Mathematics (60 credits)*
- Physics: *section 14.29.12: Bachelor of Science (B.Sc.) - Honours Physics (78 credits)*
- Planetary Sciences: *section 14.10.9: Bachelor of Science (B.Sc.) - Honours Planetary Sciences (81 credits)*
- Probability and Statistics: *section 14.21.15: Bachelor of Science (B.Sc.) - Honours Probability and Statistics (64 credits)*
- Software Engineering: *section 14.9.15: Bachelor of Science (B.Sc.) - Honours Software Engineering (75 credits)*

11.1.4.5 Joint Honours Programs

- Mathematics and Computer Science: *section 14.21.14: Bachelor of Science (B.Sc.) - Joint Honours Mathematics and Computer Science (75 credits)*
- Mathematics and Physics: *section 14.29.13: Bachelor of Science (B.Sc.) - Honours Mathematics and Physics (81 credits)*
- Physics and Chemistry: *section 14.29.14: Bachelor of Science (B.Sc.) - Honours Physics and Chemistry (80 credits)*
- Statistics and Computer Science: *section 14.21.16: Bachelor of Science (B.Sc.) - Honours Statistics and Computer Science (79 credits)*

11.2 Minor Programs

Minor Programs

Atmospheric Science, *section 14.3.4: Bachelor of Science (B.Sc.) - Minor Atmospheric Science (18 credits)*

Biology, *section 14.5.6: Bachelor of Science (B.Sc.) - Minor Biology (25 credits)*

Biotechnology, *section 14.6.5: Bachelor of Science (B.Sc.) - Minor Biotechnology (for Science Students) (24 credits)*

Chemical Engineering, *section 14.7.6: Bachelor of Science (B.Sc.) - Minor Chemical Engineering (24 credits)*

Chemistry, *section 14.7.5: Bachelor of Science (B.Sc.) - Minor Chemistry (18 credits)*

Cognitive Science, *section 14.8.2: Bachelor of Science (B.Sc.) - Minor Cognitive Science (24 credits)*

Computer Science, *section 14.9.7: Bachelor of Science (B.Sc.) - Minor Computer Science (24 credits)*

Earth System Science, *section 14.11.3: Bachelor of Science - Minor Earth System Science (18 credits)*

Education for Science Students, *section 14.34.4: Bachelor of Science (B.Sc.) - Minor Education for Science Students (18 credits)*

Electrical Engineering, *section 14.29.7: Bachelor of Science (B.Sc.) - Minor Electrical Engineering (24 credits)*

Environment, *section 14.12.3: Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Minor Environment (18 credits)*

Field Study, *section 14.14.1: Field Studies - Minor Field Studies (18 credits)*

Minor Programs

Finance for Non-Management Students, *section 14.20.1: Minor Finance (For Non-Management Students) (18 credits)*

General Science, *section 14.15.3: Bachelor of Science (B.Sc.) - Minor General Science (18 credits)*

Geochemistry, *section 14.10.5: Bachelor of Science (B.Sc.) - Minor Geochemistry (18 credits)*

Geography, *section 14.16.5: Bachelor of Science (B.Sc.) - Minor Geography (18 credits)*

Geographic Information Systems and Remote Sensing, *section 14.16.6: Bachelor of Science (B.Sc.) - Minor Geographic Information Systems and Remote Sensing (18 credits)*

Geology, *section 14.10.4: Bachelor of Science (B.Sc.) - Minor Geology (18 credits)* (*previously named Earth and Planetary Sciences*)

Human Nutrition – see *Programs, Courses and University Regulations > Faculties & Schools > Faculty of Agricultural and Environmental Sciences > Undergraduate > Academic Programs > : Minor Human Nutrition (24 credits)*

Interdisciplinary Life Sciences, *section 14.18.3: Bachelor of Science (B.Sc.) - Minor Interdisciplinary Life Sciences (24 credits)*

Kinesiology, *section 14.19.3: Bachelor of Science (B.Sc.) - Minor Kinesiology (24 credits)*

Management for Non-Management Students, *section 14.20.2: Minor Management (For Non-Management Students) (18 credits)*

Marketing for Non-Management Students, *section 14.20.3: Minor Marketing (For Non-Management Students) (18 credits)*

Mathematics, *section 14.21.5: Bachelor of Science (B.Sc.) - Minor Mathematics (24 credits)*

Musical Applications of Technology – see *Programs, Courses and University Regulations > Faculties & Schools > Schulich School of Music > Undergraduate > : Minor Musical Applications of Technology (18 credits)*

Musical Science and Technology – see *Programs, Courses and University Regulations > Faculties & Schools > Schulich School of Music > Undergraduate > : Minor Musical Science and Technology (18 credits)*

Natural History, *section 14.33.4: Bachelor of Science (B.Sc.) - Minor Natural History (24 credits)*

Neuroscience, *section 14.25.3: Bachelor of Science (B.Sc.) - Minor Neuroscience (25 credits)*

Operations Management for Non-Management Students, *section 14.20.4: Minor Operations Management (For Non-Management Students) (18 credits)*

Pharmacology, *section 14.28.4: Bachelor of Science (B.Sc.) - Minor Pharmacology (24 credits)*

Physics, *section 14.29.6: Bachelor of Science (B.Sc.) - Minor Physics (18 credits)*

Psychology, *section 14.32.6: Bachelor of Science (B.Sc.) - Minor Psychology (24 credits)*

Statistics, *section 14.21.6: Bachelor of Science (B.Sc.) - Minor Statistics (24 credits)*

Technological Entrepreneurship for Science Students – application required, see *program listing*: *section 14.35.3: Bachelor of Science (B.Sc.) - Minor Technological Entrepreneurship for Science Students (18 credits)* (*Please note that this Minor is currently under review.*)

Notes:

1. The Minor in Chemical Engineering is only available to students in Chemistry.
2. The Minor in Electrical Engineering is only available to students in the Major program in Physics.
3. The Minor in General Science is only available to students in B.Sc. Liberal programs.

11.3 Concurrent B.Sc. and B.Ed. Program (Science or Mathematics for Teachers)

Note: The Concurrent B.Sc. and B.Ed. program is no longer accepting new students as of Fall 2011.

Concurrent B.Sc. and B.Ed. Programs (see *section 14.34: Science or Mathematics for Teachers*)

Major in Mathematics for Teachers – *section 14.34.13: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Mathematics for Teachers (135 credits)*

Major Concentration in Biology with a Minor in Chemistry for Teachers – *section 14.34.5: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Cell/Molecular with Minor Chemistry for Teachers (135 credits)* or *section 14.34.6: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Organismal with Minor Chemistry for Teachers (135 credits)*

Concurrent B.Sc. and B.Ed. Programs (see *section 14.34: Science or Mathematics for Teachers*)

Major Concentration in Biology with a Minor in Physics for Teachers – *section 14.34.7: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Cell/Molecular with Minor Physics for Teachers (135 credits)* or *section 14.34.8: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Organismal with Minor Physics for Teachers (135 credits)*

Major Concentration in Chemistry with a Minor in Biology for Teachers – *section 14.34.9: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Chemistry with Minor Biology for Teachers (135 credits)*

Major Concentration in Chemistry with a Minor in Physics for Teachers – *section 14.34.10: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Chemistry with Minor Physics for Teachers (135 credits)*

Major Concentration in Physics with a Minor in Biology for Teachers – *section 14.34.11: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Physics with Minor Biology for Teachers (135 credits)*

Major Concentration in Physics with a Minor in Chemistry for Teachers – *section 14.34.12: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Physics with Minor Chemistry for Teachers (135 credits)*

11.4 Bachelor of Arts and Science

Please see *Programs, Courses and University Regulations > Faculties & Schools > Bachelor of Arts and Science* for details.

11.5 Internship Programs – Industrial Practicum (IP) and Internship Year in Science (IYS)

The Faculty of Science offers an internship program which features the Industrial Practicum (4 months) and the Internship Y

Major Concentrations

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 Arts (B.A.) - Major Concentration International Development Studies (36 credits)*

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

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

Langue et littérature françaises - Études et pratiques littéraires, *: Baccalauréat ès Arts (B.A.) - Concentration majeure langue et littérature françaises - Études et pratiques littéraires (36 crédits)*

Langue et littérature françaises - Traduction, *: Baccalauréat ès Arts (B.A.) - Concentration majeure langue et littérature françaises - Traduction (36 crédits)*

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

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

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

Music (available to students in B.Sc. Liberal only), *: Bachelor of Arts (B.A.) - Major Concentration Music (36 credits)*

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

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

Philosophy and Western Religions, *: Bachelor of Arts (B.A.) - Major Concentration Philosophy and Western Religions (36 credits)*

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

Québec Studies, *: Bachelor of Arts (B.A.) - Major Concentration Quebec Studies / La concentration Majeur en Études sur le Québec (36 credits)*

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

Scriptures and Interpretation – see Religious Studies, *: Bachelor of Arts (B.A.) - Major Concentration Scriptures and Interpretations (36 credits)*

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

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

World Religions – see Religious Studies, *: Bachelor of Arts (B.A.) - Major Concentration World Religions (36 credits)*

11.6.2 Minor Concentrations

Minor Concentrations

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

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

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

Canada/Québec – see Political Science, *: Bachelor of Arts (B.A.) - Minor Concentration Political Science: Canada/Québec (18 credits)*

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

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

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

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

Communication Studies – see Art History and Communication Studies, *: Bachelor of Arts (B.A.) - Minor Concentration Communication Studies (18 credits)*

Comparative Politics – see Political Science, *: Bachelor of*

Minor Concentrations

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

English – Drama and Theatre, *: Bachelor of Arts (B.A.) - Minor Concentration English - Drama and Theatre (18 credits)*

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

Geographical Information Systems - see Geography, *: Bachelor of Arts (B.A.) - Minor Concentration Geographic Information Systems (18 credits)*

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

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

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

German Literature and Culture in Translation, *: Bachelor of Arts (B.A.) - Minor Concentration German Literature and Culture in Translation (18 credits)*

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

Hispanic Literature and Culture, *: Bachelor of Arts (B.A.) - Minor Concentration Hispanic Literature and Culture (18 credits)*

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

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

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

International Relations – see Political Science, *: Bachelor of Arts (B.A.) - Minor Concentration International Relations (18 credits)*

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

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

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

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

Langue et littérature françaises – Critique littéraire, *: Baccalauréat ès Arts (B.A.) - Concentration mineure langue et littérature françaises - Critique littéraire (18 crédits)*

Langue et littérature françaises – Études et pratiques littéraires, *: Baccalauréat ès Arts (B.A.) - Concentration mineure langue et littératineur*

Minor Concentrations

Scriptural Languages – see Religious Studies, *: Bachelor of Arts (B.A.) - Minor Concentration Scriptural Languages (18 credits)*

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

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

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

South Asia – see Political Science, *: Bachelor of Arts (B.A.) - Minor Concentration South Asia (18 credits)*

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

World Religions – see Religious Studies, *: Bachelor of Arts (B.A.) - Minor Concentration World Religions (18 credits)*

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

12 Undergraduate Research Opportunities

Because McGill is a research-intensive university, research informs the curriculum. There are many opportunities for talented students to take part in research during their undergraduate studies, whether at McGill, in affiliated hospitals, at other universities, or in the field. Many of these are organized through formal courses or programs organized by the Faculty of Science or its departments. For more information, see the following:

- *section 12.1: Research Project Courses*
- *section 12.1.1: "396" Undergraduate Research Project Courses*
- *section 12.2: Undergraduate Student Research Awards* – NSERC USRA, NSERC Industrial USRA, SURA, FRSQ USRA
- *section 12.3: Undergraduate Research Conference*
- *section 12.4: Other opportunities*
- Dean's Multidisciplinary Undergraduate Research List – see description elsewhere in *Programs, Courses and University Regulations > University Regulations and Resources > Undergraduate > Graduation > : Graduation Honours: Faculty of Science Dean's Multidisciplinary Undergraduate Research List*

The **Office for Undergraduate Research in Science (OURS)** coordinates several of the aforementioned programs, and can help students find out about other opportunities. Visit the OURS website at *www.mcgill.ca/science/research/ours* to find out more.

Because internships and field study programs may include a research component, please also see:

- *section 13.1: Industrial Practicum (IP) and Internship Year in Science (IYS)*
- *section 13.2: Field Study and Study Abroad*

12.1 Research Project Courses

Departments offer a variety of research-based courses that allow you to perform research under the supervision of a McGill researcher for academic credit. Depending on the unit, courses featuring undergraduate research may bear names such as: majors project, honours project, advanced lab, independent research, technical project, independent study, or research project and seminar. For more information, see the research course list online at *www.mcgill.ca/science/research/ours/researchc8.906 413.215 Tmb.fi8.695 Tm1(tunities)Tj1 0 0 1 43.5,0 1 107.357 37695 Tm1(tunities)Tj1.Iw*

12.2 Undergraduate Student Research Awards

There are several award programs that fund undergraduate student research projects at McGill (and sometimes off-campus), usually in the summer. Please see the following:

- *section 12.2.1: NSERC Undergraduate Student Research Awards*
- *section 12.2.2: NSERC Industrial Undergraduate Student Research Awards*
- *section 12.2.3: SURA: Science Undergraduate Research Awards*
- *section 12.2.4: FRSQ Undergraduate Student Research Awards*

Please also consult the Office for Undergraduate Research in Science website at *www.mcgill.ca/science/research/ours* for any new programs that may have been added.

12.2.1 NSERC Undergraduate Student Research Awards

The Natural Sciences and Engineering Research Council of Canada Undergraduate Student Research Awards (NSERC USRA) in Universities program supports 16 consecutive weeks of paid full-time research under the supervision of a professor who holds an NSERC grant. It is an excellent way to prepare for graduate studies or a future career in science. This program is offered at other universities across Canada, and a travel allowance from NSERC is available.

To apply, students must first identify a pro137.513 541.601 Tmn8ts must firstm(This prra r)Tj1 0 0 4,Tm(war)Tj1 0 51hould1 71.8intsj1 lRSQ Under

Science website (*www.mcgill.ca/science/research/ours*); however, many opportunities arise as a result of students talking with their professors. For advice on approaching professors, and more generally on how to get involved in research, see *www.mcgill.ca/science/research/ours/how*.

In addition to opportunities available at McGill, there are several external opportunities at other institutions. Many of these are catalogued at *www.mcgill.ca/science/research/ours/opportunities*. You may also want to look for additional opportunities funded or offered by the relevant research agencies, institutions, and universities of interest: for example, a provincial cancer research society, a national science funding agency, or a national psychological association.

13 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 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.

13.1 Industrial Practicum (IP) and Internship Year in Science (IYS)

These programs are open to all Science undergraduate students. An internship is a career-related, professionally supervised, paid work term and done during your undergraduate degree in a field related to your studies. Internships may have a basis in research. To be eligible to apply:

- You must be a full-time undergraduate student in Science before and after the IP or the IYS is completed.
- You must have completed at least 27 credits and should have at least 12 credits remaining in your degree program.
- Your CGPA must be 2.7 or higher.
- International students are eligible to apply to all IYS positions (unless otherwise indicated in the job posting) and to summer IPs (provided the student has an off-campus work permit).

For more information on IP and IYS, please see *section 7.4.5: Internship Year in Science (IYS)* and *www.mcgill.ca/science/internships-field/internships*.

13.2 Field Study and Study Abroad

McGill's Field Study Semester programs (in Africa, Barbados, and Panama) are research-based, as are many shorter field courses offered by the Departments of Biology, Earth & Planetary Sciences, and Geography. See *Programs, Courses and University Regulations > Faculties & Schools > Field Studies > Undergraduate > : Opportunities for Field Study and Study Abroad* and *www.mcgill.ca/science/student/internships-field* for more information about these programs and courses.

14 Academic Programs

What is a Major Program?

A major is a versatile, comprehensive primary area of study. Most major .17 Tmh(A major is Tm(Y)Tj1 0 s188 238.17 Tm.(A maj,eprogra.ca/science/st8718.84ld)Tj0 G

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14.2.2 About Anatomy and Cell Biology

The Department of Anatomy and Cell Biology offers courses that deal with cell biology, 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. Students should choose their major based on their interest and also consider the Interdisciplinary Minor in Life Sciences. A B.Sc. in Anatomy and Cell Biology provides an excellent preparation for technical and administrative positions in laboratories of universities, research institutions, hospitals, 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 new cryo-electron microscope facility in the Department is unique and represents a cutting edge technology to apply fundamental discoveries to therapeutic applications.

Inquiries about programs should be directed to the Department of Anatomy and Cell Biology.

14.2.3 Anatomy and Cell Biology (ANAT) Faculty

Chair
Craig Mandato

Associate Professors

M.F. Lalli; B.Sc., M.Sc.(Bowling Green), Ph.D.(McG.)

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

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

Hojatollah Vali; B.Sc., M.Sc., Ph.D.(Munich) (*joint appt. with Earth and Planetary Sciences*)

Assistant Professors

Fiona Bedford; B.Sc.(Birm.), Ph.D.(Lond.)

Isabelle Rouiller; Ph.D.(UK)

Associate Members

John J.M. Bergeron (*Medicine*)

Albert Berghuis (*Biochemistry*)

Colin Chalk (*Neurology & Neurosurgery*)

Jean-Fran

Adjunct Professors

Atilla Sik; M.Sc., Ph.D.(Hungary)

Faculty Lecturer

Ayman Behiery; M.B., Ch.B.(Cairo)

14.2.4 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)

* 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:

List A

9 credits selected from:

ANAT 321	(3)	Circuitry of the Human Brain
ANAT 322	(3)	Neuroendocrinology
ANAT 365	(3)	Cellular Trafficking
ANAT 381	(3)	Basis of Embryology
ANAT 565	(3)	Diseases-Membrane Trafficking
NEUR 310	(3)	Cellular Neurobiology

List B

6-7 credits selected from:

ANAT 321	(3)	Circuitry of the Human Brain
ANAT 322	(3)	Neuroendocrinology
ANAT 365	(3)	Cellular Trafficking
ANAT 381	(3)	Basis of Embryology

ANAT 565	(3)	Diseases-Membrane Trafficking
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 Oncogenes
BIOL 320	(3)	Evolution of Brain and Behaviour
EXMD 504	(3)	Biology of Cancer
NEUR 310	(3)	Cellular Neurobiology
PATH 300	(3)	Human Disease
PHAR 300	(3)	Drug Action
PHAR 301	(3)	Drugs and Disease

14.2.5 Bachelor of Science (B.Sc.) - Major Anatomy and Cell Biology (67 credits)

Required Courses (43 credits)

Note: ANAT 261 must be taken in U1.

* 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/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
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 Cour(3)

ANAT 322	(3)	Neuroendocrinology
ANAT 365	(3)	Cellular Trafficking
ANAT 381	(3)	Basis of 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 565	(3)	Diseases-Membrane Trafficking
MIMM 314	(3)	Intermediate Immunology
NEUR 310	(3)	Cellular Neurobiology

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

ANAT 322	(3)	Neuroendocrinology
ANAT 365	(3)	Cellular Trafficking
ANAT 381	(3)	Basis of Embryology
ANAT 416	(3)	Development, Disease and Regeneration
ANAT 432	(9)	Honours Research Project
ANAT 458	(3)	Membranes and Cellular Signaling
ANAT 541	(3)	Cell and Molecular Biology of Aging
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

BIOT 505	(3)	Selected Topics in Biotechnology
EXMD 401	(3)	Physiology and Biochemistry Endocrine Systems
EXMD 502	(3)	Advanced Endocrinology 01
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)Tm6	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 303	(3)	Principles of Toxicology
PHAR 562	(3)	General Pharmacology 1
PHAR 563	(3)	General Pharmacology 2
PHGY 311	(3)	Channels, Synapses & Hormones
PHGY 312	(3)	Respiratory, Renal, & Cardiovascular Physiology
PHGY 313	(3)	Blood, Gastrointestinal, & Immune Systems Physiology
PHGY 314	(3)	Integrative Neuroscience
PHGY 45 Hormones	(3)ATm24	Advanced Neurophysiology

student must have a CGPA of at least 3.20 at the end of their U2 year. It is expected that at the beginning of the third year, the students who wish to continue in the Honours program will be those who feel that they are seriously interested in a career in Cell Biology. The Honours degree will be recommended after successful completion of the program with a CGPA of at least 3.20.

Required Courses (52 credits)

Note: ANAT 261 must be taken in U1.

* 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/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
ANAT 432	(9)	Honours Research Project
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
		Principles of P 7lt(BIOLu6.961 Tm2118endourses:)Tj.691 657.001 Tm(v001 Tms Tm21 1 0 0 1 70.544.581 0 0 1 86.88

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

ANAT 322	(3)	Neuroendocrinology
ANAT 365	(3)	Cellular Trafficking
ANAT 381	(3)	Basis of Embryology
ANAT 416	(3)	Development, Disease and Regeneration
ANAT 432	(9)	Honours Research Project
ANAT 458	(3)	Membranes and Cellular Signaling
ANAT 541	(3)	Cell and Molecular Biology of Aging
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 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 314	(3)	Molecular Biology of Oncogenes
BIOL 320	(3)	Evolution of Brain and Behaviour
BIOL 370	(3)	Human Genetics Applied
BIOL 514	(3)	Neurobiology Learning and Memory
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
EXMD 401	(3)	Physiology and Biochemistry Endocrine Systems
EXMD 502	(3)	Advanced Endocrinology 01
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 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
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)	General Pharmacology 1
PHAR 563	(3)	General Pharmacology 2
PHGY 311	(3)	Channels, Synapses & 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)	Cellular Immunology
PHGY 515	(3)	Physiology of Blood 1
PHGY 516	(3)	Physiology of Blood 2
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

14.3 Atmospheric and Oceanic Sciences (ATOC)

14.3.1 Location

Burnside Hall, Room 945
805 Sherbrooke Street West
Montreal, Quebec H3A 0B9

Telephone: 514-398-3764
Fax: 514-398-6115
Email: *undergraduateinfo@meteo.mcgill.ca*
Website: *www.mcgill.ca/meteo*

14.3.2 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 improv

Adjunct Professors

Ashu Dastoor; Ph.D.(Indian IT)

Luc Fillion; Ph.D.(McG.)

Pierre Gauthier; Ph.D.(McG.)

Hai Lin; Ph.D.(McG.)

Damon Matthews; Ph.D.(Vic., BC)

Seok-Woo Son; Ph.D.(Penn.)

Associate Member

Michel Bourqui; Ph.D.(ETH Zurich)

14.3.4 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 (15 credits)

ATOC 214	(3)	Introduction: Physics of the Atmosphere
ATOC 215	(3)	Oceans, Weather and Climate
ATOC 309	(3)	Weather Radars and Satellites
ATOC 315	(3)	Thermodynamics and Convection

Either of the following courses:

ATOC 219	(3)	Introduction to Atmospheric Chemistry
CHEM 219	(3)	Introduction to Atmospheric Chemistry

Complementary Course (3 credits)

3 credits from the following:

ATOC 312	(3)	Rotating Fluid Dynamics
ATOC 357	(3)	Atmospheric and Oceanic Science Laboratory

14.3.5 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
MATH 315	(3)	Ordinary Differential Equations

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:

ATOC 357	(3)	Atmospheric and Oceanic Science Laboratory
PHYS 257	(3)	Experimental Methods 1

3 credits selected from:

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

3 credits selected from:

PHYS 232	(3)	Heat and Waves
PHYS 253	(3)	Thermal Physics

12-16 credits selected from (at least 6 of which must be ATOC):

ATOC 309	(3)	Weather Radars and Satellites
ATOC 419	(3)	Advances in Chemistry of Atmosphere
ATOC 512	(3)	Atmospheric and Oceanic Dynamics
ATOC 513	(3)	Waves and Stability
ATOC 515	(3)	Turbulence in Atmosphere and Oceans
ATOC 521	(3)	Cloud Physics
ATOC 525	(3)	Atmospheric Radiation
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 558	(3)	Numerical Methods and Laboratory
ATOC 568	(3)	Ocean Physics
COMP 208	(3)	Computers in Engineering
MATH 203	(3)	Principles of Statistics 1
		Introduction to Partial Dif

ATOC 214	(3)	Introduction: Physics of the Atmosphere
ATOC 312	(3)	Rotating Fluid Dynamics
ATOC 315	(3)	Thermodynamics and Convection
COMP 208	(3)	Computers in Engineering
MATH 222	(3)	Calculus 3
MATH 223	(3)	Linear Algebra
MATH 314	(3)	Advanced Calculus

ATOC 540	(3)	Synoptic Meteorology 1
ATOC 541	(3)	Synoptic Meteorology 2
ATOC 546	(1)	Current Weather Discussion
ATOC 558	(3)	Numerical Methods and Laboratory
ATOC 568	(3)	Ocean Physics
CHEM 223	(2)	Introductory Physical Chemistry 1
CHEM 243	(2)	Introductory Physical Chemistry 2
CHEM 253	(1)	Introductory Physical Chemistry 1 Laboratory
CHEM 263	(1)	Introductory Physical Chemistry 2 Laboratory
CHEM 367	(3)	Instrumental Analysis 1
CHEM 575	(3)	Chemical Kinetics
EPSC 320	(3)	Elementary Earth Physics
EPSC 340	(3)	Earth and Planetary Inference

ATOC 541	(3)	Synoptic Meteorology 2
ATOC 546	(1)	Current Weather Discussion
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 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 339	(3)	Measurements Laboratory in General Physics
PHYS 340	(3)	Majors Electricity and Magnetism
PHYS 342	(3)	Majors Electromagnetic Waves
PHYS 446	(3)	Majors Quantum Physics

Complementary Course (3 credits)

Students select one of the following courses:

PHYS 432	(3)	Physics of Fluids
PHYS 434	(3)	Optics
PHYS 439	(3)	Majors Laboratory in Modern Physics

14.3.8 Bachelor of Science (B.Sc.) - Honours Atmospheric Science (73 credits)

72-73 credits

Students can be admitted to the Honours program after completion of the U1 year of the Major in Atmospheric Science program with a minimum GPA of 3.30. Students having completed a U1 year in a different program with high standing may be admitted to the Honours program on the recommendation of that department.

A minimum GPA of 3.30 in the Honours program courses (taken as a whole) is required to remain in the program. A CGPA of 3.30 on the total program is also required to graduate with honours.

Required Courses (27 credits)

ATOC 214	(3)	Introduction: Physics of the Atmosphere
ATOC 312	(3)	Rotating Fluid Dynamics
ATOC 315	(3)	Thermodynamics and Convection
ATOC 480	(3)	Honours Research Project
COMP 208	(3)	Computers in Engineering
MATH 222	(3)	Calculus 3
MATH 223	(3)	Linear Algebra
MATH 314	(3)	Advanced Calculus
MATH 315	(3)	Ordinary Differential Equations

Complementary Courses (46 credits)

45-46 credits

Note: All students are encouraged to consult with the undergraduate adviser for help selecting from among the complementary courses. As general recommendations (but not programmatic requirements), students wishing to comply with Environment Canada recommendations for careers in operational meteorology are advised to take ATOC 215, 309, 512, 513, 540, 541, and 546. Students interested in atmospheric chemistry, aerosols, and cloud physics are advised to take ATOC 219, 309, 419, 521, 525, 540 and CHEM 223, 253. Suggested minors include math, physics, chemistry, computer science, earth and planetary science, and geography.

27 credits at the 200 to 300 level

3-6 credits selected from:

ATOC 215	(3)	Oceans, Weather and Climate
AT	(3)	Introduction to Atmospheric Chemistry

18-19 credits at the 400 to 500 level, selected from the following (at least 12 credits must come from AT

14.4.2 About Biochemistry

Biochemistry is the application of chemical, genetic, and biophysical approaches to the study of biological processes at the cellular and molecular level. We are interested in, for example, mechanisms of brain function; cellular differentiation; energy utilization by animals and microorganisms; and in the molecular basis of inheritance and disease. The researcher seeks to determine how specific molecules such as proteins, nucleic acids, lipids, vitamins, and hormones function in various cellular processes. Particular emphasis is placed on the regulation of reactions in living cells. The knowledge and methods developed by researchers are applied in all fields of medicine, in agriculture, and in many chemical and health-related industries. Biochemistry is unique in providing basic theoretical training, as well as basic practical laboratory training and research in both enzymology and genetic engineering, which are the two basic components in the rapidly expanding field of Biotechnology.

There are three programs offered by the Department of Biochemistry: Major, Honours, and Liberal. The Major and Honours programs provide a sound background for students who wish to have a professional career in biochemistry, and can lead to postgraduate studies and research careers in hospital, university, or industrial laboratories. The Liberal program is less specialized, offering students opportunities to select courses in other fields of interest.

During the first year, each program provides basic training in organic, physical, and analytical chemistry, as well as in biology and physiology. The Honours and Major programs become more specialized in biochemistry during the following two years, with additional work in chemistry and biology.

Students interested in pursuing an *ad hoc* Joint Major or Joint Honours degree between Biochemistry and a second discipline may consult with our Chief Academic Adviser, Dr. Albert Berghuis (*albert.berghuis@mcgill.ca*).

The increasing involvement of complex technology in modern society requires personnel trained in both chemistry and biology. With the advent of biotechnology, the combination of chemistry, molecular biology, enzymology, and genetic engineering found in the biochemistry program provides the essential background and training. The researcher is in an advantageous position to fulfil this role and assume a wide variety of positions in industry and the health field. These positions include: research and development in the chemical and pharmaceutical industries; testing and research in government and hospital laboratories; and management. Many graduates pursue higher degrees in research and attain academic positions in universities and colleges.

14.4.3 Adviser

New students interested in Biochemistry should refer to our website for information regarding orientation and program advising: *www.mcgill.ca/biochemistry/undergraduates/advising*.

Returning students must schedule an advising appointment directly with the academic adviser assigned to them in their first year in Biochemistry.

14.4.4 Biochemistry (BIOC) Faculty

Chair

David Y. Thomas

Associate Chair

Kalle Gehring

Emeritus Professors

Rhoda Blostein; B.Sc., M.Sc., Ph.D.(McG.), F.R.S.C. (*joint appt. with Medicine*)

Peter E. Braun; B.Sc., M.Sc.(Br. Col.), Ph.D.(Calif., Berk.)

Robert E. MacKenzie; B.Sc.(Agr.)(McG.), M.N.S., Ph.D.(C'nell.)

Edward A. Meighen; B.Sc.(Alta.), Ph.D.(Calif., Berk.)

Walter E. Mushynski; B.Sc., Ph.D.(McG.)

Theodore L. Sourkes; M.Sc.(McG.), Ph.D.(C’nell), F.R.S.C.

Clifford P. Stanners; B.Sc.(McM.), M.A., Ph.D.(Tor.)

Professors

Nicole Beauchemin; B.Sc., M.Sc., Ph.D.(Montr.) (*joint appt. with Oncology and Medicine*)

Albert Berghuis; B.Sc., M.Sc.(Rijks Univ. Groningen, The Netherlands), Ph.D.(Br. Col.) (*Canada Research Chair in Structural Biology*)

Philip E. Branton; B.Sc., M.Sc., Ph.D.(Tor.), F.R.S.C. (*Gilman Cheney Professor of Biochemistry*)

Kalle Gehring; B.A.(Brown), M.Sc.(Mich.), Ph.D.(Calif., Berk.) (*Chercheur National du FRSQ*)

Vincent Giguère; B.Sc., Ph.D.(Laval) (*joint appt. with Oncology and Medicine*)

Philippe Gros; B.Sc., M.Sc.(Montr.), Ph.D.(McG.), F.R.S.C. (*James McGill Professor*)

Roderick McInnes; B.Sc., M.D.(Dal.), Ph.D.(McG.) (*Canada Research Chair in Neurogenetics*) (*joint appt. with Human Genetics*)

Professors

William Muller; B.Sc., Ph.D.(McG.) (*Canada Research Chair in Molecular Oncology*)

Alain Nepveu; B.Sc., M.Sc.(Montr.), Ph.D.(Sher.) (*James McGill Professor*) (*joint appt. with Oncology and Medicine*)

Morag Park; B.Sc., Ph.D.(Glasgow), F.R.S.C. (*Diane & Sal Guerrera Chair in Cancer Genetics*) (*James McGill Professor*) (*joint appt. with Oncology and Medicine*)

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

Gordon C. Shore; B.Sc.(Guelph), Ph.D.(McG.)

Joseph Shuster; B.Sc.(McG.), Ph.D.(Calif.), M.D.(Alta.)

John R. Silvius; B.Sc., Ph.D.(Alta.)

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

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

Associate Members

Youla Tsantrizos (*Chemistry*)

Bernard Turcotte (*Medicine*)

Simon Wing (*Medicine*)

Xiang-Jiao Yang (*Medicine*)

Adjunct Professors

Mirek Cygler (*Biochemistry*, Sask.)

Jacques Drouin (*IRCM*)

Anny Fortin (*Dafra Pharma*)

Tarik Möröy (*IRCM*)

Donald Nicholson (*Merck Frosst*)

Enrico Purisima (*NRC/BRI*)

René Roy (*UQAM*)

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

U1 Required Courses (20 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
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)	Biology of Organisms
MIMM 211	(3)	Introductory Microbiology
PHGY 209	(3)	Mammalian Physiology 1
PHGY 210	(3)	Mammalian Physiology 2

U2 Required Courses (15 credits)

BIOC 300D1	(3)	Laboratory in Biochemistry
BIOC 300D2	(3)	Laboratory in Biochemistry
BIOC 311	(3)	Metabolic Biochemistry
BIOC 312	(3)	Biochemistry of Macromolecules
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
COMP 202	(3)	Foundations of Programming
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

14.4.6 Bachelor of Science (B.Sc.) - Major Biochemistry (67 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
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
CHEM 287	(2)	Introductory Analytical Chemistry
CHEM 297	(1)	Introductory Analytical Chemistry Laboratory

U1 Complementary Courses (6 credits)

6 credits selected from:

BIOL 205	(3)	Biology of Organisms
MIMM 211	(3)	Introductory Microbiology
PHGY 209	(3)	Mammalian Physiology 1
PHGY 210	(3)	Mammalian Physiology 2

U2 Required Courses (23 credits)

ANAT 262	(3)	Introductory Molecular and Cell Biology
BIOC 300D1	(3)	Laboratory in Biochemistry
BIOC 300D2	(3)	Laboratory in Biochemistry
BIOC 311	(3)	Metabolic Biochemistry
BIOC 312	(3)	Biochemistry of Macromolecules

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
COMP 202	(3)	Foundations of Programming
MATH 203	(3)	Principles of Statistics 1
MATH 222	(3)	Calculus 3
PSYC 204	(3)	Introduction to Psychological Statistics

U3 Required Courses (6 credits)

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

U3 Complementary Courses (6 credits)

At least 3 credits selected from:

BIOC 404	(3)	Biophysical Chemistry
BIOC 458	(3)	Membranes and Cellular Signaling
BIOC 503	(3)	Immunochemistry
PSYT 455	(3)	Neurochemistry

The remainder, if any, to be selected from the following list:

BIOC 570	(3)	Biochemistry of Lipoproteins
BIOL 300	(3)	Molecular Biology of the Gene
BIOL 303	(3)	Developmental Biology
BIOL 304	(3)	Evolution
BIOL 313	(3)	Eukaryotic Cell Biology
BIOL 314	(3)	Molecular Biology of Oncogenes
CHEM 382	(3)	Organic Chemistry: Natural Products
CHEM 502	(3)	Advanced Bio-Organic Chemistry
CHEM 532	(3)	Structural Organic Chemistry
CHEM 552	(3)	Physical Organic Chemistry
CHEM 572	(3)	Synthetic Organic Chemistry
EXMD 502	(3)	Advanced Endocrinology 01
MIMM 214	(3)	Introductory Immunology: Elements of Immunity
MIMM 324	(3)	Fundamental Virology
PHAR 300	(3)	Drug Action
PHGY 311	(3)	Channels, Synapses & Hormones

14.4.7 Bachelor of Science (B.Sc.) - Honours Biochemistry (76 credits)

Admission to the Honours program will not be granted until U2. Students who wish to enter the Honours program in U2 should follow the U1 Major program. Those who satisfactorily complete the U1 Major program with a GPA of at least 3.20 and a mark of B- or better in every required course are eligible for admission to the Honours program.

Students seeking admission to the Honours program must obtain permission from the Departmental Student Affairs Officer, Christine Laberge (christine.laberge@mcgill.ca), during the Add/Drop period in September of their second year.

Promotion to U3 year is based on satisfactory completion of U2 courses with a GPA of at least 3.20 and a mark of B- or better in every required course. In borderline cases, the marks received in BIOC 311 and BIOC 312 will be of particular importance for continuation in the U3 Honours year.

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 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
BIOL 200	(3)	Molecular Biology
		Basic Genetia30 1 614.761 Tm0 0 10

BIOL 373	(3)	Biometry
COMP 202	(3)	Foundations of Programming
MATH 203	(3)	Principles of Statistics 1
MATH 222	(3)	Calculus 3
PSYC 204	(3)	Introduction to Psychological Statistics

U3 Required Courses (15 credits)

BIOC 404	(3)	Biophysical Chemistry
BIOC 450	(3)	Protein Structure and Function
BIOC 454	(3)	Nucleic Acids
BIOC 462	(6)	Research Laboratory in Biochemistry

U3 Complementary Courses (6 credits)

At least 3 credits selected from:

BIOC 458	(3)	Membranes and Cellular Signaling
BIOC 491	(6)	Independent Research
BIOC 503	(3)	Immunochemistry
PSYT 455	(3)	Neurochemistry

The remainder, if any, to be selected from the following list:

BIOC 570	(3)	Biochemistry of Lipoproteins
BIOL 300	(3)	Molecular Biology of the Gene
BIOL 303	(3)	Developmental Biology
BIOL 304	(3)	Evolution
BIOL 313	(3)	Eukaryotic Cell Biology
BIOL 314	(3)	Molecular Biology of Oncogenes
CHEM 382	(3)	Organic Chemistry: Natural Products
CHEM 502	(3)	Advanced Bio-Organic Chemistry
CHEM 532	(3)	Structural Organic Chemistry
CHEM 552	(3)	Physical Organic Chemistry
CHEM 572	(3)	Synthetic Organic Chemistry
EXMD 502	(3)	Advanced Endocrinology 01
EXMD 503	(3)	Advanced Endocrinology 02
MIMM 214	(3)	Introductory Immunology: Elements of Immunity
MIMM 324	(3)	Fundamental Virology
PHAR 300	(3)	Drug Action
PHGY 311	(3)	Channels, Synapses & Hormones

14.4.8 Biochemistry (BIOC) Related Programs

14.4.8.1 Interdepartmental Honours in Immunology

For more information, see

14.5.3 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), and two courses in Physics (mechanics and electromagnetism). Students entering into the B.A. & Sc., the

Macdonald campus: NRSC 437, PLNT 358, WILD 350, WILD 415, WILD 420, WILD 421.

14.5.4.4 Concentrations Available Within the Area of Ecology

Ecology is the study of the interactions between organisms and environment that affect distribution, abundance, and other characteristics of the organisms. A strong analytical and quantitative orientation is common to all areas of ecology, and thus students wishing to specialize in these areas are strongly encouraged to develop their background in statistical analysis, computing, and mathematical modeling. Many of the ecology courses feature a strong analytical component, and students will find that background preparation in this area is very useful, if not essential. Ecology depends heavily on field research, and thus BIOL 331 and/or other field courses should be considered as vital to all concentrations in this area.

14.5.4.4.1 General and Applied Ecology Concentration

The concentration in general and applied ecology is designed to introduce the breadth of contemporary ecology, at the levels of the ecosystem, communities, and populations, and at the level of the individual organism, with an accent on the application of this science to practical problems in environmental management, and the management of resources and pests. In addition to general courses dealing with general principles, there is a selection of courses dealing with particular groups of organisms. Since it is essential to know how knowledge is obtained, the concentration includes a field course in ecology.

Key courses: BIOL 305, BIOL 308, BIOL 331 or BIOL 334D1/BIOL 334D2, BIOL 350/ENTO 350, BIOL 373, COMP 202, COMP 273.

Other suggested courses: BIOL 307, BIOL 324, BIOL 377, BIOL 418, BIOL 427, BIOL 428, BIOL 429, BIOL 432, BIOL 434, BIOL 441, BIOL 465, BIOL 466, BIOL 467, BIOL 468D1/BIOL 468D2, BIOL 469D1/BIOL 469D2, BIOL 510, BIOL 515, BIOL 540, BIOL 571, BIOL 590, BIOL 594, GEOG 302, REDM 405.

Macdonald campus: PLNT 460.

14.5.4.4.2 Aquatic Ecology Concentration

This concentration is designed to introduce the principles of ecology as they pertain to aquatic ecosystems and aquatic biota. Since it is essential to know how knowledge is obtained, as well as what has been learned, one of the courses (Limnology) involves field work, and one of the courses (Biological Oceanography) a laboratory component, that stress the techniques used to study aquatic ecology. In addition, the concentration includes a field course in ecology. There is also a variety of courses in aquatic disciplines offered in other departments that complement the aquatic ecology courses offered in Biology.

Key courses: BIOL 305, BIOL 308, BIOL 331 or another field course, BIOL 373, BIOL 418, BIOL 432 (or ENVB 315), BIOL 441, BIOL 465, BIOL 515, COMP 202, COMP 273.

Other suggested courses: BIOL 307, BIOL 429, BIOL 434, BIOL 466, BIOL 467, BIOL 468D1/BIOL 468D2, BIOL 469D1/BIOL 469D2, BIOL 540, BIOL 590, GEOG 305, GEOG 306, GEOG 308, GEOG 322, REDM 405.

14.5.4.4.3 Marine Biology Concentration

This concentration is designed to offer students a broad introduction to marine biology and marine ecology, which will form the basis for graduate studies in the fields, or for employment in aquatic biology and oceanography.

Key courses: BIOL 305, BIOL 308, BIOL 335, BIOL 373, BIOL 441, BIOL 515.

Other suggested courses: ATOC 512, ATOC 550, BIOL 331, BIOL 334D1/BIOL 334D2, BIOL 418, BIOL 429, BIOL 432, BIOL 434, BIOL 465, BIOL 540, BIOL 590, EPSC 542.

For students intending to proceed to graduate work, one independent studies course (BIOL 466 or BIOL 467, BIOL 468D1/BIOL 468D2, BIOL 469D1/BIOL 469D2) is recommended. Because of the importance of numerical analyses in all fields of ecology, courses in Biometry (e.g. BIOL 373) and Computer Science (COMP 202 or COMP 273) are recommended.

14.5.4.5 Evolutionary Biology Concentration

Evolutionary biology is the study of processes that change organisms and their characteristics through time. Evolutionary biologists are concerned with adaptations of organisms and the process of natural selection.

Key courses: BIOL 304, BIOL 305, BIOL 307, BIOL 320, BIOL 324, BIOL 331, BIOL 352, BIOL 373, BIOL 377, BIOL 435, BIOL 463, BIOL 466 or BIOL 467, BIOL 468D1/BIOL 468D2, BIOL 469D1/BIOL 469D2, BIOL 555D1/BIOL 555D2, BIOL 569, BIOL 570, BIOL 571, BIOL 573, BIOL 585, BIOL 594.

Other suggested courses in Organismal Biology: BIOL 240, BIOL 335, BIOL 350/ENTO 350, BIOL 355, BIOL 427, BIOL 428, BIOL 463.

Macdonald campus: PLNT 358, WILD 420.

Genetics and Development: BIOL 300, BIOL 303.

Ecology and Behaviour: BIOL 309, BIOL 429, BIOL 434, BIOL 507, BIOL 515, BIOL 590, REDM 405.

14.5.4.6 Human Genetics Concentration

The courses recommended for students interested in human genetics are designed to offer a broad perspective in this rapidly advancing area of biology. Genetics is covered at all levels of organization (the gene, the chromosome, the cell, the organism, and the population), using pertinent examples from all species, but with special emphasis on humans.

Key courses: BIOL 301, BIOL 370, BIOL 373, BIOL 416, BIOL 520, BIOL 568, BIOL 575.

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14.5.4.7 Molecular Genetics and Development Concentration

The discoveries that have fuelled the ongoing biomedical and biotechnology revolution have been derived from the fusion of a number of fields of biological investigation, including molecular biology, genetics, cellular and developmental biology, and biochemistry. A substantial amount of this research has been conducted upon model eukaryotic organisms, such as yeast, the fruit fly (*Drosophila*), the nematode (*C. elegans*), and the mustard weed (*Arabidopsis*). In the molecular genetics and development concentration, students will obtain a comprehensive understanding of how these "model eukaryotes" have advanced our knowledge of the mechanisms responsible for cellular function and organismal development. Graduates from this concentration will be well prepared to pursue higher degrees in the fields of basic biology, biotechnology, and biomedicine or to assume a wide variety of positions in government, universities, and medical and industrial institutions.

Key courses: BIOL 300, BIOL 301, BIOL 303, BIOL 373, BIOL 569; CHEM 203 or CHEM 204 combined with CHEM 214, CHEM 212, CHEM 222.

Other suggested courses: BIOL 313, BIOL 314, BIOL 316, BIOL 416, BIOL 466, BIOL 467, BIOL 468D1/BIOL 468D2, BIOL 469D1/BIOL 469D2, BIOL 518, BIOL 520, BIOL 524, BIOL 544.

14.5.4.8 Neurobiology Concentration

Nervous systems are perhaps the most complex entities in the natural world, being composed of up to trillions of interconnected cells that must operate in a coordinated manner to produce behaviour that can range from the mundane (e.g., regulation of heart rate) to the magnificent (e.g., musical composition). The neurobiology discipline, one of the fastest growing areas of modern biology, seeks to understand the evolution, development, and operation of nervous systems. The neurobiology concentration addresses these issues by examining neural structure, function, and development at levels of organization that range from the molecular to the organismal. As a result of exposure to a wide range of experimental and intellectual approaches, students receive a sound, broadly based education in biology.

Key courses: BIOL 306, BIOL 320, BIOL 373, BIOL 389, BIOL 507, BIOL 514, BIOL 530, BIOL 532, BIOL 588.

Other suggested courses: ANAT 321, ANAT 322, BIOL 300, BIOL 303, BIOL 466, BIOL 467, BIOL 468D1/BIOL 468D2, BIOL 469D1/BIOL 469D2, NEUR 310, NSCI 200, NSCI 201, PHAR 562, PHGY 311, PHGY 314, PHGY 425, PHGY 451, PHGY 556, PSYC 311, PSYC 318, PSYC 342, PSYC 410, PSYC 470, PSYT 455, PSYT 500.

14.5.5 Biology (BIOL) Faculty

Revision, August 2013. Start of revision.

Chair

Graham A.C. Bell

Emeritus Professors

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)

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

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

John B. Lewis; B.Sc., M.Sc., Ph.D.(McG.)

Professors

Graham A.C. Bell; B.A., D.Phil.(Oxf.), F.R.S.C. (*James McGill Professor*)

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

Lauren Chapman; B.Sc.(Alta.), Ph.D.(McG.) (*Canada Research Chair in Respiratory Ecology and Aquatic Conservation*)

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

Andrew Gonzalez; B.Sc.(Nott.), Ph.D.(Imperial Coll., Lond.) (*Canada Research Chair in Biodiversity Science*)

Siegfried Hekimi; M.Sc., Ph.D.(Geneva) (*Strathcona Chair in Zoology; Robert Archibald & Catherine Louise Campbell Chair in Developmental Biology*)

Paul F. Lask

Professors

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

Associate Professors

Ehab Abouheif; M.Sc.(C'dia), Ph.D.(Duke) (*Canada Research Chair in Evolutionary Developmental Biology*)

Thomas Bureau; B.Sc.(Calif.), Ph.D.(Texas) (*William Dawson Scholar*)

Melania Cristescu; B.Sc., M.Sc.(Ovidius Univ. Constanta, Romania), Ph.D.(Guelph)

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

François Fagotto; Ph.D.(Neuchâtel) (*Canada Research Chair in Cell Biology*)

Gregor Fussmann; Dipl.(Berlin), Ph.D.(Max Planck Institute)

Irene Gregory-Eaves; B.Sc.(Vic., BC), M.Sc., Ph.D.(Qu.)

Frédéric Guichard; B.Sc.(Ea

Associate Members

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

RVH: Hugh J. Clarke, Daniel Dufort, Teruko Taketo

Adjunct Professors

Centre National de la Recherche Scientifique (CNRS): Michel L Myeauo R

CHEM 212*	(4)	Introductory Organic Chemistry 1

Complementary Courses (28 credits)

Students complete a minimum of 27 credits or a maximum of 28 complementary course credits selected as follows:

3 or 4 credits selected from:

BIOL 206	(3)	Methods in Biology of Organisms
BIOL 301	(4)	Cell and Molecular Laboratory

24 credits of Biology courses

9 credits of which, in consultation with the Program Adviser, can be replaced with appropriate Science courses from other departments.

No more than 6 of the 24 credits can be taken at the 200 level.

14.5.8 Bachelor of Science (B.Sc.) - Major Biology (59 credits)

The Major requires 58 or 59 credits depending on a student's choice of complementary courses.

Students in the Major program are permitted to take a maximum of 9 credits of research courses.

U1 Required Courses (18 credits)

BIOL 200	(3)	Molecular Biology
BIOL 201	(3)	Cell Biology and Metabolism
BIOL 202	(3)	Basic Genetics
BIOL 205	(3)	Biology of Organisms
BIOL 206	(3)	Methods in Biology of Organisms
BIOL 215	(3)	Introduction to Ecology and Evolution

U2 or U3 Required Course (4 credits)

BIOL 301	(4)	Cell and Molecular Laboratory

Complementary Courses (37 credits)

Students complete a minimum of 36 credits or maximum of 37 credits selected as follows:

U1 Complementary Course

* Students who have already taken CHEM 212 or its equivalent will choose another appropriate complementary course, to be approved by the Adviser.

CHEM 212*	(4)	Introductory Organic Chemistry 1

U2 or U3 Complementary Courses

12 credits selected from:

BIOL 300	(3)	Molecular Biology of the Gene

21-24 credits selected in consultation with the Program Adviser. All courses must be at the 300 level or higher; they are to include Biology courses of which at most three courses may be substituted, given the Adviser's consent, with science courses offered by other departments. Unless required by the Major, prerequisites for these courses must be taken as electives.

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

Revision, August 2013. Start of revision.

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 ph

Physics (6 credits)

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

Course Requirements for Quantitative Biology Streams (22 credits)

21 or 22 credits from one of the following two streams:

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

Biology

BIOL 206	(3)	Methods in Biology of Organisms
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)	Monteregian Flora
BIOL 331	(3)	Ecology/Behaviour Field Course
BIOL 334	(3)	Applied Tropical Ecology
BIOL 432	(3)	Limnology

9 credits chosen from the following list, of which 6 credits must be at the 400 level or above:

BIOL 310	(3)	Biodiversity and Ecosystems
BIOL 324	(3)	Ecological Genetics
BIOL 373	(3)	Biometry
BIOL 434	(3)	Theoretical Ecology
BIOL 510	(3)	Advances in Community Ecology
BIOL 594	(3)	Advanced Evolutionary Ecology

Stream 2: Physical Biology (22 credits)

BIOL 301	(4)	Cell and Molecular Laboratory
BIOL 319	(3)	Introduction to Biophysics
PHYS 333	(3)	Thermal and Statistical 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 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)	Topics in Geometry
MATH 437	(3)	Mathematical Methods in Biology
MATH 447	(3)	Introduction to Stochastic Processes

* Students may take COMP 350 OR MATH 317.

Recommendations for Physical Biology stream

CHEM 222	(4)	Introductory Organic Chemistry 2
CHEM 345	(3)	Molecular Properties and Structure 1
CHEM 355	(3)	Molecular Properties and Structure 2
CHEM 514	(3)	Biophysical Chemistry
PHYS 242*	(2)	Electricity and Magnetism
PHYS 342	(3)	Majors Electromagnetic Waves
PHYS 413	(3)	Physical Basis of Physiology
PHYS 434	(3)	Optics
PHYS 446	(3)	Majors Quantum Physics
PHYS 534	(3)	Nanoscience and Nanotechnology

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

Recommendations for Theoretical Ecology and Evolutionary Biology stream

MATH 204	(3)	Principles of Statistics 2

MATH 242	(3)	Analysis 1
MATH 324	(3)	Statistics
MATH 340	(3)	Discrete Structures 2
MATH 423	(3)	Regression and Analysis of Variance
MATH 524	(4)	Nonparametric Statistics
MATH 525	(4)	Sampling Theory and Applications
PHYS 333*	(3)	Thermal and Statistical Physics

* PHYS 333 is now required for the Physical Biology stream

Revision, August 2013. End of revision.

14.5.10 Bachelor of Science (B.Sc.) - Major Biology and Mathematics (76 credits)

This program is built on a selection of mathematics and biology courses that recognize mathematical biology as a field of research, with three streams within biology: Ecology and Evolutionary Ecology, Molecular Evolution, and Neurosciences.

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 program.

This program is recommended for U1 students achieving a CGPA of 3.2 or better, and entering CEGEP students with a Math/Science R-score of 28.0 or better.

Required Courses (34 credits)

* If a student has already taken CHEM 212 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.

BIOL 200	(3)	Molecular Biology
BIOL 201	(3)	Cell Biology and Metabolism
		Introduction to Ecology and Ev

BIOL 466	(3)	Independent Research Project 1
BIOL 467	(3)	Independent Research Project 2
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 Sequence 1 or 2 and from "Remaining Math Courses" as follows:

Sequence 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

Sequence 2: Statistics

9 credits from the following:

MATH 324	(3)	Statistics
MATH 423	(3)	Regression and Analysis of Variance
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 Structures 2
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

21 credits (if BIOL course was selected as a research course) or 24 credits 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 of Organisms

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

At least 9 credits chosen from the following list, of which 6 credits must be at the 400 level or above:

BIOL 202	(3)	Basic Genetics
BIOL 304	(3)	Evolution
BIOL 308	(3)	Ecological Dynamics
BIOL 310	(3)	Biodiversity and Ecosystems
BIOL 324	(3)	Ecological Genetics
BIOL 434	(3)	Theoretical Ecology
BIOL 435	(3)	Natural Selection
BIOL 466	(3)	Independent Research Project 1
BIOL 467	(3)	Independent Research Project 2
BIOL 468	(6)	Independent Research Project 3
BIOL 585	(3)	Game Theory and Evolutionary Dynamics
BIOL 590	(3)	Linking Community and Ecosystem Ecology
		Advanced Ev

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 466	(3)	Independent Research Project 1
BIOL 467	(3)	Independent Research Project 2
BIOL 468	(6)	Independent Research Project 3
BIOL 530	(3)	Advances in Neuroethology
PHGY 314	(3)	Integrative Neuroscience
PHGY 425	(3)	Analyzing Physiological Systems
PSYC 427	(3)	Sensorimotor Behaviour

Remaining BINF, BIOL, NEUR, PHGY, PSYC

For the remaining BINF, BIOL, NEUR, PHGY, PSYC complementary course credits, if any, students top up their credits to the necessary 21-24 credits with any course listed in the above three streams. Other relevant courses may be substituted with the approvvv7ected as 70.52 435.94143m(an2)Tj50 0 1 OL 4.11f1 0 0 1 67

BIOL 301	(4)	Cell and Molecular Laboratory
BIOL 373	(3)	Biometry

U2 and U3 Complementary Courses (33 credits)

Students who take CHEM 212 in U1 complete 30 credits and those exempted from CHEM 212 complete 33 credits selected as follows:

12 credits selected from:

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

18-21 credits in Biology at the 300 level or higher, of which 9 credits may be from other Science departments, with approval of the Adviser.

U3 Required Courses (4 credits)

BIOL 499D1	(2)	Honours Seminar in Biology
BIOL 499D2	(2)	Honours Seminar in Biology

U3 Complementary Courses (12 credits)

9-12 credits selected from:

BIOL 479D1	(4.5)	Honours Research Project 1
BIOL 479D2	(4.5)	Honours Research Project 1
BIOL 480D1	(6)	Honours Research Project 2
BIOL 480D2	(6)	Honours Research Project 2

14.5.12 Biology (BIOL) Related Programs and Study Semesters

14.5.12.1 Joint Major in Computer Science and Biology

For more information, see *section 14.9.11: Bachelor of Science (B.Sc.) - Major Computer Science and Biology (73 credits)*.

14.5.12.2 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 *Programs, Courses and University Regulations > Faculties & Schools > Field Studies > Undergraduate > : Panama Field Study Semester*. You can also visit the following website for details: *www.mcgill.ca/science/student/internships-field*.

14.5.12.3 Africa Field Study Semester

The Department of Geography, Faculty of Science, coordinates the 15-credit interdisciplinary Africa Field Study Semester; see *Programs, Courses and University Regulations > Faculties & Schools > Field Studies > Undergraduate > : Africa Field Study Semester*. You can also visit the following website for details: *www.mcgill.ca/science/student/internships-field*.

14.6 Biotechnology (BIOT)

14.6.1 Location

Sheldon Biotechnology Centre

Lyman Duff Building
3775 University Street
Montreal, Quebec H3A 2B4

Telephone: 514-398-3998

14.6.2 About Biotechnology

Biotechnology, the science of understanding, selecting, and promoting useful organisms and specific gene products for commercial and therapeutic purposes, is the success story of this generation. It demands a broad comprehension of biology and engineering as well as detailed knowledge of at least one basic subject such as molecular genetics, protein chemistry, microbiology, or chemical engineering.

The Minor in Biotechnology is offered by the Faculties of Engineering and of Science, and students combine the Minor with the regular departmental Major (or Honours or Faculty) program. The Minor emphasizes an area relevant to biotechnology which is complementary to the main program.

Students should identify their interest in the Biotechnology Minor to their departmental academic adviser and to the program supervisor of the Minor and, at the time of registration for the U2 year, should declare their intent to embark on the Minor. Before registering for the Minor, and with the agreement of the 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 a course taught by the Faculty of Science.

14.6.3 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;
- obtain a grade of C or better in the courses presented for the Minor.

14.6.4 Biotechnology (BIOT) Faculty

Program Supervisor

Jacalyn Vogel; M.Sc.(E. Ill.), Ph.D.(Kansas) (*Canadian Pacific Chair in Biotechnology*)

14.6.5 Bachelor of Science (B.Sc.) - Minor Biotechnology (for Science Students) (24 credits)

To obtain the Minor Biotechnology, Science students must:

a) satisfy both the requirements for the departmental program and for the Minor;

b) complete 24 credits, 18 of which must be exclusively for the Minor program.*

* Approved substitutions must be made for any of the required courses which are part of the student's main program.

Required Courses (15 credits)

* Students may take either BIOL 201 or BIOC 212.

BIOC 212*	(3)	Molecular Mechanisms of Cell Function
BIOL 200	(3)	Molecular Biology
BIOL 201*	(3)	Cell Biology and Metabolism
BIOL 202	(3)	Basic Genetics
BIOT 505	(3)	Selected Topics in Biotechnology
MIMM 211	(3)	Introductory Microbiology

Complementary Courses (9 credits)

9 credits selected from courses outside the department of the student's main program. Students may select three courses from one of the lists below, or may choose three alternate courses with adviser approval.

Biomedicine

ANAT 541	(3)	Cell and Molecular Biology of Aging
EXMD 504	(3)	Biology of Cancer
PATH 300	(3)	Human Disease

Chemical Engineering

CHEE 200	(3)	Chemical Engineering Principles 1
CHEE 204	(3)	Chemical Engineering Principles 2
CHEE 474	(3)	Biochemical Engineering

Chemistry

CHEM 382	(3)	Organic Chemistry: Natural Products
CHEM 502	(3)	Advanced Bio-Organic Chemistry
CHEM 552	(3)	Physical Organic Chemistry

General

FACC 300	(3)	Engineering Economy

Immunology

ANAT 261	(4)	Introduction to Dynamic Histology
BIOC 503	(3)	Immunochemistry
MIMM 214	(3)	Introductory Immunology: Elements of Immunity
MIMM 414	(3)	Advanced Immunology
PHGY 513	(3)	Cellular Immunology

Management

ECON 208	(3)	Microeconomic Analysis and Applications
MGCR 211	(3)	Introduction to Financial Accounting
MGCR 341	(3)	Finance 1
MGCR 352	(3)	Marketing Management 1
MGCR 472	(3)	Operations Management

Microbiology

MIMM 323	(3)	Microbial Physiology
MIMM 324	(3)	Fundamental Virology
MIMM 413	(3)	Parasitology
MIMM 465	(3)	Bacterial Pathogenesis
MIMM 466	(3)	Viral Pathogenesis

Molecular Biology (Biology)

BIOL 300	(3)	Molecular Biology of the Gene
BIOL 314	(3)	Molecular Biology of Oncogenes

BIOL 520	(3)	Gene Activity in Development
BIOL 524	(3)	Topics in Molecular Biology
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 01
EXMD 503	(3)	Advanced Endocrinology 02
PHAR 562	(3)	General Pharmacology 1
PHAR 563	(3)	General Pharmacology 2
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

14.6.6 Biotechnology (BIOT) Related Programs

14.6.6.1 Program for Students in the Faculty of Engineering

See *Programs, Courses and University Regulations > Faculties & Schools > Faculty of Engineering > Undergraduate > Academic Programs > Minor Programs > : Biotechnology Minor* for details.

14.7 Chemistry (CHEM)

14.7.1 Location

Otto Maass Chemistry Building
801 Sherbrooke Street West
Montreal, Quebec H3A 0B8

Website: *www.chemistry.mcgill.ca*

Departmental Office: Room 322
Telephone: 514-398-6999

Student Advisory Office: Room 314
Website: *www.chemistry.mcgill.ca/advising/index.htm*

14.7.2 Office for Science and Society

The Office for Science and Society is dedicated to the promotion of critical thinking and the presentation of practical scientific information to the public, educators, and students in an accurate and responsible fashion. The Office answers queries from the public as well as from the media, with a view toward establishing scientific accuracy. The Office also offers a variety of educational and interesting presentations on scientific topics and its members contribute to a number of courses under the umbrella of “The World of Chemistry.”

Director

Joseph A. Schwarcz; B.Sc., Ph.D.(McG.)

Members

Ariel Fenster; L.Sc., D.E.A.(Paris), Ph.D.(McG.)

David N. Harpp; A.B.(Middlebury), M.A.(Wesl.), Ph.D.(N. Carolina), F.C.I.C. (*William C. Macdonald Professor of Chemistry*)

14.7.3 About Chemistry

Chemistry is both a pure science, offering a challenging intellectual pursuit, and an applied science whose technology is of fundamental importance to the economy and society. Modern chemists seek an understanding of the structure and properties of atoms and molecules to predict and interpret the properties and transformations of matter and the energy changes that accompany those transformations. Many of the concepts of physics and mathematics are basic to chemistry, while chemistry is of fundamental importance to many other disciplines such as the biological and medical sciences, geology, metallurgy, etc.

A degree in chemistry leads to a wide variety of professional vocations. The large science-based industries (petroleum refining, plastics, pharmaceuticals, etc.) all employ chemists in research, development, and quality control. Many federal and provincial departments and agencies employ chemists in research and testing laboratories. Such positions are expected to increase with the currently growing concern for the environment and for consumer protection. A background in chemistry is also useful as a basis for advanced study in other related fields, such as medicine and the biological sciences. For a business career, a B.Sc. in Chemistry can profitably be combined with a master's degree in Business Administration, or a study of law for work as a patent lawyer or forensic scientist.

Chemistry courses at the university level are traditionally divided into four areas of specialization: 1) organic chemistry

Emeritus Professors

Arthur S. Perlin; M.Sc., Ph.D.(McG.), F.R.S.C. (*E.B. Eddy Emeritus Professor of Industrial Chemistry*)

William C. Purdy; B.A.(Amh.), Ph.D.(MIT), F.C.I.C. (*William C. Macdonald Emeritus Professor of Chemistry*)

Leon E. St-Pierre; B.Sc.(Alta.), Ph.D.(Notre Dame), F.C.I.C.

Michael A. Whitehead; B.Sc., Ph.D., D.Sc.(Lond.), F.C.I.C.

Professors

Bruce Arndtsen; B.A.(Car. Coll.), Ph.D.(Stan.) (*William Dawson Scholar*)

D. Scott Bohle; B.A.(Reed College), M.Phil., Ph.D.(Auck.) (*CRC Tier I Chair*)

David H. Burns; B.Sc.(Puget Sound), Ph.D.(Wash.)

Ian S. Butler; B.Sc., Ph.D.(Brist.), F.C.I.C., C.Sci., C.Chem., F.R.S.C. (UK)

Masad J. Damha; B.Sc., Ph.D.(McG.) (*James McGill Pr*

Assistant Professors

Bradley Siwick; B.A.Sc., M.Sc., Ph.D.(Tor.) (*joint appt. with Physics*)

Associate Members

James A. Finch (*Mining & Metallurgical Engineering*)

P. Grütter (*Physics*)

Esther Schirrmacher (*Medicine*)

Ralf Schirrmacher (*Medicine*)

Adjunct Professors

Yvan Guindon; B.Sc., Ph.D.(Montr.), F.C.I.C., F.R.S.C.

Christian Reber; B.Sc., Ph.D.(Berne)

Ivor Wharf; B.Sc., Ph.D.(Lond.), A.R.C.S., D.I.C.

Robert Zamboni; B.Sc., Ph.D.(McG.)

14.7.5 Bachelor of Science (B.Sc.) - Minor Chemistry (18 credits)

Required Courses (18 credits)

* Denotes courses with CEGEP equivalents.

Substitutions for these by more advanced courses may be made at the discretion of the Adviser.

CHEM 203	(3)	Survey of Physical Chemistry
CHEM 212*	(4)	Introductory Organic Chemistry 1
CHEM 222*	(4)	Introductory Organic Chemistry 2
CHEM 253	(1)	Introductory Physical Chemistry 1 Laboratory
CHEM 281	(3)	Inorganic Chemistry 1
CHEM 287	(2)	Introductory Analytical Chemistry
CHEM 297	(1)	Introductory Analytical Chemistry Laboratory

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

Revision, July 2013. Start of revision.

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 CHEE 392 and CHEE 393

** 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 392*	(4)	Project Laboratory 1
CHEE 393*	(5)	Project Laboratory 2
CHEE 438	(3)	Engineering Principles in Pulp and Paper Processes
	(3)	Research Project and Seminar 1

Inorg

CHEM 367	(3)	Instrumental Analysis 1
CHEM 377	(3)	Instrumental Analysis 2
CHEM 392	(3)	Integrated Inorganic/Organic Laboratory
MATH 315	(3)	Ordinary Differential Equations
PHYS 242	(2)	Electricity and Magnetism

Complementary Course (3 credits)

3 credits from:

CHEM 355	(3)	Molecular Properties and Structure 2

14.7.9 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Chemistry - Physical (47 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 CEGEP. Students from outside Quebec or transfer students should consult the Academic Adviser.

See http://www.chemistry.mcgill.ca/advising/inside/advisors.php.

The Liberal Program: Core Science Component Chemistry - Physical Option is not certified by the Ordre des chimistes du Québec. Students interested in pursuing a career in Chemistry in Quebec are advised to take an appropriate B.Sc. program in Chemistry.

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.

CHEM 212*	(4)	Introductory Organic Chemistry 1
CHEM 222*	(4)	Introductory Organic Chemistry 2
CHEM 223	(2)	Introductory Physical Chemistry 1
CHEM 243	(2)	Introductory Physical Chemistry 2
CHEM 253	(1)	Introductory Physical Chemistry 1 Laboratory
CHEM 263	(1)	Introductory Physical Chemistry 2 Laboratory
CHEM 281	(3)	Inorganic Chemistry 1
CHEM 287	(2)	Introductory Analytical Chemistry
CHEM 297	(1)	Introductory Analytical Chemistry Laboratory
CHEM 381	(3)	Inorganic Chemistry 2
MATH 222**	(3)	Calculus 3

Physical Option Courses (21 credits)

CHEM 345	(3)	Molecular Properties and Structure 1
CHEM 355	(3)	Molecular Properties and Structure 2
CHEM 365	(2)	Statistical Thermodynamics

CHEM 393	(2)	Physical Chemistry Laboratory 2
COMP 208	(3)	Computers in Engineering
MATH 223	(3)	Linear Algebra
MATH 315	(3)	Ordinary Differential Equations
PHYS 242	(2)	Electricity and Magnetism

14.7.10 Bachelor of Science (B.Sc.) - Major Chemistry (59 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 (53 credits)

The required courses in this program consist of 53 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 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 142, omission tg3Mi

Complementary Courses (6 credits)

6 credits of additional Chemistry (CHEM) courses at the 300 level or higher.

14.7.11 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 (54 credits)

The required courses in this program consist of 54 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.chemistry.mcgill.ca/advising/inside/advisors.php.

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 219	(3)	Introduction to Atmospheric Chemistry
CHEM 222*	(4)	Introductory Organic Chemistry 2
CHEM 223	(2)	Introductory Physical Chemistry 1
CHEM 243	(2)	Introductory Physical Chemistry 2
CHEM 253	(1)	Introductory Physical Chemistry 1 Laboratory
CHEM 263	(1)	Introductory Physical Chemistry 2 Laboratory
CHEM 281	(3)	Inorganic Chemistry 1
CHEM 287	(2)	Introductory Analytical Chemistry
CHEM 297	(1)	Introductory Analytical Chemistry Laboratory
CHEM 302	(3)	Introductory Organic Chemistry 3
CHEM 345	(3)	Molecular Properties and Structure 1
CHEM 355	(3)	Molecular Properties and Structure 2
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)	Integrated Inorganic/Organic Laboratory
CHEM 393	(2)	Physical Chemistry Laboratory 2
MATH 222**	(3)	Calculus 3
MATH 315	(3)	Ordinary Differential Equations

Complementary Courses (9 credits)

3 credits, one of:

CHEM 419	(3)	Advances in Chemistry of Atmosphere
CHEM 462	(3)	Green Chemistry

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
ATOC 412	(3)	Atmospheric Dynamics
CHEM 567	(3)	Chemometrics: Data Analysis
CHEM 575	(3)	Chemical Kinetics
CHEM 597	(3)	Analytical Spectroscopy
EPSC 542	(3)	Chemical Oceanography

14.7.12 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 (60 credits)

The required courses in this program consist of 60 credits in chemistry, biology and mathematics, listed below. The courses marked with an asterisk (*) a54.Tj16.j1Tm(

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CHEM 297	(1)	Introductory Analytical Chemistry Laboratory
CHEM 302	(3)	Introductory Organic Chemistry 3
CHEM 345	(3)	Molecular Properties and Structure 1
CHEM 355	(3)	Molecular Properties and Structure 2
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)	Integrated Inorganic/Organic Laboratory
CHEM 393	(2)	Physical Chemistry Laboratory 2
CHEM 502	(3)	Advanced Bio-Organic Chemistry
MATH 222**	(3)	Calculus 3
MATH 315	(3)	Ordinary Differential Equations

Complementary Course (3 credits)

One of:

BIOL 202	(3)	Basic Genetics
BIOL 301	(4)	Cell and Molecular Laboratory
MIMM 211	(3)	Introductory Microbiology
PHGY 209	(3)	Mammalian Physiology 1
PHGY 210	(3)	Mammalian Physiology 2

14.7.13 Bachelor of Science (B.Sc.) - Major Chemistry - Materials (62 credits)

Program Prerequisites

PRE-PROGRAM REQUIREMENTS:

Students entering from the Freshman program must hav

CHEM 263	(1)	Introductory Physical Chemistry 2 Laboratory
		Inorganic Chemistry 1

CHEM 222*	(4)	Introductory Organic Chemistry 2
CHEM 223	(2)	Introductory Physical Chemistry 1
CHEM 243	(2)	Introductory Physical Chemistry 2
CHEM 253	(1)	Introductory Physical Chemistry 1 Laboratory
CHEM 263	(1)	Introductory Physical Chemistry 2 Laboratory
CHEM 281	(3)	Inorganic Chemistry 1
CHEM 287	(2)	Introductory Analytical Chemistry
CHEM 297	(1)	Introductory Analytical Chemistry Laboratory
CHEM 302	(3)	Introductory Organic Chemistry 3
CHEM 345	(3)	Molecular Properties and Structure 1
CHEM 355	(3)	Molecular Properties and Structure 2
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)	Integrated Inorganic/Organic Laboratory
CHEM 393	(2)	Physical Chemistry Laboratory 2
MATH 222**	(3)	Calculus 3
MATH 315	(3)	Ordinary Differential Equations
PHYS 242	(2)	Electricity and Magnetism

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)	Research Project 2

12 credits of additional Chemistry courses as follows:

6 credits of which must be at the 300 level or higher, and

6 credits of which must be at the 400 level or higher.

14.7.15 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 (60 credits)

The required courses in this program consist of 60 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.chemistry

ATOC 315	(3)	Thermodynamics and Convection
ATOC 412	(3)	Atmospheric Dynamics
CHEM 567	(3)	Chemometrics: Data Analysis
		Chemical Kinetics

CHEM 393	(2)	Physical Chemistry Laboratory 2
MATH 222**	(3)	Calculus 3
MATH 315	(3)	Ordinary Differential Equations

Complementary Courses (18 credits)

18 credits selected as follows:

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)	Research Project 2

6 credits, two of the following courses:

BIOL 202	(3)	Basic Genetics
BIOL 301	(4)	Cell and Molecular Laboratory
CHEM 502	(3)	Advanced Bio-Organic Chemistry
MIMM 211	(3)	Introductory Microbiology
MIMM 214	(3)	Introductory Immunology: Elements of Immunity

CHEM 222*	(4)	Introductory Organic Chemistry 2
CHEM 223	(2)	Introductory Physical Chemistry 1
CHEM 243	(2)	Introductory Physical Chemistry 2
CHEM 253	(1)	Introductory Physical Chemistry 1 Laboratory
CHEM 263	(1)	Introductory Physical Chemistry 2 Laboratory
CHEM 281	(3)	Inorganic Chemistry 1
CHEM 287	(2)	Introductory Analytical Chemistry
CHEM 297	(1)	Introductory Analytical Chemistry Laboratory
CHEM 302	(3)	Introductory Organic Chemistry 3
CHEM 334	(3)	Advanced Materials
CHEM 345	(3)	Molecular Properties and Structure 1
CHEM 355	(3)	Molecular Properties and Structure 2
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)	Integrated Inorganic/Organic Laboratory
CHEM 393	(2)	Physical Chemistry Laboratory 2
CHEM 470***	(6)	Research Project 1
CHEM 574	(3)	Introductory Polymer Chemistry
MATH 222**	(3)	Calculus 3
MATH 315	(3)	Ordinary Differential Equations
PHYS 242	(2)	Electricity and Magnetism

Complementary Courses (9 credits)

9 credits, three of:

* Students take either ANAT 542 or MIME 542.

ANAT 542*	(3)	Transmission Electron Microscopy
CHEM 462	(3)	Green Chemistry
CHEM 531	(3)	Chemistry of Inorganic Materials
CHEM 533	(3)	Small Molecule Crystallography
CHEM 534	(3)	Nanoscience and Nanotechnology
CHEM 571	(3)	Polymer Synthesis
dA7N462	(3)	Supramolecular Chemistry

14.8 Cognitive Science

14.8.1 About Cognitive Science

Cognitive Science is the multidisciplinary study of cognition in humans and machines. The goal is to understand the principles of intelligence and thought with the hope that this will lead to a better understanding of the mind and of learning, and to the development of intelligent devices that constructively extend human abilities.

Students wishing to enrol in the Minor in Cognitive Science must meet with the Interdisciplinary Programs Adviser in the Faculty of Science.

14.8.2 Bachelor of Science (B.Sc.) - Minor Cognitive Science (24 credits)

The Minor Cognitive Science is intended to allow students in the Faculty of Arts or the Faculty of Science to explore the interdisciplinary study of cognition. The goal is to understand the principles of intelligence with the hope that this will lead to a better understanding of the mind and learning.

Students wishing to complete this Minor must meet with the Interdisciplinary Programs Adviser in the Science Office for Undergraduate Student Advising (SOUSA).

Required Course (3 credits)

PSYC 532	(3)	Cognitive Science

Complementary Courses (21 credits)

Note:

Students must take a minimum of 6 credits at the 400 to 500 level.

Students may not take any courses from their home department(s).

Students complete a minimum of 9 credits each in two areas.

Computer Science and Mathematics

COMP 206	(3)	Introduction to Software Systems
COMP 230	(3)	Logic and Computability
COMP 250	(3)	Introduction to Computer Science
COMP 251	(3)	Algorithms and Data Structures
COMP 302	(3)	Programming Languages and Paradigms
COMP 330	(3)	Theory of Computation
COMP 417	(3)	Introduction Robotics and Intelligent Systems
COMP 424	(3)	Artificial Intelligence
COMP 527	(3)	Logic and Computation
COMP 531	(3)	Advanced Theory of Computation
MATH 318	(3)	Mathematical Logic

Linguistics

LING 201	(3)	Introduction to Linguistics
LING 330	(3)	Phonetics
LING 331	(3)	Phonology 1
LING 355	(3)	Language Acquisition 1
LING 360	(3)	Introduction to Semantics
LING 371	(3)	Syntax 1
LING 419	(3)	Linguistic Theory and its Foundations

LING 440	(3)	Morphology
LING 455	(3)	Second Language Syntax
LING 571	(3)	Syntax 2
LING 590	(3)	Language Acquisition and Breakdown

Philosophy

PHIL 210	(3)	Introduction to Deductive Logic 1
PHIL 304	(3)	Chomsky
PHIL 306	(3)	Philosophy of Mind
PHIL 310	(3)	Intermediate Logic
PHIL 415	(3)	Philosophy of Language
PHIL 474	(3)	Phenomenology
PHIL 506	(3)	Seminar: Philosophy of Mind
PHIL 511	(3)	Seminar: Philosophy of Logic and Mathematics

Psychology

PSYC 213	(3)	Cognition
PSYC 301	(3)	Animal Learning & Theory
PSYC 304	(3)	Child Development
PSYC 310	(3)	Intelligence
PSYC 311	(3)	Human Cognition and the Brain
PSYC 315	(3)	Computational Psychology
PSYC 340	(3)	Psychology of Language
PSYC 410	(3)	Special Topics in Neuropsychology
PSYC 413	(3)	Cognitive Development

14.9 Computer Science (COMP)

14.9.1 Location

McConnell Engineering Building, Room 318
3480 University Street
Montreal, Quebec H3A 0E9
Telephone: 514-398-7071
Fax: 514-398-3883

Undergraduate Student Affairs Office
Lorne Trottier Building, Room 2060
3630 University Street
Montreal, Quebec H3A 0C6
Telephone: 514-398-7071 ext. 00739
Fax: 514-398-4653

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14.9.2 About Computer Science

Computer Science covers the theory and practice behind the design and implementation of computer and information systems. Fundamental to computer science are questions about how to describe, process, manage, and analyze information and computation. A fundamental building block is the study of algorithms. An algorithm presents a detailed sequence of actions solving a particular task. A computer program is the implementation of an algorithm in a specific programming language, which enables a computer to execute the algorithm. Software generally refers to a computer program or a set of related computer programs.

Based on the building blocks of computational thinking and programming, computer science is split into many different areas such as the study of algorithms and data structures, programming languages and methodology, theory of computation, software engineering (the design of large software systems), computer architecture (the structure of the hardware), communication between computers, operating systems (the software that shields users from the underlying hardware), database systems (software that handles large amounts of data efficiently), artificial intelligence (algorithms inspired by human information processing), computer vision (algorithms that let computers see and recognize their environment), computer graphics, robotics (algorithms that control robots), and computational biology (algorithms and methods that address problems inspired by biology). Computer science also plays an important role in many other fields, including Biology, Physics, Engineering, Business, Music, and Neuroscience, where it is necessary to process and reason about large amounts of data. Computer Science is strongly related to mathematics, linguistics, and engineering.

A degree in Computer Science offers excellent job prospects. As the use of computers and specialized software plays a crucial role in business, science, and our personal life, computer science graduates are in high demand. Computer scientists find jobs in software development, in consulting, in research, and in project management. As computer scientists often develop the software for a specific application domain (e.g., business, engineering, medicine), they must be prepared and willing to get to know their application area.

The School of Computer Science offers a wide range of programs. Most programs start with the same set of basic courses allowing students to decide on their exact program once they get a basic understanding of the discipline. Within the Faculty of Science, there are a major, an honours, a liberal, and a minor program in Computer Science, a major and a liberal program in Software Engineering, a major in Computer Science: Computer Games Option, a joint major and a joint honours program in Mathematics and Computer Science (see *section 14.21: Mathematics and Statistics (MATH)*), a joint major and a joint honours program in Statistics and Computer Science (see *section 14.21: Mathematics and Statistics (MATH)*), a joint major in Physics and Computer Science (see *section 14.29: Physics (PHYS)*), and a joint major in Computer Science and Biology (see *section 14.5: Biology (BIOL)*). The School also offers a major concentration and minor concentrations in Computer Science, and a major concentration in Software Engineering through the Faculty of Arts (see *Programs, Courses and University Regulations* > *Faculties & Schools* > *Faculty of Arts* > *Undergraduate* > *Academic Programs* > *: Computer Science (COMP)*) or as part of a Bachelor of Arts and Science (see *Programs, Courses and University Regulations*

have been completed with at least an average of B-. A background in computer science is not necessary as students may start their studies with the introductory course COMP 202. However, taking COMP 202 in the Freshman year, or completing an equivalent course in CEGEP, would be an asset and allo

Associate Professors

Adrian Vetta; B.Sc., M.Sc.(LSE), Ph.D.(MIT)

Assistant Professors

Hamed Hatami; B.Sc.(Sharif Univ. of Technology), M.Sc., Ph.D.(Tor.)

Wenbo He; B.Eng.(Harbin), M.Eng., Ph.D.(Ill.)

Paul Kry; B.Sc.(Wat.), M.Sc., Ph.D.(Br. Col.)

Derek Ruths; B.Sc., M.Sc., Ph.D.(Rice)

Jérôme Waldispühl; B.Sc.(Nice and Sophia-Antipolis, France), M.Sc.(Paris VII), Ph.D.(École Poly., France)

Faculty Lecturer

Joseph Vybihal; B.Sc., M.Sc.(McG.)

Associate Members

Daniel J. Levitin (*Psychology*)

Dirk Schlimm (*Philosophy*)

Raja Sengupta (*Geography*)

F. Bruce Shepherd (*Mathematics*)

Thomas Richard Shultz (*Psychology*)

Renée Sieber (*Geography*)

Adjunct Professors

Masoumeh Tabaeh Izadi; B.Sc.(Tehran), M.Sc.(King's Coll., Lond.), Ph.D.(McG.)

Theodore Perkins; B.A.(Car.), M.Sc.(Wisc.), Ph.D.(Mass.)

Ioannis Rekleitis; B.Sc.(Athens), M.Sc., Ph.D.(McG.)

Ger Otto Sabidussi

Hans Vangheluwe; B.Sc., M.Sc., D.Sc.(Ghent, Belgium)

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

This Minor is designed for students who want to gain a basic understanding of computer science principles and get an overview of some computer science areas. Basic computer science skills are important in many domains. Thus, the Minor is useful for students majoring in any discipline. It can be taken in conjunction with any program in the Faculties of Science and Engineering (with the exception of other programs in Computer Science).

Students must obtain approval from the adviser of their main program. Students are strongly encouraged to talk to an adviser of the School of Computer

* Note: COMP 251 is a prerequisite for many of the other complementary courses.

COMP 251*	(3)	Algorithms and Data Structures
COMP 273	(3)	Introduction to Computer Systems
MATH 222	(3)	Calculus 3
MATH 240	(3)	Discrete Structures 1

14.9.8 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 (21 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 222	(3)	Calculus 3
MATH 240	(3)	Discrete Structures 1

Complementary Courses (24 credits)

3-6 credits from:

MATH 223	(3)	Linear Algebra
MATH 318	(3)	Mathematical Logic
MATH 323	(3)	Probability
MATH 324	(3)	Statistics
MATH 340	(3)	Discrete Structures 2

At least 3 credits from:

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

At least 3 credits from:

COMP 302	(3)	Programming Languages and Paradigms
COMP 303	(3)	Software Development

The remaining complementary courses should be selected from any COMP courses at the 300 level or above except COMP 364, COMP 396, COMP 400 and COMP 431.

Note: Advanced COMP courses have more prerequisites than the required courses for this program. Students have to make sure that they have the appropriate prerequisites when choosing upper-level courses.

14.9.9 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.

Students may complete this program with a minimum of 48 credits or a maximum of 49 credits depending on their choice of complementary courses.

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 Development
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 1

Complementary Courses (13 credits)

3 credits selected from:

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

9-10 credits selected from the courses below:

COMP 322	(1)	Introduction to C++
COMP 409	(3)	Concurrent Programming
COMP 421	(3)	Database Systems
COMP 520	(4)	Compiler Design
COMP 525	(3)	Formal Verification
COMP 529	(4)	Software Architecture
COMP 533	(3)	Model-Driven Software Development
COMP 535	(3)	Computer Networks 1

Or any computer science course at the 300 level or above, excluding COMP 364, COMP 396, and COMP 400.

14.9.10 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 Development
COMP 310	(3)	Operating Systems
MATH 222	(3)	Calculus 3
MATH 223	(3)	Linear Algebra
MATH 240	(3)	Discrete Structures 1

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 MA

6 credits from the following:

MATH 222	(3)	Calculus 3
MATH 223	(3)	Linear Algebra

Required Computer Science Courses

12-16 credits from:

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

** Students take either COMP 462 or COMP 561.

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

- at least 3 credits at the 400 level or above from each block

Computer Science Block

Note: All COMP courses at the 400 level or above (except COMP 400).

COMP 273	(3)	Introduction to Computer Systems
COMP 302	(3)	Programming Languages and Paradigms
COMP 303	(3)	Software Development
COMP 310	(3)	Operating Systems
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
MATH 240	(3)	Discrete Structures 1

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

Biology Block

BIOL 300	(3)	Molecular Biology of the Gene
BIOL 309	(3)	Mathematical Models in Biology
BIOL 310	(3)	Biodiversity and Ecosystems
BIOL 313	(3)	Eukaryotic Cell Biology
BIOL 395	(1)	Quantitative Biology Seminar 1
BIOL 435	(3)	Natural Selection
BIOL 495	(1)	Quantitative Biology Seminar 2
BIOL 518	(3)	Advanced Topics in Cell Biology
BIOL 551	(3)	Principles of Cellular Control
BIOL 568	(3)	Topics on the Human Genome
BIOL 569	(3)	Developmental Evolution
BIOL 583	(3)	Advanced Biometry

14.9.12 Bachelor of Science (B.Sc.) - Major Computer Science - Computer Games (67 credits)

This program is a specialization within Computer Science. It fulfils all the basic requirements of the Major Computer Science. Complementary courses focus 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 67 credits depending if they are exempt from taking COMP 202 and their choice of complementary courses.

Required Courses (50 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 Development
COMP 308	(1)	Computer Systems Lab
COMP 310	(3)	Operating Systems
COMP 322	(1)	Introduction to C++
COMP 330	(3)	Theory of Computation
COMP 361D1	(3)	Software Engineering Project
COMP 361D2	(3)	Software Engineering Project
COMP 557	(3)	Fundamentals of Computer Graphics
MATH 222	(3)	Calculus 3
MATH 223	(3)	Linear Algebra
MATH 240	(3)	Discrete Structures 1
MATH 323	(3)	Probability

Complementary Courses (17 credits)

Students complete a minimum of 15 or a maximum of 17 complementary credits selected as follows:

3 credits selected from:

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

6-8 credits selected from:

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 559	(4)	Fundamentals of Computer Animation

6 credits selected from:

COMP 409	(3)	Concurrent Programming
COMP 421	(3)	Database Systems
COMP 535	(3)	Computer Networks 1

14.9.13 Bachelor of Science (B.Sc.) - Major Software Engineering (63 credits)

This program provides a broad introduction to the principles of computer science and covers in depth the design and development of software systems.

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

Required Courses (39 credits)

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

** Students may select either COMP 310 or ECSE 427, but not both.

COMP 202*	(3)	Foundations of Programming

Introduction to Software Systems

COMP 424	(3)	Artificial Intelligence
COMP 512	(4)	Distributed Systems
COMP 520	(4)	Compiler Design
COMP 521	(4)	Modern Computer Games
COMP 522	(4)	Modelling and Simulation
COMP 535	(3)	Computer Networks 1
COMP 557*	(3)	Fundamentals of Computer Graphics
COMP 558	(3)	Fundamentals of Computer Vision
ECSE 424	(3)	Human-Computer Interaction
ECSE 532*	(3)	Computer Graphics

14.9.14 Bachelor of Science (B.Sc.) - Honours Computer Science (75 credits)

Students may complete this program with a minimum of 72 credits or a maximum of 75 credits depending 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 (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 Development
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)	Honours Project in Computer Science
MATH 222	(3)	Calculus 3
MATH 223	(3)	Linear Algebra
MATH 240	(3)	Discrete Structures 1
MATH 340**	(3)	Discrete Structures 2
MATH 350**	(3)	Graph Theory and Combinatorics

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). At least 12 credits must be at the 500 level.

14.9.15 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 (42 credits)

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

** Students may select either COMP 310 or ECSE 427, but not both.

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 Development
COMP 310**	(3)	Operating Systems
COMP 361D1	(3)	Software Engineering Project
COMP 361D2	(3)	Software Engineering Project
COMP 400	(3)	Honours Project in Computer Science
ECSE 427**	(3)	Operating Systems
ECSE 429	(3)	Software Validation
MATH 223	(3)	Linear Algebra
MATH 240	(3)	Discrete Structures 1

Complementary Courses (33 credits)

Of the 33 credits, at least 12 credits must be at the 500 level or above. Courses at the 600 level require special permission. Information on the policy and procedures for such permission may be found at: http://www.mcgill.ca/science/sousa/general/course/600-level_courses/.

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

Group A:

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

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

At least 18 credits selected from the following, with at least 6 credits selected from Software Engineering Specializations, and at least 9 credits selected from Applications Specialties.

Software Engineering Specializations

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

COMP 409*	(3)	Concurrent Programming
COMP 523	(3)	Language-based Security
COMP 525	(3)	Formal Verification
COMP 529	(4)	Software Architecture
COMP 533	(3)	Model-Driven Software Development
ECSE 420*	(3)	Parallel Computing

Application Specialties

COMP 350	(3)	Numerical Computing
COMP 417	(3)	Introduction Robotics and Intelligent Systems
COMP 421	(3)	Database Systems
COMP 424	(3)	Artificial Intelligence
COMP 512	(4)	Distributed Systems
COMP 520	(4)	Compiler Design
COMP 521	(4)	Modern Computer Games
COMP 522	(4)	Modelling and Simulation
COMP 535	(3)	Computer Networks 1
COMP 557	(3)	Fundamentals of Computer Graphics
COMP 558	(3)	Fundamentals of Computer Vision
ECSE 424	(3)	Human-Computer Interaction

At least 6 credits selected from any COMP courses at the 500 level or above. These may include courses on the Software Engineering Specializations and Application Specialties lists.

14.9.16 Computer Science (COMP) Related Programs

14.9.16.1 Joint Major in Mathematics and Computer Science

For more information, see *section 14.21: Mathematics and Statistics (MATH)*.

14.9.16.2 Joint Honours in Mathematics and Computer Science

For more information, see *section 14.21: Mathematics and Statistics (MATH)*. Students must consult an Honours adviser in both departments.

14.9.16.3 Joint Major in Statistics and Computer Science

For more information, see *section 14.21: Mathematics and Statistics (MATH)*.

14.9.16.4 Joint Honours in Statistics and Computer Science

For more information, see *section 14.21: Mathematics and Statistics (MATH)*. Students must consult an Honours adviser in both departments.

14.9.16.5 Joint Major in Physics and Computer Science

For more information, see *section 14.29: Physics (PHYS)*.

14.9.16.6 Minor in Cognitive Science

Students following Major or Honours programs in Computer Science may want to consider the Minor in Cognitive Science.

14.10 Earth and Planetary Sciences (EPSC)

14.10.1 Location

Frank Dawson Adams Building, Room 238
3450 University Street
Montreal, Quebec H3A 0E8

Telephone: 514-398-6767
Fax: 514-398-4680
Email: *kristy.thornton@mcgill.ca*
Website: *www.eps.mcgill.ca*

14.10.2 About Earth and Planetary Sciences

Revision, August 2013. Start of revision.

The domain of Earth and Planetary Sciences includes the solid Earth and its hydrosphere and extends to the neighbouring terrestrial planets. It is a

Professors

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

EPSC 233	(3)	Earth and Life History

9 credits selected from the list below and other 300-level and higher courses in Earth and Planetary Sciences may be substituted with permission.

EPSC 203	(3)	Structural Geology
EPSC 231	(3)	Field School 1
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 1

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

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)	Isotope Geology
EPSC 542	(3)	Chemical Oceanography
EPSC 561	(3)	Ore-forming Processes 1
EPSC 570	(3)	Cosmochemistry
EPSC 590	(3)	Applied Geochemistry Seminar

14.10.6 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 203	(3)	Structural Geology
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 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 312	(3)	Spectroscopy of Minerals
EPSC 330	(3)	Earthquakes and Earth Structure
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)	Isotope Geology
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 1
EPSC 562	(3)	Ore-forming Processes 2
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

14.10.7 Bachelor of Science (B.Sc.) - Major Earth and Planetary Sciences (66 credits)

The program curriculum is designed to provide a rigorous foundation in physical sciences and the flexibility to create an individualized program in preparation for careers in industry, teaching, and research. The program is accepted for professional qualification in most Canadian provinces.

U1 Required Courses (21 credits)

EPSC 203	(3)	Structural Geology
EPSC 210	(3)	Introductory Mineralogy
EPSC 212	(3)	Introductory Petrology
EPSC 220	(3)	Principles of Geochemistry
EPSC 231	(3)	Field School 1
EPSC 312	(3)	Spectroscopy of Minerals
MATH 222	(3)	Calculus 3

U1 Complementary Course (3 credits)

3 credits, one of:

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

U2 and/or U3 Required Courses (24 credits)

EPSC 320	(3)	Elementary Earth Physics
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 445	(3)	Metamorphic Petrology
EPSC 452	(3)	Mineral Deposits

Complementary Courses (18 credits)

3 credits, one of:

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

plus 15 credits (five courses) chosen from the following:

Note: Other courses at the 300 level or higher in Earth and Planetary Sciences and 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 330	(3)	Earthquakes and Earth Structure
EPSC 425	(3)	Sediments to Sequences
EPSC 435	(3)	Applied Geophysics
EPSC 470D1	(3)	Undergraduate Thesis Research
EPSC 470D2	(3)	Undergraduate Thesis Research
EPSC 501	(3)	Crystal Chemistry
EPSC 519	(3)	Isotope Geology
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 1
EPSC 562	(3)	Ore-forming Processes 2
EPSC 567	(3)	Advanced Volcanology
EPSC 570	(3)	Cosmochemistry
EPSC 580	(3)	Aqueous Geochemistry
EPSC 590	(3)	Applied Geochemistry Seminar

14.10.8 Bachelor of Science (B.Sc.) - Honours Earth Sciences (75 credits)

The program curriculum is designed to provide a rigorous foundation in physical sciences and the flexibility to create an individualized program in preparation for careers in industry, teaching, and research. It is intended to provide an excellent preparation for graduate work in the earth sciences. The program is accepted for professional qualification in most Canadian provinces.

Note: Honours students must maintain a CGPA equal to or greater than 3.20.

U1 Required Courses (24 credits)

EPSC 203	(3)	Structural Geology
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 312	(3)	Spectroscopy of Minerals
MATH 222	(3)	Calculus 3

U2 and/or U3 Required Courses (33 credits)

EPSC 320	(3)	Elementary Earth Physics
EPSC 340	(3)	Earth and Planetary Inference
EPSC 350	(3)	Tectonics
EPSC 355	(3)	Sedimentary Geology
EPSC 423	(3)	Igneous Petrology
EPSC 445	(3)	Metamorphic Petrology
EPSC 452	(3)	Mineral Deposits
EPSC 480D1	(3)	Honours Research Project
EPSC 480D2	(3)	Honours Research Project
MATH 314	(3)	Advanced Calculus
MATH 315	(3)	Ordinary Differential Equations

Complementar

EPSC 562	(3)	Ore-forming Processes 2
EPSC 567	(3)	Advanced Volcanology
EPSC 580	(3)	Aqueous Geochemistry
EPSC 590	(3)	Applied Geochemistry Seminar

14.10.10 Earth and Planetary Sciences (EPSC) Related Programs

14.10.10.1 Joint Major in Physics and Geophysics

For more information, see *section 14.29: Physics (PHYS)*.

14.10.10.2 Earth System Science Interdepartmental Major

Revision, August 2013. Start of revision.

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*).

Revision, August 2013. End of revision.

For more information, see *section 14.11: Earth System Science (ESYS)*.

Complementary Cour

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
	(3)	Principles Earth Citizenship

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 312	(3)	Spectroscopy of Minerals
EPSC 320	(3)	Elementary Earth Physics
EPSC 330	(3)	Earthquakes and Earth Structure
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
	phic Petrology	Metamorphic Petrology

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
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 312	(3)	Spectroscopy of Minerals
EPSC 320	(3)	Elementary Earth Physics
EPSC 330	(3)	Earthquakes and Earth Structure
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
	(3)	Metamorphic Petrology

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 470	(3)	Wetlands
GEOG 495	(3)	Field Studies - Physical Geography
GEOG 499	(3)	Subarctic Field Studies
GEOG 501	(3)	Modelling Environmental Systems
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
MATH 317	(3)	Numerical Analysis
MATH 319	(3)	Introduction to Partial Differential Equations
MATH 323	(3)	Probability
MATH 326	(3)	Nonlinear Dynamics and Chaos
MATH 423	(3)	Regression and Analysis of Variance
MATH 437	(3)	Mathematical Methods in Biology
MATH 447	(3)	Introduction to Stochastic Processes
MATH 525	(4)	Sampling Theory and Applications
NRSC 540	(3)	Socio-Cultural Issues in Water
PHYS 331	(3)	Topics in Classical Mechanics
PHYS 340	(3)	Majors Electricity and Magnetism
PHYS 342	(3)	Majors Electromagnetic Waves
PHYS 432	(3)	Physics of Fluids

* MATH 315 is a required course for the B.Sc. Honours Earth System Science.

14.12 Environment

14.12.1 Location

Downtown Campus
3534 University Street
Montreal, Quebec H3A 2A7
Telephone: 514-398-2827
Fax: 514-398-1643

Macdonald Campus
Rowles House
21,111 Lakeshore Road
Sainte-Anne-de-Bellevue, Quebec H9X 3V9
Telephone: 514-398-7559
Fax: 514-398-7846

14.12.2 About Environment

All courses given by the McGill School of Environment (Subject Code ENVR) are considered as courses taught by the Faculty of Science.

Science students who are interested in studying the environment should refer to *Programs, Courses and University Regulations* > *Faculties & Schools* > *McGill School of Environment* .

Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.8s6i M0mc5R0 G0/I

Suggested Course List

The Suggested Course List is divided into two thematic categories: Social Sciences and Policy; and Natural Sciences and Technology.

Most courses listed at the 300 level and higher have prerequisites. You are urged to prepare your program of study with this in mind.

This list is not meant to be exhaustive. You are also encouraged to examine the course lists of the various domains in the Environment program for other courses that might interest you. Courses not on the Suggested Course list may be included in the Minor with the permission of the MSE Program Adviser.

Location Note: When planning your schedule and registering for courses, you should verify where each course is offered because courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue.

Social Sciences and Policy

* Note: If WILD 415 is taken, 1 additional credit of complementary courses must be taken.

AGEC 231	(3)	Economic Systems of Agriculture
AGEC 333	(3)	Resource Economics
AGEC 430	(3)	Agriculture, Food and Resource Policy

GEOG 410	(3)	Geography of Underdevelopment: Current Problems
GEOG 530	(3)	Global Land and Water Resources
GEOG 551	(3)	Environmental Decisions
MGPO 440	(3)	Strategies for Sustainability
NRSC 221	(3)	Environment and Health
NRSC 540	(3)	Socio-Cultural Issues in Water
PHIL 230	(3)	Introduction to Moral Philosophy 1
PHIL 237	(3)	Contemporary Moral Issues
PHIL 334	(3)	Ethical Theory
PHIL 343	(3)	Biomedical Ethics
PHIL 348	(3)	Philosophy of Law 1
POLI 211	(3)	Comparative Government and Politics
POLI 212	(3)	Government and Politics - Developed World
POLI 227	(3)	Developing Areas/Introduction
POLI 345	(3)	International Organizations
POLI 445	(3)	International Political Economy: Monetary Relations
PSYC 215	(3)	Social Psychology
RELG 270	(3)	Religious Ethics and the Environment
RELG 340	(3)	Religion and the Sciences
RELG 370	(3)	Religion and Human Rights
RELG 376	(3)	Religious Ethics
SOCI 222	(3)	Urban Sociology
SOCI 234	(3)	Population and Society
SOCI 235	(3)	Technology and Society
SOCI 254	(3)	Development and Underdevelopment
SOCI 386	(3)	Contemporary Social Movements
URBP 201	(3)	Planning the 21st Century City
URBP 506	(3)	Environmental Policy and Planning
URBP 530	(3)	Urban Environmental Planning
WILD 415*	(2)	Conservation Law

Natural Sciences and T

BIOL 305	(3)	Animal Diversity
BIOL 308*	(3)	Ecological Dynamics
BIOL 310	(3)	Biodiversity and Ecosystems
BIOL 342	(3)	Marine Biology
BIOL 418	(3)	Freshwater Invertebrate Ecology
BIOL 432*	(3)	Limnology
BIOL 436	(3)	Evolution and Society
BIOL 465	(3)	Conservation Biology
BREE 217*	(3)	Hydrology and Water Resources
BREE 322	(3)	Organic Waste Management
BREE 518	(3)	Bio-Treatment of Wastes
BTEC 502	(3)	Biotechnology Ethics and Society
CHEE 230	(3)	Environmental Aspects of Technology
CHEM 212	(4)	Introductory Organic Chemistry 1
CHEM 281	(3)	Inorganic Chemistry 1
CHEM 462	(3)	Green Chemistry
CIVE 225	(4)	Environmental Engineering
CIVE 323	(3)	Hydrology and Water Resources
CIVE 550	(3)	Water Resources Management
ENTO 340	(3)	Field Entomology
ENVB 210	(3)	The Biophysical Environment
ENVB 301	(3)	Meteorology
ENVB 305*	(3)	Population & Community Ecology
ENVB 315*	(3)	Science of Inland Waters
ENVB 410	(3)	Ecosystem Ecology
ENVB 415	(3)	Ecosystem Management
ENVB 430*	(3)	GIS for Natural Resource Management
ENVR 200	(3)	The Global Environment
ENVR 202	(3)	The Evolving Earth
EPSC 201	(3)	Understanding Planet Earth
		Earth and 1IHSC 201

LSCI 230*	(3)	Introductory Microbiology
MICR 331	(3)	Microbial Ecology
MIME 308	(3)	Social Impact of Technology
MIME 320	(3)	Extraction of Energy Resources
MIMM 211*	(3)	Introductory Microbiology
MIMM 214	(3)	Introductory Immunology: Elements of Immunity
MIMM 323	(3)	Microbial Physiology
MIMM 324	(3)	Fundamental Virology

ENVR 301	(3)	Environmental Research Design
ENVR 400	(3)	Environmental Thought

Core: Complementary Course - Senior Research Project (3 credits)

Only 3 credits will be applied to the program; extra credits will count as electives.

9 credits of Math or Physical Science (at least 6 credits of which are at the 300 level or above):

* Note: You may take ATOC 419 or CHEM 419, but not both; you may take AEMA 305 or MATH 315, but not both.

AEMA 305*	(3)	Differential Equations
ATOC 309	(3)	Weather Radars and Satellites
ATOC 412	(3)	Atmospheric Dynamics
ATOC 419*	(3)	Advances in Chemistry of Atmosphere
ATOC 540	(3)	Synoptic Meteorology 1
CHEE 230	(3)	Environmental Aspects of Technology
CHEM 243	(2)	Introductory Physical Chemistry 2
CHEM 377	(3)	Instrumental Analysis 2
CHEM 419*	(3)	Advances in Chemistry of Atmosphere
CIVE 225	(4)	Environmental Engineering
COMP 208	(3)	Computers in Engineering
GEOG 505	(3)	Global Biogeochemistry
MATH 223	(3)	Linear Algebra
MATH 315*	(3)	Ordinary Differential Equations
NRSC 333	(3)	Pollution and Bioremediation
NRSC 510	(3)	Agricultural Micrometeorology

Social Science:

One of:

ANTH 206	(3)	Environment and Culture
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
GEOG 302	(3)	Environmental Management 1
GEOG 404	(3)	Environmental Management 2
GEOG 498	(3)	Humans in Tropical Environments
RELG 270	(3)	Religious Ethics and the Environment

14.12.5 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)

This domain (63 credits including core) is open only to students in the B.Sc.(Ag.Env.Sc.) Major in Environment or B.Sc. Major in Environment program.

This domain links the academic study of biological diversity with the applied field of conservation biology. The study of biological diversity, or "biodiversity," lies at the intersection of evolution with ecology and genetics, combining the subdisciplines of evolutionary ecology, evolutionary genetics, and ecological genetics. It has two main branches: the creation of diversity and the maintenance of diversity. Both processes are governed by a general mechanism of selection acting over different scales of space and time. This gives rise to a distinctive set of principles and generalizations that regulate rates of diversification and levels of diversity, as well as the abundance or rarity of different species. Conservation biology constitutes the application of these principles in the relevant social and economic context to the management of natural systems, with the object of preventing the extinction of rare species and maintaining the diversity of communities. As the impact of industrialization and population growth on natural systems has become more severe, conservation has emerged as an important area of practical endeavour.

Suggested First Year (U1) Courses

For suggestions on courses to take in your first year (U1), you can consult the "MSE Student Handbook 2012-2013" available on the MSE website (http://www.mcgill.ca/mse), or contact Ms. Kathy Roulet, the Program Adviser (kathy.roulet@mcgill.ca).

Program Requirements

Note: Students are required to take a maximum of 30 credits at the 200 level and a minimum of 12 credits at the 400 level or higher in this program. This includes core and required courses.

Location Note: When planning their schedule and registering for courses, students should verify where each course is offered because courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue.

Core: Required Courses (18 credits)

Location Note: Core required courses are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue. You should register in Section 001 of an ENVR course that you plan to take on the Downtown campus, and in Section 051 of an ENVR course that you plan to take on the Macdonald campus.

ENVR 200	(3)	The Global Environment
ENVR 201	(3)	Society, Environment and Sustainability
ENVR 202	(3)	The Evolving Earth
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 301	(3)	Environmental Research Design
ENVR 400	(3)	Environmental Thought

Core: Complementar Complemeyp4.j1lTj1 1 60 0 1 165.86461 T1i 40 iwnto0

BIOL 465	(3)	Conservation Biology
WILD 421	(3)	Wildlife Conservation

Ecology:

One of:

BIOL 308	(3)	Ecological Dynamics
ENVB 305	(3)	Population & Community Ecology

Statistics:

One of:

AEMA 310	(3)	Statistical Methods 1
BIOL 373	(3)	Biometry

Science, Policy, and Management:

9 credits are chosen from interface between science, policy, and management as follows:

* Note: You may take AGEC 200 or ECON 208, but not both.

AGEC 200*	(3)	Principles of Microeconomics
AGRI 550	(3)	Sustained Tropical Agriculture
ECON 208*	(3)	Microeconomic Analysis and Applications
ECON 225	(3)	Economics of the Environment
GEOG 302	(3)	Environmental Management 1
GEOG 370	(3)	Protected Areas
GEOG 408	(3)	Geography of Development
GEOG 410	(3)	Geography of Underdevelopment: Current Problems

Field Courses

One of:

AGRI 452	(3)	Water Resources in Barbados
BIOL 331	(3)	Ecology/Behaviour Field Course
BIOL 334	(3)	Applied Tropical Ecology
BIOL 553	(3)	Neotropical Environments
GEOG 495	(3)	Field Studies - Physical Geography
GEOG 499	(3)	Subarctic Field Studies
WILD 475	(3)	Desert Ecology

General Scientific Principles

6 credits of general scientific principles selected from the following:

* Note: You may take ENVB 430 or GEOG 306, but not both.

(A second field course from the domain curriculum may also be taken.)

** Note: You may take BIOL 432 or ENVB 315, but not both.

BIOL 324	(3)	Ecological Genetics
BIOL 342	(3)	Marine Biology

BIOL 432**	(3)	Limnology
BIOL 441	(3)	Biological Oceanography
ENVB 313	(3)	Phylogeny and Biogeography
ENVB 315**	(3)	Science of Inland Waters
ENVB 410	(3)	Ecosystem Ecology
ENVB 430*	(3)	GIS for Natural Resource Management
ENVB 437	(3)	Assessing Environmental Impact
GEOG 272	(3)	Earth's Changing Surface
GEOG 306*	(3)	Raster Geo-Information Science
GEOG 321	(3)	Climatic Environments
GEOG 322	(3)	Environmental Hydrology
GEOG 350	(3)	Ecological Biogeography
MICR 331	(3)	Microbial Ecology
PLNT 460	(3)	Plant Ecology
WILD 311	(3)	Ethology
WOOD 420	(3)	Environmental Issues: Forestry

Social Science:

One of:

* Note: If WILD 415 is taken, 1 additional credit of complementary courses must be taken.

AGEC 333	(3)	Resource Economics
ANTH 339	(3)	Ecological Anthropology
ANTH 416	(3)	Environment/Development: Africa
ECON 326	(3)	Ecological Economics
GEOG 404	(3)	Environmental Management 2
GEOG 498	(3)	Humans in Tropical Environments
GEOG 510	(3)	Humid Tropical Environments
URBP 520	(3)	Globalization: Planning and Change
WILD 415*	(2)	Conservation Law

Organisms and Diversity:

6 credits of organisms and diversity selected as follows:

* Note: You may take BIOL 350 or ENTO 350, but not both; you may take BIOL 540 or ENVR 540, but not both.

AGRI 340	(3)	Principles of Ecological Agriculture
ANTH 311	(3)	Primate Behaviour and Ecology
BIOL 335	(3)	Marine Mammals
BIOL 350*	(3)	Insect Biology and Control
BIOL 355	(3)	Trees: Ecology & Evolution
BIOL 427	(3)	Herpetology
BIOL 540*	(3)	Ecology of Species Invasions
ENTO 350*	(3)	Insect Biology and Control
ENTO 352	(3)	Biocontrol of Pest Insects
ENTO 440	(3)	Insect Diversity

ENVR 540*	(3)	Ecology of Species Invasions
PLNT 304	(3)	Biology of Fungi
PLNT 358	(3)	Flowering Plant Diversity
WILD 307	(3)	Natural History of Vertebrates
WILD 350	(3)	Mammalogy
WILD 420	(3)	Ornithology
WILD 424	(3)	Parasitology

14.12.6 Bachelor of Science (B.Sc.) - Major Environment - Earth Sciences and Economics (66 credits)

The resources necessary for human society are extracted from the Earth, used as raw materials in our factories and refineries, and then returned to the Earth as waste. Geological processes produce resources humans depend on, and they also determine the fate of wastes in the environment. Understanding Earth's geologic processes provides us with the knowledge to mitigate many of our society's environmental impacts due to resource extraction and waste disposal. Additionally, economics frequently affects what energy sources power our society and how our wastes are treated. Earth sciences and economics are essential for our understanding of the many mechanisms, both physical and social, that affect Earth's environment.

This domain includes the fundamentals of each discipline. Students learn of minerals, rocks, soils, and waters and how these materials interact with each other and with the atmosphere. Fundamental economic theory and the economic effects of public policy toward resource industries, methods of waste disposal, and the potential effects of global warming on the global economy are also explored.

Suggested First Year (U1) Courses

For suggestions on courses to take in your first year (U1), you can consult the "MSE Student Handbook" available on the MSE website (http://www.mcgill.ca/mse), or contact Kathy Roulet, the Program Adviser (kathy.roulet@mcgill.ca).

Program Requirements

Note: Students are required to take a maximum of 34 credits at the 200 level and a minimum of 15 credits at the 400 level or higher in this program. This includes core and required courses.

Location Note: When planning your schedule and registering for courses, you should verify where each course is offered because courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue.

Core: Required Courses (18 credits)

Location Note: Core required courses are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue. You should register in Section 001 of an ENVR course that you plan to take on the Downtown campus, and in Section 051 of an ENVR course that you plan to take on the Macdonald campus.

ENVR 200	(3)	The Global Environment
ENVR 201	(3)	Society, Environment and Sustainability
ENVR 202	(3)	The Evolving Earth
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 301	(3)	Environmental Research Design
ENVR 400	(3)	Environmental Thought

Core: Complementary Course - Senior Research Project (3 credits)

Only 3 credits will be applied to the program; extra credits will count as electives.

AGRI 519	(6)	Sustainable Development Plans
ENVR 401	(3)	Environmental Research
ENVR 451	(6)	Research in Panama

Domain: Required Courses (21 credits)

ECON 230D1	(3)	Microeconomic Theory
ECON 230D2	(3)	Microeconomic Theory

ECON 405	(3)	Natural Resource Economics
EPSC 210	(3)	Introductory Mineralogy
EPSC 212	(3)	Introductory Petrology
EPSC 220	(3)	Principles of Geochemistry
EPSC 355	(3)	Sedimentary Geology

Domain: Complementary Courses (24 credits)

24 credits of complementary courses are selected as follows:

3 credits - Statistics courses

9 credits - List A

12 credits - List B

Statistics:

One of the following Statistics courses or equivalent.

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.

	(3)	Statistical Methods 1

EPSC 435	(3)	Applied Geophysics
EPSC 452	(3)	Mineral Deposits
EPSC 519	(3)	Isotope Geology
EPSC 542	(3)	Chemical Oceanography
EPSC 549	(3)	Hydrogeology
EPSC 580	(3)	Aqueous Geochemistry
EPSC 590	(3)	Applied Geochemistry Seminar
GEOG 302	(3)	Environmental Management 1
GEOG 322	(3)	Environmental Hydrology
SOIL 510	(3)	Environmental Soil Chemistry

14.12.7 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)

The Cellular concentration in this domain is open only to students in the B.Sc.(Ag.Env.Sc.) Major Environment or B.Sc. Major Environment program.

This domain considers the interface between the environment and human well-being, with particular focus on the triad that ties human health to the environment through the elements of food and infectious agents. Each of these elements is influenced by planned and unplanned environmental disturbances. For example, agricultural practices shift the balance between beneficial and harmful ingredients of food. Use of insecticides presents dilemmas with regard to the environment, economics, and human health. The distribution of infectious diseases is influenced by the climatic conditions that permit vectors to coexist with humans, by deforestation, by urbanization, and by human interventions ranging from the building of dams to provision of potable water.

In designing interventions that aim to prevent or reduce infectious contaminants in the environment, or to improve food production and nutritional quality, not only is it important to understand methods of intervention, but also to understand social forces that influence how humans respond to such interventions.

Students in the Cellular concentration will explore these interactions in more depth, at a physiological level. Students in the Population concentration will gain a depth of understanding at an ecosystem level that looks at society, land, and population health.

Suggested First Year (U1) Courses

For suggestions on courses to take in your first year (U1), consult the "MSE Student Handbook 2012-2013" available on the MSE website (http://www.mcgill.ca/mse), or contact Ms. Kathy Roulet, the Program Adviser (kathy.roulet@mcgill.ca).

Program Requirements

Note: Students are required to take a maximum of 31 credits at the 200 level and a minimum of 12 credits at the 400 level or higher in this program. This includes core and required courses.

Location Note: When planning your schedule and registering for courses, you should verify where each course is offered because courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue.

Core: Required Courses (18 credits)

Location Note: Core required courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue. You should register in Section 001 of an ENVR course that you plan to take on the Downtown campus, and in Section 051 of an ENVR course that you plan to take on the Macdonald campus.

ENVR 200	(3)	The Global Environment
ENVR 201	(3)	Society, Environment and Sustainability
ENVR 202	(3)	The Evolving Earth
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 301	(3)	Environmental Research Design
ENVR 400	(3)	Environmental Thought

Core: Complementary Course - Senior Research Project (3 credits)

Only 3 credits will be applied to the program; extra credits will count as electives.

AGRI 519	(6)	Sustainable Development Plans
ENVR 401	(3)	Environmental Research

ENVR 451	(6)	Research in Panama

Domain: Required Course (3 credits)

PARA 410	(3)	Environment and Infection

Domain: Complementary Courses (39 credits)

39 credits of the complementary courses are selected as follows:

21 credits - Fundamentals, 3 credits from each category

12 credits - Human Health, maximum of 3 credits from any one category

6 credits - Natural Environment, maximum of 3 credits from any one category

Fundamentals:

21 credits of Fundamentals, 3 credits from each category.

Health, Society, and Environment

* Note: You may take GEOG 221 or NRSC 221, but not both.

GEOG 221*	(3)	Environment and Health
GEOG 303	(3)	Health Geography
NRSC 221*	(3)	Environment and Health
SOCI 234	(3)	Population and Society
SOCI 309	(3)	Health and Illness

Toxicology

ANSC 312	(3)	Animal Health and Disease
PHAR 303	(3)	Principles of Toxicology

Cellular Biology

ANSC 234	(3)	Biochemistry 2
BIOL 201	(3)	Cell Biology and Metabolism
LSCI 202	(3)	Molecular Cell Biology

Genetics

BIOL 202	(3)	Basic Genetics
LSCI 204	(3)	Genetics

Molecular Biology

BIOL 200	(3)	Molecular Biology
LSCI 211	(3)	Biochemistry 1

Statistics

One of the following Statistics courses or equivalent:

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.

(3) Statistical Methods 1

SOCI 309	(3)	Health and Illness

Toxicology

	(3)	Animal Health and Disease

BREE 217*	(3)	Hydrology and Water Resources
GEOG 321	(3)	Climatic Environments
GEOG 322*	(3)	Environmental Hydrology
NRSC 510	(3)	Agricultural Micrometeorology

Decision Making and Social Change

* Note: You may take AGEC 200 or ECON 208, but not both.

AGEC 200*	(3)	Principles of Microeconomics
AGEC 242	(3)	Management Theories and Practices
BTEC 502	(3)	Biotechnology Ethics and Society
ECON 208*	(3)	Microeconomic Analysis and Applications
EDER 461	(3)	Society and Change
GEOG 302	(3)	Environmental Management 1
GEOG 404	(3)	Environmental Management 2
PHIL 343	(3)	Biomedical Ethics
URBP 520	(3)	Globalization: Planning and Change

Development and History

AGRI 210	(3)	Agro-Ecological History
ANTH 212	(3)	Anthropology of Development
HIST 292	(3)	History and the Environment
SOCI 254	(3)	Development and Underdevelopment

* Note: NUTR 512 (Video conference Downtown and at the Macdonald campus)

AGRI 411	(3)	Global Issues on Development, Food and Agriculture
NUTR 403	(3)	Nutrition in Society
NUTR 501	(3)	Nutrition in Developing Countries

GIS Techniques

ENVB 430	(3)	GIS for Natural Resource Management
GEOG 201	(3)	Introductory Geo-Information Science

Basic Environmental Science:

One of:

BREE 217	(3)	Hydrology and Water Resources
CIVE 323	(3)	Hydrology and Water Resources
ENVB 210	(3)	The Biophysical Environment
GEOG 305	(3)	Soils and Environment
GEOG 322	(3)	Environmental Hydrology
GEOG 350	(3)	Ecological Biogeography

Statistics:

6 credits of Statistics are selected from one of the following two options.

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. Several Statistics courses overlap (especially with MATH 324) and cannot be taken together. These rules do not apply to B.Sc.(Ag.Env.Sc.) students.

Option 1

MATH 323	(3)	Probability
MATH 324	(3)	Statistics

Option 2

One of:

AEMA 310	(3)	Statistical Methods 1
BIOL 373TH 324	(3)	Biometry

GEOG 501	(3)	Modelling Environmental Systems
MATH 223	(3)	Linear Algebra
MATH 326	(3)	Nonlinear Dynamics and Chaos
MATH 423	(3)	Regression and Analysis of Variance
MATH 447	(3)	Introduction to Stochastic Processes
MATH 525	(4)	Sampling Theory and Applications
SOCI 504	(3)	Quantitative Methods 1
SOCI 505	(3)	Quantitative Methods 2
SOCI 580	(3)	Social Research Design and Practice

List 2

3 credits minimum of environmental sciences chosen from:

AGRI 452	(3)	Water Resources in Barbados
AGRI 550	(3)	Sustained Tropical Agriculture
BIOL 331	(3)	Ecology/Behaviour Field Course
BIOL 553	(3)	Neotropical Environments
ENVB 313	(3)	Phylogeny and Biogeography
GEOG 300	(3)	Human Ecology in Geography
GEOG 302	(3)	Environmental Management 1
GEOG 404	(3)	Environmental Management 2
GEOG 494	(3)	Urban Field Studies
GEOG 499	(3)	Subarctic Field Studies
NRSC 333	(3)	Pollution and Bioremediation
PLNT 460	(3)	Plant Ecology
WILD 401	(4)	Fisheries and Wildlife Management
WOOD 420	(3)	Environmental Issues: Forestry

14.12.10 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)

This domain (63 credits including core) is open only to students in the B.Sc.(Ag.Env.Sc.) Major in Environment or B.Sc. in Environment program.

The business of food production is an area of human activity with a large and intimate interaction with the environment. Modern agriculturalists must strike a delicate balance between trying to provide food for themselves, their families, and urban dwellers and trying to minimize environmental damage. When negative effects due to agricultural activities do occur, they are not usually the classic point-source effects that we have come to associate with industry or large cities. Rather, the effects are over extremely large land areas cumulating, perhaps, in pollution of river systems or lakes some distance away. As world populations grow, and as diets change, potentially negative interactions between agricultural systems and other facets of the environment will become more frequent. In the same way, urban sprawl will make conflicts between agriculture and urbanites more common.

With a judicious choice of courses, graduates of this domain may be eligible to apply for membership in the Ordre des agronomes du Québec (OAQ) and the Agricultural Institute of Canada (AIC).

Program Prerequisites or Corequisites

All students in this program MUST take these pre- or corequisite courses, or their equivalents. These courses are taken as follows:

Location Note: When planning their schedule and registering for courses, students should verify where each course is offered because courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue.

One of the following courses or CEGEP equivalent (e.g., CEGEP objective 00XU):

BIOL 112	(3)	Cell and Molecular Biology

LSCI 211	(3)	Biochemistry 1

One of the following courses or CEGEP equivalent (e.g., CEGEP objective 00XV):

CHEM 212	(4)	Introductory Organic Chemistry 1
FDSC 230	(4)	Organic Chemistry

Suggested First Year (U1) Courses

For suggestions on courses to take in your first year (U1), you can consult the "MSE Student Handbook 2012-2013" available on the MSE website (http://www.mcgill.ca/mse), or contact Ms. Kathy Roulet, the Program Adviser (kathy.roulet@mcgill.ca).

Program Requirements

Note: Students are required to take a maximum of 34 credits at the 200 level and a minimum of 15 credits at the 400 level or higher in this program. This includes core and required courses, but does not include the domain prerequisites or corequisites listed above.

Location Note: When planning their schedule and registering for courses, students should verify where each course is offered because courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue.

Core: Required Courses (18 credits)

Location Note: Core required courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue. You should register in Section 001 of an ENVR course that you plan to take on the Downtown campus, and in Section 051 of an ENVR course that you plan to take on the Macdonald campus.

ENVR 200	(3)	The Global Environment
ENVR 201	(3)	Society, Environment and Sustainability
ENVR 202	(3)	The Evolving Earth
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 301	(3)	Environmental Research Design
ENVR 400	(3)	Environmental Thought

Core: Complementary Course - Senior Research Project (3 credits)

Only 3 credits will be applied to the program; extra credits will count as electives.

AGRI 519	(6)	Sustainable Development Plans
ENVR 401	(3)	Environmental Research
ENVR 451	(6)	Research in Panama

Domain: Required Courses (9 credits)

AEBI 210	(3)	Organisms 1
AGRI 210	(3)	Agro-Ecological History
PLNT 300	(3)	Cropping Systems

Domain: Complementary Courses (33 credits)

33 credits of complementary courses selected as follows:

15 credits - Basic Sciences

12 credits - Applied Sciences

6 credits - Social Sciences/Humanities

Basic Sciences:

15 credits of Basic Sciences selected as follows:

One of the following Statistics courses or equivalent:

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.

AEMA 310	(3)	Statistical Methods 1
MATH 203	(3)	Principles of Statistics 1

One of:

AGRI 340	(3)	Principles of Ecological Agriculture
ANSC 250	(3)	Principles of Animal Science

One of:

BIOL 202	(3)	Basic Genetics
LSCI 204	(3)	Genetics

One of:

ENVB 210	(3)	The Biophysical Environment
GEOG 305	(3)	Soils and Environment

One of:

BIOL 308	(3)	Ecological Dynamics
ENVB 305	(3)	Population & Community Ecology

Applied Sciences:

12 credits of Applied Sciences from the following:

* Note: You may take BREE 217 or GEOG 322, but not both; you may take FDSC 200 or NUTR 207, but not both.

AGRI 411	(3)	Global Issues on Development, Food and Agriculture
AGRI 435	(3)	Soil and Water Quality Management
AGRI 550	(3)	Sustained Tropical Agriculture
BIOL 465	(3)	Conservation Biology
BIOL 553	(3)	Neotropical Environments
BREE 217*	(3)	Hydrology and Water Resources
BREE 322	(3)	Organic Waste Management
BREE 518	(3)	Bio-Treatment of Wastes
ENVB 437	(3)	Assessing Environmental Impact
FDSC 200*	(3)	Introduction to Food Science
FDSC 535	(3)	Food Biotechnology
GEOG 302	(3)	Environmental Management 1
GEOG 322*	(3)	Environmental Hydrology
MICR 331	(3)	Microbial Ecology
NRSC 333	(3)	Pollution and Bioremediation

NUTR 207*	(3)	Nutrition and Health
NUTR 403	(3)	Nutrition in Society
		Environment and Infection

Note: Students are required to take a maximum of 30 credits at the 200 level and a minimum of 12 credits at the 400 level or higher in this program. This includes Core and Required courses.

Location Note: Core Required courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue.

Core: Required Courses (18 credits)

Location Note: Core required courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue. You should register in Section 001 of an ENVR course that you plan to take on the Downtown campus, and in Section 051 of an ENVR course that you plan to take on the Macdonald campus.

ENVR 200	(3)	The Global Environment
ENVR 201	(3)	Society, Environment and Sustainability
ENVR 202	(3)	The Evolving Earth
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 301	(3)	Environmental Research Design
ENVR 400	(3)	Environmental Thought

Core: Complementary Course - Senior Research Project (3 credits)

Only 3 credits will be applied to the program; extra credits will count as electives.

AGRI 519	(6)	Sustainable Development Plans
ENVR 401	(3)	Environmental Research
ENVR 451	(6)	Research in Panama

Domain Required Course (3 credits)

GEOG 203	(3)	Environmental Systems

Domain: Complementary Courses (39 credits)

39 credits of complementary courses are selected as follows:

9 credits - 3 credits from each category of Statistics, GIS and Remote Sensing Techniques, Weather and Climate

9 credits of fundamental land surface processes

3 credits of environment and resource management

3 credits of field course

3 credits of social science

12 credits total of advanced studies chosen from List A: Particular Environments and List B: Surface Processes

Statistics

One of the following Statistics courses or equivalent:

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.

AEMA 310	(3)	Statistical Methods 1

189.005 Tm((3))Tj1ePG 1 176.593 K 1730((3))Tj1730((3))Tj1730((3) and C of adv)Tj1 0in restrictions. Stud. SAci1 s1 0 0 1 321.691 0 Statistics and Spatial Analysis

GEOG 308	(3)	Principles of Remote Sensing

Weather and Climate

One of:

ATOC 215	(3)	Oceans, Weather and Climate
ENVB 301	(3)	Meteorology

Fundamental Land Surface Processes:

9 credits of fundamental land surface processes chosen as follows:

GEOG 321	(3)	Climatic Environments

And/or one of:

GEOG 272	(3)	Earth's Changing Surface
SOIL 300	(3)	Geosystems

And/or one of:

GEOG 305	(3)	Soils and Environment
SOIL 326	(3)	Soils in a Changing Environment

And/or one of:

BREE 217	(3)	Hydrology and Water Resources
GEOG 322	(3)	Environmental Hydrology

Environment and Resource Management:

One of:

* Note: You may take BIOL 308 or ENVB 305, but not both.

Soil and Water Quality Manage(And/or one of:)Tj1 0 0y57.508 286.4.6e1M one of:

Field Course:

One of:

BIOL 553	(3)	Neotropical Environments
GEOG 495	(3)	Field Studies - Physical Geography
GEOG 496	(3)	Geographical Excursion
GEOG 499	(3)	Subarctic Field Studies
WILD 475	(3)	Desert Ecology

Social Science:

One of:

AGEC 333	(3)	Resource Economics
ANTH 339	(3)	Ecological Anthropology
ECON 225	(3)	Economics of the Environment
ECON 326	(3)	Ecological Economics
ECON 405	(3)	Natural Resource Economics
GEOG 221	(3)	Environment and Health
GEOG 408	(3)	Geography of Development
GEOG 498	(3)	Humans in Tropical Environments
NRSC 221	(3)	Environment and Health
SOCI 565	(3)	Social Change in Panama
URBP 520	(3)	Globalization: Planning and Change

12 credits total of advanced studies chosen from the following two lists:

List A - Particular Environments:

3-9 credits of advanced study of Particular Environments:

* Note: You may take BIOL 432 or ENVB 315, but not both.

BIOL 432*	(3)	Limnology
ENVB 315*	(3)	Science of Inland Waters
ENVB 410	(3)	Ecosystem Ecology
GEOG 350	(3)	Ecological Biogeography
GEOG 372	(3)	Running Water Environments
GEOG 470	(3)	Wetlands
GEOG 536	(3)	Geocryology
GEOG 550	(3)	Historical Ecology Techniques
PLNT 35ropical En	(3)	Flowering Plant Diversity

EPSC 549	(3)	Hydrogeology
EPSC 580	(3)	Aqueous Geochemistry
GEOG 501	(3)	Modelling Environmental Systems
GEOG 505	(3)	Global Biogeochemistry
GEOG 537	(3)	Advanced Fluvial Geomorphology
NRSC 333	(3)	Pollution and Bioremediation
SOIL 331	(3)	Soil Physics
SOIL 510	(3)	Environmental Soil Chemistry

Bachelor of Science (Agricultural and Envir

ENVR 202	(3)	The Evolving Earth
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 301	(3)	Environmental Research Design
ENVR 400	(3)	Environmental Thought

Core: Complementary Course - Senior Research Project (3 credits)

Only 3 credits will be applied to the program; extra credits will count as electives.

AGRI 519	(6)	Sustainable Development Plans
ENVR 401	(3)	Environmental Research
ENVR 451	(6)	Research in Panama

Domain: Complementary Courses (42 credits)

42 credits of complementary courses are selected as follows:

9 credits - Basic Principles of Ecosystem Processes and Diversity

6 credits - 3 credits from each category of Statistics and GIS

6 credits - Advanced Ecosystem Components

6 credits - Advanced Ecological Processes

6 credits - Social Processes

9 credits - Ecosystem Components or Management of Ecosystems

Basic Principles of Ecosystem Processes:

9 credits of basic principles of ecosystem processes and diversity are selected as follows:

One of:

AEBI 210	(3)	Organisms 1
AEBI 211	(3)	Organisms 2
BIOL 305	(3)	Animal Diversity

One of:

BIOL 308	(3)	Ecological Dynamics
ENVB 305	(3)	Population & Community Ecology

One of:

ENVB 210	(3)	The Biophysical Environment
GEOG 305	(3)	Soils and Environment

Statistics

One of:

AEMA 310	(3)	Statistical Methods 1
BIOL 373	(3)	Biometry

GIS Methods

One of:

ENVB 430	(3)	GIS for Natural Resource Management
GEOG 201	(3)	Introductory Geo-Information Science

Advanced Ecosystem Components:

6 credits of advanced ecosystem components selected from:

BIOL 553	(3)	Neotropical Environments
GEOG 372	(3)	Running Water Environments
PLNT 358	(3)	Flowering Plant Diversity
SOIL 326	(3)	Soils in a Changing Environment
WILD 307	(3)	Natural History of Vertebrates

Advanced Ecological Processes:

6 credits of advanced ecological processes selected from:

* Note: You may take BIOL 432 or ENVB 315, but not both; you can take BREE 217 or GEOG 322, but not both.

BIOL 432*	(3)	Limnology
BIOL 465	(3)	Conservation Biology
BREE 217*	(3)	Hydrology and Water Resources
ENVB 315*	(3)	Science of Inland Waters
ENVB 410	(3)	Ecosystem Ecology
GEOG 322*	(3)	Environmental Hydrology

AGRI 435	(3)	Soil and Water Quality Management
AGRI 452	(3)	Water Resources in Barbados
AGRI 550	(3)	Sustained Tropical Agriculture
ENVB 437	(3)	Assessing Environmental Impact
GEOG 302	(3)	Environmental Management 1
GEOG 404	(3)	Environmental Management 2
PLNT 300	(3)	Cropping Systems
SOIL 335	(3)	Soil Ecology and Management
WILD 401	(4)	Fisheries and Wildlife Management
WOOD 441	(3)	Integrated Forest Management

14.12.13 Bachelor of Science (Agricultural and Environmental Sciences) (B.Sc.(Ag.Env.Sc.)) or Bachelor of Science (B.Sc.) - Major Environment -Water Environments and Ecosystems - Biological (60 credits)

This concentration (60 credits including core) is open only to students in the B.Sc.(Ag.Env.Sc.) Major in Environment or B.Sc. Major in Environment program.

To educate students in both the ecological and physical facets of the water environment, this domain offers two concentrations, with students choosing one or the other.

Those electing the Biological concentration will focus on the mechanisms regulating the different forms of life in water bodies. They will acquire, as well, a good understanding of the physical mechanisms controlling water properties. Students interested in studying the transport and transformation mechanisms of water on the planet, from rivers to the oceans and atmosphere, will select the Physical concentration. They will acquire, as well, a solid background in the biological processes taking place in water bodies.

Graduates of this domain are qualified to enter the work force or to pursue advanced studies in fields such as marine biology, geography, ph

ENVR 451	(6)	Research in Panama

Domain: Required Courses (6 credits)

ATOC 214	(3)	Introduction: Physics of the Atmosphere
ATOC 215	(3)	Oceans, Weather and Climate

Domain: Complementary Courses (33 credits)

33 credits of complementary courses are selected as follows:

6 credits - Hydrology/Water Resources, Population/Community and Ecology

3 credits - Math and Statistics

3 credits - Field Course

3 credits - Social Sciences and Policy

18 credits chosen in total from List A and List B

Hydrology/Water Resources, Population/Community and Ecology:

6 credits selected as follows:

One of:

BREE 217	(3)	Hydrology and Water Resources
GEOG 322	(3)	Environmental Hydrology

And one of:

BIOL 308	(3)	Ecological Dynamics
ENVB 305	(3)	Population & Community Ecology

Math and Statistics:

One of:

* Note: AEMA 310 or equivalent

AEMA 202	(3)	Intermediate Calculus
AEMA 310*	(3)	Statistical Methods 1
MATH 203	(3)	Principles of Statistics 1
MATH 222	(3)	Calculus 3

Field Course:

3 credits selected from the following courses or an equivalent Aquatic Field course:

AGRI 452	(3)	Water Resources in Barbados
BIOL 331	(3)	Ecology/Behaviour Field Course
GEOG 495	(3)	Field Studies - Physical Geography

Social Sciences and Policy:

One of:

AGEC 333	(3)	Resource Economics
ANTH 339	(3)	Ecological Anthropology

ECON 225	(3)	Economics of the Environment
ECON 326	(3)	Ecological Economics
GEOG 404	(3)	Environmental Management 2
GEOG 498	(3)	Humans in Tropical Environments
POLI 345	(3)	International Organizations
SOCI 565	(3)	Social Change in Panama
URBP 520	(3)	Globalization: Planning and Change

18 credits chosen in total from List A and List B as follows:

List A

9-12 credits chosen from:

* Note: you may take BIOL 540 or ENVR 540, but not both; you may take ENVB 210 or GEOG 305, but not both; you may take BIOL 432 or ENVB 315, but not both.

AGRI 435	(3)	Soil and Water Quality Management
BIOL 342	(3)	Marine Biology
BIOL 432*	(3)	Limnology
BIOL 441	(3)	Biological Oceanography
BIOL 465	(3)	Conservation Biology
BIOL 540*	(3)	Ecology of Species Invasions
BIOL 553	(3)	Neotropical Environments
BIOL 570	(3)	Advanced Seminar in Evolution
ENTO 535	(3)	Aquatic Entomology
ENVB 210*	(3)	The Biophysical Environment
ENVB 315*	(3)	Science of Inland Waters
ENVR 540*	(3)	Ecology of Species Invasions
GEOG 305*	(3)	Soils and Environment
GEOG 350	(3)	Ecological Biogeography
MICR 331	(3)	Microbial Ecology
NRSC 333	(3)	Pollution and Bioremediation
PARA 410	(3)	Environment and Infection
WILD 401	(4)	Fisheries and Wildlife Management

List B

6-9 credits chosen from:

* Note: you may take ATOC 219 or CHEM 219, but not both; you may take ATOC 419 or CHEM 419, but not both; you may take ENVB 430 or GEOG 201, but not both; CHEM 287 and CHEM 297 must be taken together.

ATOC 219*	(3)	Introduction to Atmospheric Chemistry
ATOC 419*	(3)	Advances in Chemistry of Atmosphere
CHEM 219*	(3)	Introduction to Atmospheric Chemistry
CHEM 287*	(2)	Introductory Analytical Chemistry
CHEM 297*	(1)	Introductory Analytical Chemistry Laboratory
CHEM 419*	(3)	Advances in Chemistry of Atmosphere
ENVB 430*	(3)	GIS for Natural Resource Management

EPSC 220	(3)	Principles of Geochemistry
GEOG 201*	(3)	Introductory Geo-Information Science
GEOG 308	(3)	Principles of Remote Sensing
GEOG 372	(3)	Running Water Environments
GEOG 537	(3)	Advanced Fluvial Geomorphology
GEOG 550	(3)	Historical Ecology Techniques

14.12.14 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)

This concentration (60 credits including core) is open only to students in the B.Sc.(Ag.Env.Sc.) Major in Environment or B.Sc. Major in Environment program.

To educate students in both the ecological and physical facets of the water environment, this domain offers two concentrations, with students choosing one or the other.

Students interested in studying the transport and transformation mechanisms of water on the planet, from rivers to the oceans and atmosphere, will select the Physical concentration. They will acquire, as well, a solid background in the biological processes taking place in water bodies. Those electing the Biological concentration will focus on the mechanisms regulating the different forms of life in water bodies. They will acquire, as well, a good understanding of the physical mechanisms controlling water properties.

Graduates of this domain are qualified to enter the work force or to pursue advanced studies in fields such as marine biology, geography, physical oceanography, and atmospheric science.

Suggested First Year (U1) Courses

For suggestions on courses to take in your first year (U1), you can consult the "MSE Student Handbook 2012-2013" available on the MSE website (http://www.mcgill.ca/mse), or contact Ms. Kathy Roulet, the Program Adviser (kathy.roulet@mcgill.ca).

Program Requirements

Note: Students are required to take a maximum of 30 credits at the 200 level and a minimum of 12 credits at the 400 level or higher in this program. This includes core and required courses.

Location Note: When planning your schedule and registering for courses, you should verify where each course is offered because courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue.

Core: Required Courses (18 credits)

Location Note: Core required courses for this program are taught at both McGill's Downtown campus and at the Macdonald campus in Sainte-Anne-de-Bellevue. You should register in Section 001 of an ENVR course that you plan to take on the Downtown campus, and in Section 051 of an ENVR course that you plan to take on the Macdonald campus.

ENVR 200	(3)	The Global Environment
ENVR 201	(3)	Society, Environment and Sustainability
ENVR 202	(3)	The Evolving Earth
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 301	(3)	Environmental Research Design
ENVR 400	(3)	Environmental Thought

Core: Complementary Course - Senior Research Project (3 credits)

Note: Only 3 credits will be applied to the program; extra credits will count as electives.

AGRI 519	(6)	Sustainable Development Plans
ENVR 401	(3)	Environmental Research
ENVR 451	(6)	Research in Panama

Domain: Required Courses (12 credits)

ATOC 214	(3)	Introduction: Physics of the Atmosphere
ATOC 215	(3)	Oceans, Weather and Climate
ATOC 315	(3)	Thermodynamics and Convection
GEOG 372	(3)	Running Water Environments

Domain: Complementary Courses (30 credits)

30 credits of complementary courses are selected as follows:

6 credits - Hydrology/Water Resources, Population, Community and Ecology

3 credits - Statistics or Calculus

3 credits - Field course

12 credits chosen from List A

6 credits chosen from List B

Hydrology/Water Resources, Population/Community and Ecology

6 credits selected as follows:

One of:

BREE 217	(3)	Hydrology and Water Resources
GEOG 322	(3)	Environmental Hydrology

And one of:

BIOL 308	(3)	Ecological Dynamics
ENVB 305	(3)	Population & Community Ecology

Statistics or Calculus:

One of:

* Note: AEMA 310 or equivalent.

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.

AEMA 202	(3)	Intermediate Calculus
	(3)	Statistical Methods 1

ATOC 568	(3)	Ocean Physics
BREE 416	(3)	Engineering for Land Development
CIVE 323	(3)	Hydrology and Water Resources
EPSC 549	(3)	Hydrogeology
GEOG 201	(3)	Introductory Geo-Information Science
GEOG 308	(3)	Principles of Remote Sensing
GEOG 537	(3)	Advanced Fluvial Geomorphology
NRSC 510	(3)	Agricultural Micrometeorology
URBP 520	(3)	Globalization: Planning and Change

And/or one of:

AEMA 305	(3)	Differential Equations
MATH 315	(3)	Ordinary Differential Equations

And/or one of:

BREE 506	(3)	Advances in Drainage Management
BREE 509	(3)	Hydrologic Systems and Modelling

And/or one of:

ENVB 210	(3)	The Biophysical Environment
GEOG 305	(3)	Soils and Environment

And/or one of:

ENVB 430	(3)	GIS for Natural Resource Management
GEOG 306	(3)	Raster Geo-Information Science

List B:

6 credits chosen from:

* Note: You can take BIOL 432 or ENVB 315, but not both.

BIOL 342	(3)	Marine Biology
BIOL 432*	(3)	Limnology
BIOL 441	(3)	Biological Oceanography
BIOL 465	(3)	Conservation Biology
BIOL 553	(3)	Neotropical Environments
ENVB 315*	(3)	Science of Inland Waters
GEOG 350	(3)	Ecological Biogeography
GEOG 505	(3)	Global Biogeochemistry
WILD 401	(4)	Fisheries and Wildlife Management

14.12.15 Bachelor of Science (B.Sc.) - Honours Environment (72 credits)

This program is open only to students in the B.Sc. Major Environment. To be eligible for Honours, students must satisfy the requirements set by their B.Sc. degree.

In addition, students must satisfy the following:

1. Students apply for the Honours program in March of their U2 year

12 credits of complementary courses are selected as follows:

3 credits - must be taken with the approval of the Program Adviser in an area outside of the student's previous degree (e.g., those with a B.A. or equivalent degree must take at least 3 credits in the natural sciences; those with a B.Sc. or equivalent degree must take at least 3 credits in the social sciences). A list of Suggested Courses is given below.

9 credits - must be taken in an area of focus chosen by the student with the approval of the Program Adviser. At least 6 credits must be taken at the 400 level or higher. A list of Suggested Courses is given below.

Suggested Course List

The Suggested Course List is divided into two thematic categories: Social Sciences and Policy; and Natural Sciences and Technology.

Most courses listed at the 300 level and higher have prerequisites. You are urged to prepare your program of study with this in mind.

This list is not meant to be exhaustive. You are also encouraged to examine the course lists of the various domains in the Environment program for other courses that might interest you. Courses not on the Suggested Course List may be included in the diploma with the permission of the Program Adviser.

Social Sciences and Policy

* Note: If WILD 415 is taken, 1 additional credit of complementary courses must be taken.

AGEC 231	(3)	Economic Systems of Agriculture
AGEC 333	(3)	Resource Economics
AGEC 430	(3)	Agriculture, Food and Resource Policy
AGEC 442	(3)	Economics of International Agricultural Development
AGRI 210	(3)	Agro-Ecological History
AGRI 411	(3)	Global Issues on Development, Food and Agriculture
ANTH 206	(3)	Environment and Culture
ANTH 212	(3)	Anthropology of Development
ANTH 339	(3)	Ecological Anthropology
ANTH 512	(3)	Political Ecology
BREE 503	(3)	Water: Society, Law and Policy
CIVE 433	(3)	Urban Planning
ECON 205	(3)	An Introduction to Political Economy
ECON 225	(3)	Economics of the Environment
ECON 326	(3)	Ecological Economics
ECON 347	(3)	Economics of Climate Change
ECON 405	(3)	Natural Resource Economics
ENVB 437	(3)	Assessing Environmental Impact
ENVR 201	(3)	Society, Environment and Sustainability
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 400	(3)	Environmental Thought
GEOG 200	(3)	Geographical Perspectives: World Environmental Problems
GEOG 210	(3)	Global Places and Peoples
GEOG 216	(3)	Geography of the World Economy
GEOG 221	(3)	Environment and Health
GEOG 300	(3)	Human Ecology in Geography
GEOG 301	(3)	Geography of Nunavut
GEOG 302	(3)	Environmental Management 1
GEOG 303	(3)	Health Geography
GEOG 370	(3)	Protected Areas
GEOG 382	(3)	Principles Earth Citizenship

GEOG 403	(3)	Global Health and Environmental Change
GEOG 408	(3)	Geography of Development
GEOG 410	(3)	Geography of Underdevelopment: Current Problems
GEOG 530	(3)	Global Land and Water Resources
GEOG 551	(3)	Environmental Decisions
MGPO 440	(3)	Strategies for Sustainability
NRSC 221	(3)	Environment and Health
NRSC 540	(3)	Socio-Cultural Issues in Water
PHIL 230	(3)	Introduction to Moral Philosophy 1
PHIL 237	(3)	Contemporary Moral Issues
PHIL 334	(3)	Ethical Theory
PHIL 343	(3)	Biomedical Ethics
PHIL 348	(3)	Philosophy of Law 1
POLI 211	(3)	Comparative Government and Politics
POLI 212	(3)	Government and Politics - Developed World
POLI 227	(3)	Developing Areas/Introduction
POLI 345	(3)	International Organizations
POLI 445	(3)	International Political Economy: Monetary Relations
PSYC 215	(3)	Social Psychology
RELG 270	(3)	Religious Ethics and the Environment
RELG 340	(3)	Religion and the Sciences
RELG 370	(3)	Religion and Human Rights
RELG 376	(3)	Religious Ethics
SOCI 222	(3)	Urban Sociology
SOCI 234	(3)	Population and Society
SOCI 235	(3)	Technology and Society

ATOC 215	(3)	Oceans, Weather and Climate
BIOL 240	(3)	Monteregian Flora
BIOL 305	(3)	Animal Diversity
BIOL 308	(3)	Ecological Dynamics
BIOL 310	(3)	Biodiversity and Ecosystems
BIOL 342	(3)	Marine Biology
BIOL 418	(3)	Freshwater Invertebrate Ecology
BIOL 432*	(3)	Limnology
BIOL 436	(3)	Evolution and Society
BIOL 465	(3)	Conservation Biology
BREE 217*	(3)	Hydrology and Water Resources
BREE 322	(3)	Organic Waste Management
BREE 518	(3)	Bio-Treatment of Wastes
BTEC 502	(3)	Biotechnology Ethics and Society
CHEE 230	(3)	Environmental Aspects of Technology
CHEM 212	(4)	Introductory Organic Chemistry 1
CHEM 281	(3)	Inorganic Chemistry 1
CHEM 462	(3)	Green Chemistry
CIVE 225	(4)	Environmental Engineering
CIVE 323	(3)	Hydrology and Water Resources
CIVE 550	(3)	Water Resources Management
ENTO 340	(3)	Field Entomology
ENVB 210	(3)	The Biophysical Environment
ENVB 301	(3)	Meteorology
ENVB 305	(3)	Population & Community Ecology
ENVB 315*	(3)	Science of Inland Waters
ENVB 410	(3)	Ecosystem Ecology
ENVB 415	(3)	Ecosystem Management
ENVB 430*	(3)	GIS for Natural Resource Management
ENVR 200	(3)	The Global Environment
ENVR 202	(3)	The Evolving Earth
EPSC 201	(3)	Understanding Planet Earth
EPSC 233	(3)	Earth and Life History
EPSC 425	(3)	Sediments to Sequences
EPSC 549	(3)	Hydrogeology
ESYS 301	(3)	Earth System Modelling
GEOG 200	(3)	Geographical Perspectives: World Environmental Problems
GEOG 201*	(3)	Introductory Geo-Information Science
GEOG 205	(3)	Global Change: Past, Present and Future
GEOG 272	(3)	Earth's Changing Surface
GEOG 308	(3)	Principles of Remote Sensing
GEOG 321	(3)	Climatic Environments
GEOG 322*	(3)	Environmental Hydrology

GEOG 372	(3)	Running Water Environments
GEOG 470	(3)	Wetlands
LSCI 230*	(3)	Introductory Microbiology
	(3)	Microbial Ecology

Experimental Medicine Courses		
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

14.14 Field Study

For details about the available Field Study Semesters, see *Programs, Courses and University Regulations* > *Faculties & Schools* > *Field Studies* .

14.14.1 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, 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 emphasis4u

HIST 413	(3)	Independent Research
NRSC 405	(3)	Natural History of East Africa
NUTR 403*	(3)	Nutrition in Society
REDM 405	(3)	Natural History of East Africa
WILD 420*	(3)	Ornithology

Barbados Field Study Semester (15 credits)

The Barbados Field Study Semester (BFSS) provides one term of integrated field study for students with an interest in global issues related to natural resource use as affected by socio-economic, management, urban, and physical constraints. Offered at the Bellairs Research Institute in Barbados, this program challenges students to be more effective environmental decision makers, policy makers, and managers. There is a growing need for professionals with such skills at all levels of government, within NGOs, and in the private sector. The overall goal of the BFSS is to equip future leaders to address the complexity of issues associated with the formulation and implementation of organizational strategies compatible with the societal goal of sustainable use and development of our natural resources.

The BFSS is intended for senior undergraduate students from across the University. Students must apply to participate in the program. Selection will be based on the student's Academic Standing and demonstrated interests and involvement in international issues related to natural resource use.

Barbados Field Study Semester - Required Courses

6 credits V

URBP 507	(3)	Planning and Infrastructure
URBP 520	(3)	Globalization: Planning and Change

Barbados Field Study Semester - Complementary Courses

9 credits

Students select one 3-credit course titled "Water R29 532.2.982 Tm(PlannTr R29 5382.257 ggw29 532538 of sustainDea gro)Tj1 0 09.0327.467 399.143m(olv)Tj1 0452.

(3)

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 research).

There is a one- or two-day period of transition and 13 weeks of course attendance in Panama. Field trips will be integrated into each of the courses offered.

Panama Field Study Semester - Required Courses

9 credits

BIOL 553	(3)	Neotropical Environments
ENVR 451	(6)	Research in Panama

Panama Field Study Semester - Complementary Courses

6 credits

Complementary courses change from year to year. Students will register for the 6 credits offered the Winter of their participation in the field study semester.

Winter 2014 complementary courses:

AGRI 550	(3)	Sustained Tropical Agriculture
GEOG 498	(3)	Humans in Tropical Environments

Winter 2015 complementary courses:

GEOG 404	(3)	Environmental Management 2
HIST 510	(3)	Environmental History of Latin America (Field)

Minor Field Studies - Complementary Course

In consultation with their departmental adviser and/or the Field Study Minor adviser, students who have completed one of the field study semesters described above may select a 3-credit complementary course to complete the requirements for the Minor and ask for it to be added to their academic records.

14.15 General Science

14.15.1 Location

Interdisciplinary Programs Adviser
Wendy Brett, Adviser
Telephone: 514-398-7330
Email: *wendy.brett@mcgill.ca*

14.15.2 About the General Science Minor

The Minor in General Science is only open to students in a B.Sc. Liberal program. Students interested in completing this Minor must consult with the Adviser for this program. See the program description in *section 14.15.3: Bachelor of Science (B.Sc.) - Minor General Science (18 credits)* for more information.

14.15.3 Bachelor of Science (B.Sc.) - Minor General Science (18 credits)

The Minor General Science is restricted to students in the B.Sc. Liberal program and may be used for the breadth component in this option. Students should consult their program adviser for their core science component and the Interdisciplinary Programs Adviser when selecting courses for this Minor.

Complementary Courses (18 credits)

Courses are to be chosen according to the following guidelines:

All courses must be offered by the Faculty of Science and must be at or above the 200 level*.

All courses must be different from the student's core science component courses.

Two options:

9 credits at the 300 level or above and at least 9 credits outside the student's core science component subject.

or

12 credits at the 300 level or above and at least 6 credits outside the student's core science component subject.

* Note: All Undergraduate research project courses with the 396 or 397 course number cannot be used toward the Minor General Science.

14.16 Geography (GEOG)

14.16.1 Location

Burnside Hall, Room 705
805 Sherbrooke Street West
Montreal, Quebec H3A 0B9

Telephone: 514-398-4951 or 514-398-4111
Fax: 514-398-7437
Website: *www.mcgill.ca/geography*

14.16.2 About Geography

The Department of Geography offers programs in both Arts and Science. All B.A. programs in Geography (including Urban Systems) can be found under *Programs, Courses and University Regulations > Faculties & Schools > Faculty of Arts > Undergraduate > Academic Programs > : Geography (GEOG)*.

Geography is a broad, holistic discipline; both a natural and a social science because it examines people and their environment and serves as a bridge between physical and cultural processes. Human Geography (a social science, thus B.A. programs) is concerned especially with the political, economic, social, and cultural processes and resource practices that create spatial patterns and define particular places. Physical Geography (B.Sc. programs) integrates disciplines such as climatology, geomorphology, geology, biology, hydrology, ecology, soil science, and even marine science. Whether considering greenhouse gas emissions, the spread of disease, or threats to biodiversity, in all cases geographers are interested in where things happen, why, and with what consequences.

Our graduates go on to careers in environmental consulting, social agencies, or non-governmental organizations. Skills in Geographic Information Science (GIS) are very marketable. Students are well prepared for graduate work in social sciences, urban planning, and environmental studies at leading schools.

14.16.3 Prerequisites

There are no departmental prerequisites for entrance to the B.Sc. Geography programs. Students who have completed college or pre-university geography courses fully equivalent to those in the first year of university may, with an adviser's approval, substitute other courses as part of their program.

A Science Major Concentration in Geography – Physical Geography option is available to students pursuing the B.A. & Sc. degree. This Major concentration is described in *Programs, Courses and University Regulations > Faculties & Schools > Bachelor of Arts and Science > Undergraduate > Academic Programs > : Geography (GEOG)*.

14.16.4 Geography (GEOG) Faculty

Chair

T.R. Moore

Emeritus Professors

W. Armstrong

S.H. Olson

Professors

P.G. Brown; B.A.(Haver.), M.A., Ph.D.(Col.) (*joint appt. with McGill School of Environment and Natural Resource Sciences*)

O.T. Coomes; B.Sc.(Vic., BC), M.A.(Tor.), Ph.D.(Wisc.)

Professors

T.R. Moore; B.Sc.(Swansea), Ph.D.(Aberd.)

W.H. Pollard; B.A., M.Sc.(Guelph), Ph.D.(Ott.)

N.T. Roulet; B.Sc., M.Sc.(Trent), Ph.D.(McM.) (*James McGill Professor*)

G.W. Wenzel; M.A.(Manit.), Ph.D.(McG.)

Associate Professors

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

G.L. Chmura; B.S.(Mass.), M.S.(Rhode Is.), Ph.D.(L.S.U.)

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

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

B. Lehner; Dip. Hydrol.(Freiburg), Ph.D.(Frankfurt)

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

N. Ramankutty; B.E.(P.S.G. Coll. of Tech.), M.S.(Ill.), Ph.D.(Wisc.)

N.A. Ross; B.A., M.A.(Qu.), Ph.D.(McM.)

R. Sengupta; B.Sc.(Bombay), M.Sc.(IIT, Mumbai), M.S., Ph.D.(S. Ill.-Carbondale) (*joint appt. with McGill School of Environment*)

R.E. Sieber; B.Sc.(Mich. St.), M.P.A.(W. Mich.), Ph.D.(Rutg.) (*joint appt. with McGill School of Environment*)

I.B. Strachan; B.Sc.(Tor.), M.Sc., Ph.D.(Qu.) (*cross appt. with Natural Resource Sciences*)

S. Turner; B.Soc.Sci., M.Soc.Sc.(Waikato), Ph.D.(Hull)

J. Unruh; B.A.(Kansas), M.S.(Wisc.), Ph.D.(Ariz.)

Assistant Professors

L. Berrang Ford; B.Sc.(Guelph), M.Sc.(Oxf.), Ph.D.(Guelph)

J. Ford; B.A., M.Sc.(Oxf.), Ph.D.(Guelph)

M. Kalácska; B.Sc., M.Sc., Ph.D.(Alta.)

N. Oswin; B.A. Hons.(Tor.), M.A.(Dal.), Ph.D.(Br. Col.)

J. Rhemtulla; B.Sc.(McG.), M.Sc.(Alta.), Ph.D.(Wisc. Madison) (*joint appt. with McGill School of Environment*)

14.16.5 Bachelor of Science (B.Sc.) - Minor Geography (18 credits)

The Minor Geography is expandable into the B.Sc. Major Geography.

The Minor Geography is designed to provide students in the Faculty of Science with an overview of basic elements of geography at the introductory and advanced level.

This Minor permits no overlap with any other programs.

Required Courses (12 credits)

GEOG 203	(3)	Environmental Systems
GEOG 216	(3)	Geography of the World Economy
GEOG 217	(3)	Cities in the Modern World
GEOG 302	(3)	Environmental Management 1

Complementary Courses (6 credits)

6 credits of Geography courses at the 300 and 400 level.

14.16.6 Bachelor of Science (B.Sc.) - Minor Geographic Information Systems and Remote Sensing (18 credits)

The Geographic Information Systems (GIS) and Remote Sensing Minor program provides B.Sc. students with the fundamentals of geospatial tools and technologies.

Required Courses (12 credits)

GEOG 201	(3)	Introductory Geo-Information Science
GEOG 306	(3)	Raster Geo-Information Science
GEOG 307	(3)	Socioeconomic Applications of GIS
GEOG 308	(3)	Principles of Remote Sensing

Complementary Courses (6 credits)

3 credits selected from:

GEOG 506	(3)	Advanced Geographic Information Science
GEOG 535	(3)	Remote Sensing and Interpretation

3 credits selected from:

ANTH 511	(3)	Computational Approaches to Prehistory
ATOC 309	(3)	Weather Radars and Satellites
COMP 202	(3)	Foundations of Programming
COMP 208	(3)	Computers in Engineering
COMP 250	(3)	Introduction to Computer Science
ESYS 300	(3)	Investigating the Earth System
GEOG 506*	(3)	Advanced Geographic Information Science
GEOG 535*	(3)	Remote Sensing and Interpretation

* GEOG 506 or GEOG 535 may be taken in either list of complementary courses, but credits from one group may not be double-counted in the other.

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

Required Courses (22 credits)

GEOG 201	(3)	Introductory Geo-Information Science
GEOG 203	(3)	Environmental Systems
GEOG 216	(3)	Geography of the World Economy

	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

One course (3 credits) from the following GIS/Remote Sensing courses:

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

Four courses (12 credits) from the following:

	GEOG 305	(3)	Soils and Environment
	GEOG 321	(3)	Climatic Environments
	GEOG 322	(3)	Environmental Hydrology
ases:0ases:	GEOG 372	(3)	Running Water Environments
	GEOG 470	(3)	Wetlands

One course (3 credits) from the following field courses:

GEOG 203	(3)	Environmental Systems
GEOG 216	(3)	Geography of the World Economy
GEOG 217	(3)	Cities in the Modern World
GEOG 272	(3)	Earth's Changing Surface
GEOG 290	(1)	Local Geographical Excursion
GEOG 302	(3)	Environmental Management 1
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

3 credits of GIS techniques:

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

12 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 470	(3)	Wetlands

3 credits of field courses:

(Field course availability is determined each year in February.)

GEOG 495	(3)	Field Studies - Physical Geography
GEOG 496	(3)	Geographical Excursion
GEOG 499	(3)	Subarctic Field Studies

15 credits from approved courses in Geography, or elsewhere in the Faculty of Science, or in the Faculty of Engineering; at least 9 credits of which are to be taken outside Geography. Students may also include any courses that are not already counted towards the GIS techniques or the systematic physical geography requirements. 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.

Advising Note: See the Geography website for the list of approved courses in the Faculty of Science. Some courses require the permission of the Department and from the Associate Dean of Science, Student Affairs.

Geography Approved Cour

3 credits of GIS techniques:

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

12 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 470	(3)	Wetlands

3 credits of field courses:

GEOG 495	(3)	Field Studies - Physical Geography
GEOG 496	(3)	Geographical Excursion
GEOG 499	(3)	Subarctic Field Studies

15 credits from approved courses in Geography, or elsewhere in the Faculty of Science or the Faculty of Engineering; at least 9 credits of which are to be taken outside Geography. Students may also include any courses that are not already counted towards the GIS techniques or the systematic physical geography requirements. Admission to 500-level courses in Geography requires the instructor's permission. It is not advisable to take more than one per term.

Advising Note: See the Geography website for the list of approved courses in the Faculty of Science. Some courses require the permission of the Department and from the Associate Dean of Science, Student Affairs.

GEOG 404	(3)	Environmental Management 2
GEOG 501	(3)	Modelling Environmental Systems
GEOG 505	(3)	Global Biogeochemistry
GEOG 506	(3)	Advanced Geographic Information Science
GEOG 523	(3)	Global Ecosystems and Climate
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

14.16.10 Geography (GEOG) Related Programs and Study Semesters

14.16.10.1 African Field Study Semester

The Department of Geography, Faculty of Science, coordinates the 15-credit interdisciplinary African Field Study Semester; see *www.mcgill.ca/africa*.

14.16.10.2 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 *www.mcgill.ca/pfss*.

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BIOL 200	(3)	Molecular Biology
BIOL 201*	(3)	Cell Biology and Metabolism
CHEM 212	(4)	Introductory Organic Chemistry 1
CHEM 222	(4)	Introductory Organic Chemistry 2
MIMM 211**	(3)	Introductory Microbiology
MIMM 214	(3)	Introductory Immunology: Elements of Immunity
PHGY 209**	(3)	Mammalian Physiology 1

CHEM 297*	(1)	Introductory Analytical Chemistry Laboratory
COMP 202	(3)	Foundations of Programming
COMP 250	(3)	Introduction to Computer Science
MATH 204	(3)	Principles of Statistics 2
MIMM 211**	(3)	Introductory Microbiology
MIMM 212	(2)	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 select

* BIOC 300D1 and BIOC 300D2 or

** MIMM 386D1 and MIMM 386D2 or

*** PHGY 212 and PHGY 213 and BIOL 301

BIOC 300D1*	(3)	Laboratory in Biochemistry
BIOC 300D2*	(3)	Laboratory in Biochemistry
BIOL 301***	(4)	Cell and Molecular Laboratory
MIMM 386D1**	(3)	Laboratory in Microbiology and Immunology
MIMM 386D2**	(3)	Laboratory in Microbiology and Immunology
PHGY 212***	(1)	Introductory Physiology Laboratory 1
PHGY 213***	(1)	Introductory Physiology Laboratory 2

plus 6 credits, selected from:

* Students take either BIOL 309 or MATH 315, but not both.

ANAT 365	(3)	Cellular Trafficking
BIOL 300	(3)	Molecular Biology of the Gene
BIOL 309*	(3)	Mathematical Models in Biology
BIOL 314	(3)	Molecular Biology of Oncogenes
CHEM 302	(3)	Introductory Organic Chemistry 3
MATH 222	(3)	Calculus 3
MATH 315*	(3)	Ordinary Differential Equations
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 & 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 Chemistry
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
MIMM 413	(3)	Parasitology
MIMM 465	(3)	Bacterial Pathogenesis
MIMM 466	(3)	Viral Pathogenesis
MIMM 509	(3)	Inflammatory Processes
PHAR 503	(3)	Drug Discovery and Development 1
PHAR 504	(3)	Drug Discovery and Development 2
PHGY 531	(3)	Topics in Applied Immunology
PHGY 552	(3)	Cellular and Molecular Physiology

14.18 Interdisciplinary Life Sciences

14.18.1 Location

Interdisciplinary Programs Adviser
Wendy Brett, Adviser
Telephone: 514-398-7330
Email: *wendy.brett@mcgill.ca*

14.18.2 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; Microbiology and Immunology; and Physiology are not permitted to complete this Minor.

14.18.3 Bachelor of Science (B.Sc.) - Minor Interdisciplinary Life Sciences (24 credits)

The Interdisciplinary Life Sciences Minor will allow students from the earth, physical, math, and computational science areas to broaden their studies with some basic life sciences, health social science, and empirical technological science. The Minor is 24 credits and allows students flexibility in their course selections. Students must take 9 credits from an extensive list of basic life science courses, 3 credits from an extensive list of health and social science courses, and 3 credits from an empirical and technological science list. The remaining 9 credits may be taken from courses listed in any of the three categories.

This Minor is not open to students taking a major, honours, or core science component in the following units: Anatomy and Cell Biology, Biochemistry, Microbiology and Immunology, and Physiology.

Interested students should contact the Interdisciplinary Programs Adviser.

Complementary Courses (24 credits)

The 24 credits required for this program must satisfy the following criteria:

At least 18 credits must be new credits that are not used to satisfy any other program.

At least 18 credits must be outside the student's main discipline.

Depth requirement:

at least 6 credits must be at the 300 level or above.

Breadth requirement:

at least 9 credits must be taken from the Basic Life Sciences List,

at least 3 credits from the Health Social Sciences List,

at least 3 credits from the Empirical Science and Technology List.

The remaining 9 credits may be selected from any of the lists.

Basic Life Sciences

At least 9 credits from:

* Students take either ANAT 212 or BIOC 212, but not both.

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
ANAT 321	(3)	Circuitry of the Human Brain
ANAT 365	(3)	Cellular Trafficking
ANAT 381	(3)	Basis of Embryology
BIOC 212*	(3)	Molecular Mechanisms of Cell Function
BIOC 311	(3)	Metabolic Biochemistry
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 Oncogenes
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 Design and Development 1
CHEM 504	(3)	Drug Design and Development 2
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)	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

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 396	(3)	Disease in Africa Since 1960
HIST 424	(3)	Gender, Sexuality & Medicine
HIST 447	(3)	The Natural History of America
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.

EDKP 449	(3)	Exercise Pathophysiology 2
EDKP 485	(3)	Exercise Pathophysiology 1
EDKP 495	(3)	Scientific Principles of Training
EDKP 498	(3)	Sport Psychology
EDKP 542	(3)	Environmental Exercise Physiology
EDKP 566	(3)	Advanced Biomechanics Theory

14.20 Management for Science Students

The Desautels Faculty of Management offers four minor programs for non-Management students open for application to students in the Faculty of Science. Please refer to *Programs, Courses and University Regulations* > *Faculties & Schools* > *Desautels Faculty of Management* for detailed information about program requirements and applying.

Also available to Science students is the Minor in Technological Entrepreneurship for Science students; see *section 14.35: Technological Entrepreneurship for Science Students*. (*Please note that this Minor is currently under revision.*)

14.20.1 Minor Finance (For Non-Management Students) (18 credits)

The Minor Finance consists of 18 credits of Management courses and is offered to non-Management students in the Faculties of Arts, Engineering, and Science.

The Minor has been designed to provide students with an understanding of the key concepts in corporate finance as well as investment banking.

Required Courses (9 credits)

FINE 342	(3)	Finance 2
FINE 441	(3)	Investment Management
MGCR 341*	(3)	Finance 1

Complementary Courses (9 credits)

9 credits selected from:

FINE 442	(3)	Capital Markets and Institutions
FINE 443	(3)	Applied Corporate Finance
FINE 445	(3)	Real Estate Finance
FINE 448	(3)	Financial Derivatives
FINE 449	(3)	Market Risk Models
FINE 451	(3)	Fixed Income Analysis
FINE 480	(3)	Global Investments
FINE 482	(3)	International Finance 1
FINE 492	(3)	International Finance 2
FINE 541N1	(1.5)	Applied Investments
FINE 541N2	(1.5)	Applied Investments
FINE 547	(3)	Advanced Finance Seminar

or other appropriate 300- or 400-level FINE courses with the approval of the Program Adviser.

* Prerequisite: MGCR 271, Business Statistics, or another equivalent Statistics course approved by the Program Adviser.

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.

14.20.2 Minor Management (For Non-Management Students) (18 credits)

The Minor Management consists of 18 credits of Management courses and is currently offered to non-Management students in the following Faculties: Arts, Engineering, Science, Agricultural & Environmental Sciences, Music, Religious Studies, and Kinesiology.

This Minor is designed to provide non-management students with the opportunity to obtain basic knowledge in various aspects of management.

Complementary Courses (18 credits)

Selected from categories A, B, and C:

Category A

3 credits selected from:

MGCR 211	(3)	Introduction to Financial Accounting
MGCR 341*	(3)	Finance 1

Category B

9 credits selected from:

MGCR 222	(3)	Introduction to Organizational Behaviour
MGCR 271**	(3)	Business Statistics
MGCR 293***	(3)	Managerial Economics
MGCR 331	(3)	Information Systems
MGCR 352	(3)	Marketing Management 1
MGCR 382	(3)	International Business
MGCR 472*	(3)	Operations Management

Category C

6 credits selected from:

3-6 credits from any 300- or 400-level Management courses for which prerequisites have been met.

0-3 credits may be from a specifically designated course by the student's home faculty.

* Prerequisite: MGCR 271, Business Statistics, or another equivalent Statistics course approved by the Program Adviser.

** 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.

14.20.3 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)	Marketing Management 1
MRKT 354	(3)	Marketing Management 2
MRKT 451	(3)	Marketing Research

Complementary Courses (9 credits)

3 credits selected from:

MGCR 271*	(3)	Business Statistics

6 credits selected from:

		Mark

MGSC 575	(3)	Applied Time Series Analysis Managerial Forecasting
MGSC 578	(3)	Simulation of Management Systems

The student's attention is called to the fact that a B.Com. degree with a Major in Mathematics is av

Professors
Dmitry Jak

Associate Members

Anmar Khadra (*Physiology*)

Michael Mackey (*Physiology*)

Erica E.M. Moodie (*Epidemiology & Biostatistics*)

Lawrence A. Mysak (*Atmospheric & Oceanic Sciences*)

Christopher Conway Paige (*Computer Science*)

Prakash Panangaden (*Computer Science*)

Robert W. Platt (*Pediatrics*)

James O. Ramsay (*Psychology*)

George Alexander Whitmore (*Management*)

Christina Wolfson (*Epidemiology & Biostatistics*)

Adjunct Professors

Vasek Chvatal; M.A.(Charles U., Prague), Ph.D.(Wat.)

Martin J. Gander; M.S.(ETH), M.S., Ph.D.(Stan.)

Andrew Granville; B.A., CASM(Camb.), Ph.D.(Qu.)

Adrian Iovita; B.S.(Bucharest), Ph.D.(Boston)

Olga Kharlampovich; M.A.(Ural State), Ph.D.(Leningrad), Dr.Sc.(Steklov Institute)

Ming Mei; B.Sc., M.Sc.(Jiangxi Normal Univ.), Ph.D.(Kanazawa)

Alexei Miasnikov; M.Sc.(Novosibirsk), Ph.D., Dr.Sc.(Leningrad)

M. Ram Murty; B.Sc.(Car.), Ph.D.(MIT), F.R.S.C.

Vladimir Remeslennikov; M.Sc.(Perm, Russia), Ph.D.(Novosibirsk)

Robert A. Seely; B.Sc.(McG.), Ph.D.(Cant.)

Alain C. Vandal; B.Sc., M.Sc.(McG.), Ph.D.(Auck.)

Thomas Wihler; M.S., Ph.D.(ETH)

Faculty Lecturers

Jose A. Correa; M.Sc.(Wat.), Ph.D.(Car.)

Axel Hundemer; M.Sc., Ph.D.(Munich)

Armel Djivede Kelome; M.Sc.(Benin), M.Sc.(McG.), Ph.D.(Georgia Tech.)

14.21.5 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.

14.21.6 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).

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 taketo tak

MATH 329	(3)	Theory of Interest
MATH 338	(3)	History and Philosophy of Mathematics
MATH 346	(3)	Number Theory
		T

MATH 316* (3) Complex Variables

Students interested in applied mathematics should take MATH 317, MATH 319, MATH 324, MATH 326, MATH 327, MATH 407, MATH 417.

Students considering a career in secondary school teaching are advised to take MATH 318, MATH 328, MATH 338, MATH 339, 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 329, 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 249 or MATH 316 but not both.

** 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 elective courses.

MATH 222**	(3)	Calculus 3
MATH 235	(3)	Algebra 1
MATH 236	(3)	Algebra 2
MATH 242	(3)	Analysis 1
MATH 243	(3)	Analysis 2
MATH 249*	(3)	Honours Complex Variables
MATH 314	(3)	Advanced Calculus
MATH 315	(3)	Ordinary Differential Equations
MATH 316*	(3)	Complex Variables
MATH 323	(3)	Probability

Complementary Courses (27 credits)

27 credits selected as follows:

21 credits selected from the following list, with at least 6 credits selected from:

MATH 317	(3)	Numerical Analysis
MATH 324	(3)	Statistics
MATH 335	(3)	Computational Algebra
MATH 340	(3)	Discrete Structures 2
MATH 427	(3)	Statistical Quality Control

the remainder of the 21 credits to be selected from:

MATH 204	(3)	Principles of Statistics 2
MATH 318	(3)	Mathematical Logic
MATH 319	(3)	Introduction to Partial Differential Equations
MATH 320	(3)	Differential Geometry
		Nonlinear Dynamics and Chaos

MATH 407	(3)	Dynamic Programming
MATH 410	(3)	Majors Project
MATH 417	(3)	Mathematical Programming
MATH 423	(3)	Regression and Analysis of Variance
MATH 430	(3)	Mathematical Finance
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

6 additional credits in Mathematics or related disciplines selected in consultation with the Adviser.

14.21.10 Bachelor of Science (B.Sc.) - Major Mathematics and Computer Science (72 credits)

Program Prerequisites

Students entering the Joint Major in Mathematics 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 72 credits of courses in the program specification.

MATH 133	(3)	Linear Algebra and Geometry
MATH 140	(3)	Calculus 1
MATH 141	(4)	Calculus 2

Required Courses (54 credits)

* Students who have sufficient knowledge in a programming language do not need to take COMP 202 but can replace it 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
COMP 302	(3)	Programming Languages and Paradigms
COMP 310	(3)	Operating Systems
COMP 330	(3)	Theory of Computation
COMP 360	(3)	Algorithm Design
MATH 222	(3)	Calculus 3
MATH 235	(3)	Algebra 1
MATH 236	(3)	Algebra 2
MATH 242	(3)	Analysis 1
MATH 315	(3)	Ordinary Differential Equations
MATH 317	(3)	Numerical Analysis
MATH 318	(3)	Mathematical Logic
MATH 323	(3)	Probability
MATH 340	(3)	Discrete Structures 2

Complementary Courses (18 credits)

9 credits from the set of courses recommended for a major or honours program in Mathematics.

9 credits selected from Computer Science courses at the 300 level or above (except COMP 364, COMP 396, COMP 400, COMP 431) and ECSE 508.

14.21.11 Bachelor of Science (B.Sc.) - Major Statistics and Computer Science (72 credits)

This program provides students with a solid training in both computer science and statistics together with the necessary mathematical background. As statistical endeavours involve ever increasing amounts of data, some students may want training in both disciplines.

Program Prerequisites

Students entering the Joint Major 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 72 credits of required courses.

MATH 133	(3)	Linear Algebra and Geometry
MATH 140	(3)	Calculus 1
MATH 141	(4)	Calculus 2

Required Courses (51 credits)

* Students who have sufficient knowledge in a programming language do not need to take COMP 202 but can replace it with an additional Computer Science complementary course.

** Students take either COMP 350 or MATH 317, but not both.

*** Students take either MATH 223 or MATH 236, but not both.

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

MATH 340*	(3)	Discrete Structures 2
MATH 350*	(3)	Graph Theory and Combinatorics
MATH 352	(1)	Problem Seminar
MATH 410	(3)	Majors Project
MATH 427	(3)	Statistical Quality Control
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
MATH 578**	(4)	Numerical Analysis 1

9 credits in Computer Science selected as follows:

MATH 329	(3)	Theory of Interest
MATH 338	(3)	History and Philosophy of Mathematics
MATH 348	(3)	Topics in Geometry
MATH 407	(3)	Dynamic Programming

Other courses with the permission of the Department.

Revision, June 2013. End of revision.

14.21.13 Bachelor of Science (B.Sc.) - Honours Mathematics (60 credits)

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. In addition, a student who has not completed the equivalent of MATH 222 must take it in the first term without receiving credits toward the credits required in the Honours program.

Students who transfer to Honours in Mathematics from other programs will have credits for previous courses assigned, as appropriate, by the Department.

To remain in an Honours program and to be awarded the Honours degree, the student must maintain a 3.00 GPA in the required and complementary Mathematics courses of the program, as well as an overall CGPA of 3.00.

MATH 133	(3)	Linear Algebra and Geometry
MATH 140	(3)	Calculus 1
MATH 141	(4)	Calculus 2

Required Courses (48 credits)

* MATH 314 may be substituted for MATH 248 if MATH 222 had to be taken in the Fall.

MATH 235	(3)	Algebra 1
MATH 242	(3)	Analysis 1
MATH 248*	(3)	Honours Advanced Calculus
MATH 251	(3)	Honours Algebra 2
MATH 255	(3)	Honours Analysis 2
MATH 325	(3)	Honours Ordinary Differential Equations
MATH 354	(3)	Honours Analysis 3
MATH 355	(3)	Honours Analysis 4
MATH 356	(3)	Honours Probability
MATH 357	(3)	Honours Statistics
MATH 366	(3)	Honours Complex Analysis
MATH 370	(3)	Honours Algebra 3
MATH 371	(3)	Honours Algebra 4
MATH 375	(3)	Honours Partial Differential Equations
MATH 380	(3)	Honours Differential Geometry
MATH 470	(3)	Honours Research Project

Complementary Courses (12 credits)

12 credits selected from:

MATH 350	(3)	Graph Theory and Combinatorics
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 480	(3)	Honours Independent Study
MATH 487	(3)	Honours Mathematical Programming
MATH 488	(3)	Honours Set Theory

all MATH 500-level courses.

Honours-level courses from related disciplines:

* COMP 250 may be preceded by COMP 202.

COMP 250*	(3)	Introduction to Computer Science
COMP 252	(3)	Honours Algorithms and Data Structures

no more than 6 credits from the following courses for which no Honours equivalent exists:

MATH 204	(3)	Principles of Statistics 2
MATH 329	(3)	Theory of Interest
MATH 338	(3)	History and Philosophy of Mathematics
MATH 348	(3)	Topics in Geometry
MATH 407	(3)	Dynamic Programming

Students may select other courses with the permission of the Department.

14.21.14 Bachelor of Science (B.Sc.) - Joint Honours Mathematics and Computer Science (75 credits)

Students may complete this program with a minimum of 72 credits or a maximum of 75 credits depending on whether or not they are exempt from taking COMP 202.

Program Prerequisites

Students must consult an Honours adviser in both departments. Students entering the Joint Honours in Mathematics 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 72-75 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 (45 credits)

* Students who have sufficient knowledge in a programming language are not required 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 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
		Honours Algorithm Design

MATH 557	(4)	Mathematical Statistics 2

Complementary Courses (18 credits)

At least 3 credits from:

MATH 355	(3)	Honours Analysis 4
MATH 587	(4)	Advanced Probability Theory 1
MATH 598	(4)	Topics in Probability & Statistics

The remaining credits selected from:

MATH 325	(3)	Honours Ordinary Differential Equations
MATH 350	(3)	Graph Theory and Combinatorics
MATH 352	(1)	Problem Seminar
MATH 366	(3)	Honours Complex Analysis
MATH 375	(3)	Honours Partial Differential Equations
MATH 380	(3)	Honours Differential Geometry
MATH 387	(3)	Honours Numerical Analysis
MATH 397	(3)	Honours Matrix Numerical Analysis
MATH 480	(3)	Honours Independent Study
MATH 490	(3)	Honours Mathematics of Finance
MATH 524	(4)	Nonparametric Statistics
MATH 525	(4)	Sampling Theory and Applications
MATH 545	(4)	Introduction to Time Series Analysis
MATH 547	(4)	Stochastic Processes
MATH 550	(4)	Combinatorics
MATH 589	(4)	Advanced Probability Theory 2

With at most 3 credits from the following courses for which no Honours equivalent exists:

MATH 204	(3)	Principles of Statistics 2
MATH 407	(3)	Dynamic Programming
MATH 427	(3)	Statistical Quality Control

14.21.16 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 (49 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
COMP 273	(3)	Introduction to Computer Systems
COMP 302	(3)	Programming Languages and Paradigms
COMP 330	(3)	Theory of Computation
		Honours

MATH 578**	(4)	Numerical Analysis 1

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 552	(4)	Combinatorial Optimization
COMP 564	(3)	Computational Gene Regulation
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 and COMP 431.

14.21.17 Mathematics and Statistics (MATH) Related Programs

14.21.17.1 Joint Major in Biology and Mathematics

For more information, see *section 14.5: Biology (BIOL)* > *section 14.5.10: Bachelor of Science (B.Sc.) - Major Biology and Mathematics (76 credits)*.

14.21.17.2 Joint Major in Physiology and Mathematics

For more information, see *section 14.30: Physiology (PHGY)* > *section 14.30.6: Bachelor of Science (B.Sc.) - Major Physiology and Mathematics (77*

Immunology is the study of the molecular and cellular basis of host resistance and immunity to external agents such as pathogenic microorganisms. Immunologists study the mechanisms by which the body recognizes foreign antigens, generates appropriate antibodies to an enormously diverse spectrum of antigens, and sequesters and kills invading microorganisms. Their discoveries lead to vaccination against disease, transfusions and organ transplants, allergies, cancer, autoimmune diseases and immune-deficiency diseases such as AIDS. Antibodies may soon be used in conjunction with antibiotics or chemical agents as specific “magic bullets” to diagnose disease and attack microbes and cancers.

The disciplines of microbiology and immunology are natural partners in research, and both fields use the modern methods of cell biology, molecular biology, and genetics to study basic life processes. The members of the Department of Microbiology and Immunology perform research on microbial physiology and genetics, microbial pathogenesis, molecular virology, cellular and molecular immunology, and parasitology. Students registered in the Department therefore are exposed to these related areas and receive an excellent background in basic biology and chemistry as well as in the more applied areas of biotechnology and medicine.

Many opportunities exist for careers in basic or applied microbiology and immunology, medical microbiology, environmental microbiology, and biotechnology. They include positions in industry (pharmaceutical and biotechnology), hospitals, universities, and government (environment, public health, and energy). A degree in microbiology also provides an excellent basis for entering professional and postgraduate programs in medicine, dentistry, the veterinary sciences, research, and education.

Notes on admission to Microbiology and Immunology programs:

Please note that enrolment in Microbiology and Immunology programs is limited to a total of 120 students per year. Students seeking admission to the Liberal, Majors, and Honours programs must have completed BIOL 112, CHEM 110, CHEM 120, MATH 139 or MATH 140, MATH 141, PHYS 101, and PHYS 102 or their equivalent with an overall average of at least B+ (75%).

Students transferring from other programs may be admitted with a B+ average up to the maximum program capacity of 120 students. Applicants not admitted will be placed on a waiting list and will be considered should vacancies occur. Application deadline for U0 or transfer students from other departments and faculties is the third Monday in Aro 0 0 1 27 508.hird Monday i;(75%).

U1 Complementary Course (3 credits)

3 credits, select one from:

BIOC 212	(3)	Molecular Mechanisms of Cell Function
BIOL 201	(3)	Cell Biology and Metabolism

U1, U2, or U3 Required Course (3 credits)

3 credits, select one from:

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

U2 Required Courses (15 credits)

MIMM 314	(3)	Intermediate Immunology
MIMM 323	(3)	Microbial Physiology
MIMM 324	(3)	Fundamental Virology
MIMM 386D1	(3)	Laboratory in Microbiology and Immunology
MIMM 386D2	(3)	Laboratory in Microbiology and Immunology

U3 Complementary Courses (6 credits)

6 credits selected from:

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 314	(3)	Molecular Biology of Oncogenes
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
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 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

14.22.5 Bachelor of Science (B.Sc.) - Major Microbiology and Immunology (68 credits)

The Major program is designed for students who want to acquire a substantial background in microbiology and immunology and related disciplines (chemistry, biology, biochemistry) which will prepare them for professional schools, graduate education, or entry into jobs in industry or research institutes.

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 (21 credits)

BIOC 311	(3)	Metabolic Biochemistry
BIOC 312	(3)	Biochemistry of Macromolecules
MIMM 314	(3)	Intermediate Immunology
MIMM 323	(3)	Microbial Physiology
MIMM 324	(3)	Fundamental Virology
MIMM 386D1	(3)	Laboratory in Microbiology and Immunology
MIMM 386D2	(3)	Laboratory in Microbiology and Immunology

U3 Required Courses (9 credits)

MIMM 413	(3)	Parasitology
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 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 314	(3)	Molecular Biology of Oncogenes
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
EXMD 504	(3)	Biology of Cancer
MIMM 387	(3)	The Business of Science
MIMM 414	(3)	Advanced Immunology
MIMM 509	(3)	Inflammatory Processes
PATH 300	(3)	Human Disease
PHAR 300	(3)	Drug Action
PHAR 301	(3)	Drugs and Disease
		Mammalian Ph

14.22.6 Bachelor of Science (B.Sc.) - Honours Microbiology and Immunology (74 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 (25 credits)

* Students who have taken CHEM 212 in CEGEP are exempt and must replace [redacted] credits with an elective course(s) [redacted] in CEGEP are e

** Students who have taken CHEM 222 in CEGEP are ex

MIMM 502D1	(6)	Honours Research Project in Microbiology
MIMM 502D2	(6)	Honours Research Project in Microbiology

Complementary Course (3 credits)

3 credits selected from:

ANAT 458	(3)	Membranes and Cellular Signaling
BIOC 404	(3)	Biophysical Chemistry
BIOC 450	(3)	Protein Structure and Function
BIOC 454	(3)	Nucleic Acids
BIOC 458	(3)	Membranes and Cellular Signaling
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
MIMM 414	(3)	Advanced Immunology
MIMM 509	(3)	Inflammatory Processes
PHAR 562	(3)	General Pharmacology 1
PHAR 563	(3)	General Pharmacology 2
PSYT 455	(3)	Neurochemistry

14.22.7 Microbiology and Immunology (MIMM) Related Programs

14.22.7.1 Interdepartmental Honours in Immunology

For more information, see *section 14.17: Immunology*.

This program is offered by the departments of Biochemistry, Microbiology and Immunology, and Physiology.

Students interested in immunology may choose between this Honours program and the Honours program of the Department of Microbiology and Immunology.

Details of this program may also be obtained from Professor Piccirillo in the Department of Microbiology and Immunology, Room L11.132, Montreal General Hospital; Telephone: 514-934-1934, ext. 45135; *ciro.piccirillo@mcgill.ca*.

14.23 Music

Location

14.23.3 Music Faculty

Department of Music Research Chair

Christoph Neidhöfer; Dipl.(Musikhochschule Basel), Ph.D.(Harv.)

Department of Performance Chair

Jean Lesage; Concours, Diplôme d'études supérieures(Cons. de Montréal)

Adviser (B.A./B.Sc. Music programs)

Sara Laimon; B.Mus.(Br. Col.), M.Mus.(Yale), D.M.A.(SUNY, Stony Brook)
Telephone: 514-398-1882

Diana Toni Dutz; B.Mus.(W. Ont.), Grad.Dip.(C'dia)
Telephone: 514-398-6337

14.23.4 Music Related Programs

14.23.4.1 Minor in Musical Applications of Technology and Minor in Musical Science and Technology

Science students may apply for admission to either the Minor in Musical Applications of Technology, see *Programs, Courses and University Regulations > Faculties & Schools > Schulich School of Music > Undergraduate > Programs of Study > : Minor Musical Applications of Technology (18 credits)*, or the Minor in Musical Science and Technology, see *Programs, Courses and University Regulations > Faculties & Schools > Schulich School of Music > Undergraduate > Programs of Study > : Minor Musical Science and Technology (18 credits)*. Enrolment in Music Technology programs is highly restricted. Application forms will be available from the Department of Music Research in the Schulich School of Music from February 1 and must be completed and returned to that office 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 June 1. Registration will be limited to available lab space.

14.23.4.1.1 Science Minor in Music Technology (24 credits)

This program was retired as of the 2008–2009 academic year. Students currently registered in the program should consult with their program adviser and refer to the Calendar for the academic year in which they began the program for guidance about program requirements. Science students are eligible to take the Arts Minor Concentration in Music; see *Programs, Courses and University Regulations > Faculties & Schools > Faculty of Arts > Undergraduate > Academic Programs > : Music (MUAR)*. Music courses listed as MUAR (see Faculty of Arts courses) are considered to be Arts courses. All other Music courses are considered by the Faculty of Science to be courses outside of Arts and Science (see *section 7.5.2: Courses Outside the Faculties of Arts and Science* for the relevant regulations).

14.24 Neurology and Neurosurgery (NEUR)

14.24.1 Location

Montreal Neurological Institute and Hospital
3801 University Street, Room 141
Montreal, Quebec H3A 2B4

14.24.2 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 a course taught by the Faculty of Science.

14.25 Neuroscience

14.25.1 Location

Director of Neuroscience

Professor Monroe Cohen
Department of Physiology
McIntyre Medical Sciences Building, Room 1150
3655 Promenade Sir-William-Osler
Montreal, Quebec H3G 1Y6

Interdisciplinary Programs Adviser

Wendy Brett, Adviser
Telephone: 514-398-7330
Email: *wendy.brett@mcgill.ca*
Website: *www.mcgill.ca/neuroscience*

14.25.2 About Neuroscience

Neuroscience is a multidisciplinary science devoted to the understanding of 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 drawn from a number of disciplines, including molecular and cellular biology, physiology, behavioural sciences and cognitive psychology, computer science, and artificial intelligence. In addition, scientists are investigating the nervous system of many different animals, from simple inv

BIOC 212*	(3)	Molecular Mechanisms of Cell Function
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
BIOL 389	(3)	Laboratory in Neurobiology
LING 390	(3)	Neuroscience of Language
NEUR 310	(3)	Cellular Neurobiology
PHGY 311	(3)	Channels, Synapses & 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

6-12 credits from the following list of 400- and 500-level courses, and not from the student's home department:

*** Students may select either BIOL 514 or PSYC 514.

BIOL 514***	(3)	Neurobiology Learning and Memory
BIOL 530	(3)	Advances in Neuroethology
BIOL 532	(3)	Developmental Neurobiology Seminar
BIOL 588	(3)	Advances in Molecular/Cellular Neurobiology
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 Behaviour
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 Learning and Memory
PSYC 522	(3)	Neurochemistry and Behaviour
PSYC 526	(3)	Advances in Visual Perception
PSYC 532	(3)	Cognitive Science
PSYT 455	(3)	Neurochemistry
PSYT 500	(3)	Advances: Neurobiology of Mental Disorders
PSYT 505	(3)	Neurobiology of Schizophrenia

14.25.4 Bachelor of Science (B.Sc.) - Major Neuroscience (65 credits)

The Major program in Neuroscience 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, as well as mathematics, physics, computer science, and immunology. To ensure that students have the appropriate foundation, they are required to take 29 credits in lower-level courses from physiology, biology, mathematics, computer science, psychology, and ethics. While flexible, 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 interest.

Note that enrolment in the Neuroscience Major is limited.

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. U0 students seeking admission to this program should consult the neuroscience website for admissions requirements and have completed the courses listed below or equivalent.

* Students complete one of MATH 139, MATH 140 OR MATH 150 but not both.

** Students complete one of either MATH 141 OR MATH 151 but not both.

*** Students complete one of either PHYS 101 OR PHYS 131 but not both.

+++ Students complete one of either PHYS 102 OR PHYS 142 but not both.

BIOL 112	(3)	Cell and Molecular Biology
CHEM 110	(4)	General Chemistry 1
CHEM 120	(4)	General Chemistry 2
MATH 139*	(4)	Calculus 1 with Precalculus
MATH 140*	(3)	Calculus 1
MATH 141**	(4)	Calculus 2
MATH 150*	(4)	Calculus A
MATH 151**	(4)	Calculus B
PHYS 101***	(4)	Introductory Physics - Mechanics
PHYS 102+++	(4)	Introductory Physics - Electromagnetism
PHYS 131***	(4)	Mechanics and Waves
PHYS 142+++	(4)	Electromagnetism and Optics

Core Required Courses (20 credits)

* Note: Students who have successfully completed an equivalent of CHEM 212 in CEGEP or elsewhere must replace these credits with a 3-credit elective course to satisfy the total credit requirement for the Neuroscience Major.

BIOL 200	(3)	Molecular Biology
CHEM 212*	(4)	Introductory Organic Chemistry 1
NSCI 200	(3)	Introduction to Neuroscience 1
NSCI 201	(3)	Introduction to Neuroscience 2
NSCI 300	(3)	Neuroethics
NSCI 400D1	(.5)	Neuroscience Seminar
NSCI 400D2	(.5)	Neuroscience Seminar
PSYC 311	(3)	Human Cognition and the Brain

Complementary Courses (45 credits)

9 core credits selected as follows:

3 credits from:

BIOL 373	(3)	Biometry
PSYC 305	(3)	Statistics for Experimental Design

3 credits completed by taking the course below or an equivalent in Computer Science.

COMP 202	(3)	Foundations of Programming

3 credits from:

BIOL 309	(3)	Mathematical Models in Biology
MATH 222**	(3)	Calculus 3

** 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.

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 & 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:

6 credits as follows:

ANAT 321	(3)	Circuitry of the Human Brain
PHGY 311	(3)	Channels, Synapses & Hormones

3 credits from:

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

3 credits from:

BIOL 309	(3)	Mathematical Models in Biology
COMP 206	(3)	Introduction to Software Systems
MATH 222**	(3)	Calculus 3

** 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.

C. Cognitive/Behavioural Stream

NSCI 420D1	(4.5)	Independent Research 2
NSCI 420D2	(4.5)	Independent Research 2

The remainder of the credits should be taken from the following lists. At least 15 of the 21-23 credits must be at the 400- or 500-level, which could include the above NSCI 410 or NSCI 420D1/NSCID2 research courses:

200- and 300-level courses:

* Students take either BIOL 201 OR BIOC 212, but not both.

BIOC 212*	(3)	Molecular Mechanisms of Cell Function
BIOC 311	(3)	Metabolic Biochemistry
BIOL 201*	(3)	Cell Biology and Metabolism
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
LING 390	(3)	Neuroscience of Language
MATH 315	(3)	Ordinary Differential Equations
MATH 323	(3)	Probability
MATH 324	(3)	Statistics
		Introductory Immunology: Elements of Immun 315

MIMM 509	(3)	Inflammatory Processes
NEUR 550	(3)	Free Radical Biomedicine
PHAR 562	(3)	General Pharmacology 1
PHGY 425	(3)	Analyzing Physiological Systems
PHGY 451	(3)	Advanced Neurophysiology
PHGY 513	(3)	Cellular Immunology
PHGY 520	(3)	Ion Channels
PHGY 524	(3)	Chronobiology
PHGY 556	(3)	Topics in Systems Neuroscience
PHYS 413**	(3)	Physical Basis of Physiology
PSYC 410	(3)	Special Topics in Neuropsychology
PSYC 427	(3)	Sensorimotor Behaviour
PSYC 444	(3)	Sleep Mechanisms and Behaviour
PSYC 470	(3)	Memory and Brain
PSYC 501	(3)	Auditory Perception
PSYC 502	(3)	Psychoneuroendocrinology
PSYC 506	(3)	Cognitive Neuroscience of Attention
PSYC 522	(3)	Neurochemistry and Behaviour
PSYC 526	(3)	Advances in Visual Perception
PSYC 532	(3)	Cognitive Science
PSYT 455	(3)	Neurochemistry
PSYT 500	(3)	Advances: Neurobiology of Mental Disorders
PSYT 505	(3)	Neurobiology of Schizophrenia
REDM 410	(3)	Writing Research Articles

14.25.5 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; cognition and behaviour). Students are admitted to the program after one year in a major.

The program is composed of 74 credits: 44 credits are required, including a 9-credit independent research project, and 30 credits are complementary. Because it is a limited-enrolment program, the entrance requirements for the Honours program are more stringent. Applicants must have taken a minimum of 27 graded credits in their U1 year, must have a CGPA of at least 3.50 and 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 to students who obtain a minimum cumulative grade point average of 3.70, a minimum program GPA of 3.30, and a minimum grade of B+ in NSCI 300, NSCI 400 and NSCI 430.

Required Courses (44 credits)

* Note: Students who have successfully completed an equivalent of CHEM 212 in CEGEP or elsewhere must replace these credits with a 3-credit elective course to satisfy the total credit requirement for the Neuroscience Honours Program.

ANAT 321	(3)	Circuitry of the Human Brain
BIOC 311	(3)	Metabolic Biochemistry
BIOL 200	(3)	Molecular Biology
CHEM 212*	(4)	Introductory Organic Chemistry 1
COMP 202	(3)	Foundations of Programming

NSCI 200	(3)	Introduction to Neuroscience 1
NSCI 201	(3)	Introduction to Neuroscience 2
NSCI 300	(3)	Neuroethics
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 & Hormones
PSYC 311	(3)	Human Cognition and the Brain
PSYC 318	(3)	Behavioural Neuroscience 2

MIMM 314	(3)	Intermediate Immunology
NEUR 310	(3)	Cellular Neurobiology
PHAR 300	(3)	Drug Action
PHGY 210	(3)	Mammalian Physiology 2
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 342	(3)	Hormones and Behaviour

400- and 500-level courses:

*** Students may take either MATH 437 OR PHYS 413, but not both.

BIOL 514	(3)	Neurobiology Learning and Memory
BIOL 530	(3)	Advances in Neuroethology
BIOL 532	(3)	Developmental Neurobiology Seminar
BIOL 588	(3)	Advances in Molecular/Cellular Neurobiology
BMDE 519	(3)	Biomedical Signals and Systems
MATH 437***	(3)	Mathematical Methods in Biology
MIMM 414	(3)	Advanced Immunology
MIMM 509	(3)	Inflammatory Processes
NEUR 550	(3)	Free Radical Biomedicine
PHAR 562	(3)	General Pharmacology 1
PHGY 425	(3)	Analyzing Physiological Systems
PHGY 451	(3)	Advanced Neurophysiology
PHGY 513	(3)	Cellular Immunology
PHGY 520	(3)	Ion Channels
PHGY 524	(3)	Chronobiology
PHGY 556	(3)	Topics in Systems Neuroscience
PHYS 413***	(3)	Physical Basis of Physiology
PSYC 410	(3)	Special Topics in Neuropsychology
PSYC 427	(3)	Sensorimotor Behaviour
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 522	(3)	Neurochemistry and Behaviour
PSYC 526	(3)	Advances in Visual Perception
PSYC 532	(3)	Cognitive Science
PSYT 455	(3)	Neurochemistry
PSYT 500	(3)	Advances: Neurobiology of Mental Disorders
PSYT 505	(3)	Neurobiology of Schizophrenia

REDM 410	(3)	Writing Research Articles

14.26 Nutrition (NUTR)

14.26.1 Location

School of Dietetics and Human Nutrition
Macdonald-Stewart Building, Room MS2-039
21,111 Lakeshore Road
Sainte-Anne-de-Bellevue, Quebec H9X 3V9

14.26.2 About Nutrition

The School of Dietetics and Human Nutrition offers a Minor in Human Nutrition which can be taken by Science students; see *Programs, Courses and University Regulations > Faculties & Schools > Faculty of Agricultural and Environmental Sciences > Undergraduate > Academic Programs > : Bachelor of Science in Nutritional Sciences – B.Sc.(Nutr.Sc.) (Overview)*.

NUTR 307 is considered as a course taught by the Faculty of Science and is offered simultaneously on both campuses.

14.27 Pathology (PATH)

14.27.1 Location

Department of Pathology
Duff Medical Building
3775 University Street
Montreal, Quebec H3A 2B4

14.27.2 About Pathology

There are no B.Sc. programs in Pathology, but the course PATH 300 *Human Disease* is considered as one taught by the Faculty of Science.

14.28 Pharmacology and Therapeutics (PHAR)

14.28.1 Location

McIntyre Medical Building, Room 1325
3655 Promenade Sir-William-Osler
Montreal, Quebec H3G 1Y6

Telephone: 514-398-3623
Website: *www.mcgill.ca/pharma*

14.28.2 About Pharmacology and Therapeutics

Pharmacology is the science that deals with all aspects of drugs and their interactions with living organisms. Thus, it involves the physical and chemical properties of drugs, their biochemical and physiological effects, mechanisms of action, pharmacokinetics, and therapeutic and other uses. Since the word “drug” encompasses all chemical substances that produce an effect on living cells, it is evident that pharmacology is a very extensive subject. Pharmacology is a multidisciplinary science. It has developed its own set of principles and methods to study the mode of the action of drugs, but it has also utilized many techniques and approaches from various disciplines including biochemistry, physiology, anatomy, and molecular biology, as well as others. Pharmacology encompasses a number of different areas such as pharmacogenomics, molecular biology, bioinformatics, neuropharmacology, reproductive pharmacology, endocrine pharmacology, receptor pharmacology, cardiovascular pharmacology, toxicology, developmental pharmacology, autonomic pharmacology, biochemical pharmacology, and therapeutics.

Training in pharmacology is conducted at both the undergraduate and graduate levels. Because of its breadth, students may be attracted to the subject from a variety of viewpoints; this includes those completing a bachelor's degree in any number of basic science disciplines, such as biology, zoology, chemistry, physics, biochemistry, microbiology, anatomy, and physiology. At the undergraduate level, seven lecture courses are of

Associate Members

Lesley Fellows; M.D.(McG.), Ph.D.(Oxf.)

Pierre Fiset; M.D.(Laval), F.R.C.P.S.(C)

Serge Gauthier; M.D.(Montr.)

Timothy Geary; Ph.D.(Mich.)

Bertrand Jean-Claude; M.Sc.(Moncton), Ph.D.(McG.)

Sarah Kimmins; Ph.D.(Dal.)

Stephane Laporte; Ph.D.(Sher.)

Cristian O'Flaherty; Ph.D.(McG.)

Vassilios Papadopoulos; Ph.D.(Université Pierre et Marie Curie)

Roger Prichard; B.Sc., Ph.D.(N.S.W.)

Simon Rousseau; Ph.D.(Laval)

Yoram Shir; M.D.(Israel), Ph.D.(Johns Hop.)

Laura Stone; Ph.D.(Minn.)

Marc Ware; M.D.(Univ. West Indies, Kingston, Jamaica)

Tak Pan Wong; Ph.D.(McG.)

Adjunct Professors

Bruce Allen; Ph.D.(Br. Col.)

Martin Bruno; Ph.D.(McG.)

Sylvain Chemtob; M.D.(Montr.), Ph.D.(McG.)

Yves De Koninck; Ph.D.(McG.)

Lorella Garofalo; Ph.D.(McG.)

Jennifer M.A. Laird; Ph.D.(Brist.)

Joseph Mancini; M.Sc., Ph.D.(McG.)

Karen Meerovitch; Ph.D.(McG.)

Greg Miller; Ph.D.(W. Ont.)

Thomas Sanderson; Ph.D.(Br. Col.)

14.28.4 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 coordinator: Dr. Terry Hébert; terence.hebert@mcgill.ca; 514-398-1398).

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 (12 credits)

PHAR 300	(3)	Drug Action
PHAR 301	(3)	Drugs and Disease
PHAR 562	(3)	General Pharmacology 1
PHAR 563	(3)	General Pharmacology 2

Complementary Courses (12 credits)

12 credits selected as follows:

3 credits, one of:

BIOC 212	(3)	Molecular Mechanisms of Cell Function
BIOL 200	(3)	Molecular Biology
BIOL 201	(3)	Cell Biology and Metabolism

3 credits, one of:

PHGY 209	(3)	Mammalian Physiology 1
PHGY 210	(3)	Mammalian Physiology 2

6 credits, chosen from:

* PHAR 504 can be taken with PHAR 503 only.

PHAR 303	(3)	Principles of Toxicology
PHAR 503*	(3)	Drug Discovery and Development 1
PHAR 504*	(3)	Drug Discovery and Development 2
PHAR 558	(3)	Pharmacology Selected Topics
PHAR 599	(6)	Pharmacology Research Project

Bac

PHAR 503 (3) Drug Discovery and Development 1

Or

PHGY 210	(3)	Mammalian Physiology 2
PHGY 212	(1)	Introductory Physiology Laboratory 1
PHGY 213	(1)	Introductory Physiology Laboratory 2

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

U3 Required Courses (18 credits)

* PHAR 599D1 and PHAR 599D2 are taken together.

PHAR 503	(3)	Drug Discovery and Development 1
PHAR 558	(3)	Pharmacology Selected Topics
PHAR 562	(3)	General Pharmacology 1
PHAR 563	(3)	General Pharmacology 2
PHAR 599D1*	(3)	Pharmacology Research Project
PHAR 599D2*	(3)	Pharmacology Research Project

Complementary Courses (18 credits)

18 credits selected as follows:

ANAT 321	(3)	Circuitry of the Human Brain
ANAT 322	(3)	Neuroendocrinology
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 303	(3)	Developmental Biology
BIOL 306	(3)	Neural Basis of Behaviour
BIOL 314	(3)	Molecular Biology of Oncogenes
BIOT 505	(3)	Selected Topics in Biotechnology
CHEM 302	(3)	Introductory Organic Chemistry 3
CHEM 334	(3)	Advanced Materials
CHEM 382	(3)	Organic Chemistry: Natural Products
CHEM 502	(3)	Advanced Bio-Organic Chemistry
CHEM 503	(3)	Drug Design and Development 1
CHEM 504	(3)	Drug Design and Development 2
CHEM 522	(3)	Stereochemistry
CHEM 552	(3)	Physical Organic Chemistry
EPIB 501	(3)	Population Health and Epidemiology
EXMD 401	(3)	Physiology and Biochemistry Endocrine Systems
EXMD 504	(3)	Biology of Cancer
EXMD 511	(3)	Joint Venturing with Industry
MIMM 387	(3)	The Business of Science
MIMM 414	(3)	Advanced Immunology
NEUR 310	(3)	Cellular Neurobiology
PATH 300	(3)	Human Disease
PHAR 504	(3)	Drug Discovery and Development 2
PHGY 311	(3)	Channels, Synapses & Hormones
PHGY 312	(3)	Respiratory, Renal, & Cardiovascular Physiology
PHGY 313	(3)	Blood, Gastrointestinal, & Immune Systems Physiology
PHGY 314	(3)	Integrative Neuroscience
PHGY 520	(3)	Ion Channels
PSYC 302	(3)	The Psychology of Pain
PSYC 311	(3)	Human Cognition and the Brain
PSYT 301	(3)	Issues in Drug Dependence
PSYT 455	(3)	Neurochemistry
PSYT 500	(3)	Advances: Neurobiology of Mental Disorders
REDM 410	(3)	Writing Research Articles

Revision, July 2013. End of revision.

14.29.2 Abou

Physics is in ma
in space and time h
and quantum mechanic
educational systems where

The two main undergraduate prog
very demanding. This program is appro

- Joint Major Program in Physics and Computer Science
- Joint Major Program in Physics and Geophysics

14.29.4 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.

Associate Members

J. Seuntjens (*Medical Physics*)

T. Szkopek (*Electrical & Computer Engineering*)

Curator (Rutherford Museum and McPherson Collection)

Jean Barrette; B.Sc., M.Sc., Ph.D.(Montr.)

14.29.6 Bachelor of Science (B.Sc.) - Minor Physics (18 credits)

The 18-credit Minor permits no overlap with any other programs. It contains no Mathematics courses, although many of the courses in it have Math pre- or corequisites. It will, therefore, be particularly appropriate to students in Mathematics, but it is also available to any Science student with the appropriate

14.29.7 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

14.29.8 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Physics (48 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 (39 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 436	(3)	Modern Physics
PHYS 446	(3)	Majors Quantum Physics

Complementary Courses (9 credits)

9 credits selected from:

PHYS 328	(3)	Electronics

U1 Required Courses (21 credits)

MATH 222	(3)	Calculus 3
MATH 223	(3)	Linear Algebra
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

U2 Required Courses (24 credits)

MATH 314	(3)	Advanced Calculus
MATH 315	(3)	Ordinary Differential Equations
PHYS 328	(3)	Electronics
PHYS 331	(3)	Topics in Classical Mechanics
PHYS 333	(3)	Thermal and Statistical Physics

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 (30 credits)

EPSC 203	(3)	Structural Geology
EPSC 210	(3)	Introductory Mineralogy
EPSC 231	(3)	Field School 1
MATH 222	(3)	Calculus 3
MATH 223	(3)	Linear Algebra
MATH 314	(3)	Advanced Calculus
PHYS 230	(3)	Dynamics of Simple Systems
PHYS 232	(3)	Heat and Waves
PHYS 257	(3)	Experimental Methods 1
PHYS 258	(3)	Experimental Methods 2

U2 Required Courses (18 credits)

EPSC 320	(3)	Elementary Earth Physics
EPSC 350	(3)	Tectonics
MATH 315	(3)	Ordinary Differential Equations
MATH 319	(3)	Introduction to Partial Differential Equations
PHYS 339	(3)	Measurements Laboratory in General Physics
PHYS 340	(3)	Majors Electricity and Magnetism

U2 or U3 Required Courses (6 credits)

EPSC 330	(3)	Earthquakes and Earth Structure
EPSC 510	(3)	Geodynamics and Geomagnetism

U3 Required Courses (15 credits)

PHYS 331	(3)	Topics in Classical Mechanics
PHYS 333	(3)	Thermal and Statistical Physics
PHYS 342	(3)	Majors Electromagnetic Waves
PHYS 432	(3)	Physics of Fluids

PHYS 446	(3)	Majors Quantum Physics

14.29.11 Bachelor of Science (B.Sc.) - Major Physics and Computer Science (66 credits)

The Major Physics and Computer Science is designed to give students the opportunity to combine the two fields in a way that distinguishes them from the graduates of either field by itself.

MATH 315	(3)	Ordinary Differential Equations
PHYS 232	(3)	Heat and Waves
PHYS 241	(3)	Signal Processing

U3 Required Courses (21 credits)

COMP 360	(3)	Algorithm Design
MATH 323	(3)	Probability
PHYS 331	(3)	Topics in Classical Mechanics
PHYS 339	(3)	Measurements Laboratory in General Physics
PHYS 340	(3)	Majors Electricity and Magnetism
PHYS 446	(3)	Majors Quantum Physics
PHYS 489	(3)	Special Project

14.29.12 Bachelor of Science (B.Sc.) - Honours Physics (78 credits)

Students entering this program for the first time should have high standing in mathematics and physics. In addition, a student who has not completed the equivalent of MATH 222 must take it in the first term without receiving credit toward the 78 credits required in the Honours program.

A student whose average in the required and complementary courses in any year falls below a GPA of 3.00, or whose grade in any individual required or complementary course falls below a C (unless it is improved to a C or higher in a supplementary examination or by retaking the course), may not register in the Honours program the following year, or graduate with the Honours degree, except with the permission of the Department.

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

U1 Required Courses (27 credits)

MATH 247	(3)	Honours Applied Linear Algebra
MATH 248	(3)	Honours Advanced 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)

		Honours Partial Differential Equations

PHYS 567	(3)	Particle Physics
PHYS 580	(3)	Introduction to String Theory

Revision, July 2013. End of revision.

14.29.13 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. Although the program is optimized for theoretical physics, it is broad enough and strong enough to prepare students for further study in either experimental physics or mathematics.

The minimum requirement for entry into the program is completion with high standing of the usual CEGEP courses in physics and in mathematics, or the Physics Program Prerequisites as explained below. In addition, a student who has not completed the equivalent of MATH 222 must take it in the first term without receiving credit toward the 81 credits required in the Honours program.

A student whose average in the required and complementary courses in any year falls below a GPA of 3.00, or whose grade in any individual required or complementary course falls below a C (unless the student improves the grade to a C or higher through a supplemental exam or by retaking the course), may not register in the Honours program the following year, or graduate with the Honours degree, except with the permission of both departments. The student will have two advisers, one from Mathematics and the other from Physics.

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.

Gen beefullng year

U2 Required Courses (27 credits)

MATH 242	(3)	Analysis 1
MATH 255	(3)	Honours Analysis 2
MATH 375	(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

Revision, July 2013. End of revision.

3 credits in Honours Mathematics.

14.29.14 Bachelor of Science (B.Sc.) - Honours Physics and Chemistry (80 credits)

This is a specialized and demanding program intended primarily, although not exclusively, for students with a theoretical bias who are interested in working in fields of study at the crossroads of physical chemistry and physics. The program will prepare students for either theoretical or experimental graduate work in departments where there is an emphasis on such cross-disciplinary areas as condensed matter physics, chemical physics, or material science.

A student whose average in the required and complementary courses in any year falls below a GPA of 3.00, or whose grade in any individual required or complementary course falls below a C (unless the student improves the grade to a C or above by taking a supplemental exam or retaking the course), may not register in this Honours program the following year, or graduate with the Honours degree, except with permission of both departments.

The student will have two advisers, one from Chemistry and the other from Physics.

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

U1 Required Courses (30 credits)

CHEM 223	(2)	Introductory Physical Chemistry 1
CHEM 243	(2)	Introductory Physical Chemistry 2
CHEM 253	(1)	Introductory Physical Chemistry 1 Laboratory
CHEM 263	(1)	Introductory Physical Chemistry 2 Laboratory
MATH 247	(3)	Honours Applied Linear Algebra
MATH 248	(3)	Honours Advanced 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

U2 Required Courses (24 credits)

CHEM 212	(4)	Introductory Organic Chemistry 1
CHEM 281	(3)	Inorganic Chemistry 1
CHEM 355	(3)	Molecular Properties and Structure 2
CHEM 365	(2)	Statistical Thermodynamics
COMP 208	(3)	Computers in Engineering
PHYS 350	(3)	Honours Electricity and Magnetism
PHYS 357	(3)	Honours Quantum Physics 1
PHYS 457	(3)	Honours Quantum Physics 2

U3 Required Courses (14 credits)

CHEM 393	(2)	Physical Chemistry Laboratory 2
CHEM 556	(3)	Advanced Quantum Mechanics
CHEM 574	(3)	Introductory Polymer Chemistry
PHYS 352	(3)	Honours Electromagnetic Waves
PHYS 558	(3)	Solid State Physics

U3 Complementary Courses (12 credits)

(with at least 3 credits in Chemistry and 3 credits in Physics)

3 credits selected from:

CHEM 593	(3)	Statistical Mechanics
PHYS 559	(3)	Advanced Statistical Mechanics

9 credits selected from the list below:

CHEM 480D1	(1.5)	Research Project 2
CHEM 480D2	(1.5)	Research Project 2
CHEM 531	(3)	Chemistry of Inorganic Materials
CHEM 575	(3)	Chemical Kinetics
CHEM 585	(3)	Colloid Chemistry
MATH 375	(3)	Honours Partial Differential Equations
PHYS 351	(3)	Honours Classical Mechanics 2
PHYS 434	(3)	Optics
PHYS 469	(3)	Honours Laboratory in Modern Physics 2
PHYS 479	(3)	Honours Research Project
PHYS 562	(3)	Electromagnetic Theory

14.29.15 Physics (PHYS) Related Programs

14.29.15.1 Joint Major in Atmospheric Science and Physics

See *section 14.3: Atmospheric and Oceanic Sciences (ATOC)*. This program provides a firm basis for graduate work in atmospheric science and related fields as well as a sound preparation for those who wish to embark on a career directly after the B.Sc. Students should consult undergraduate advisers in both departments.

14.29.15.2 Joint Major in Physiology and Physics

See *section 14.30: Physiology (PHGY)*. This program provides a firm basis for graduate work in bio-physics and other interdisciplinary fields involving the physical and biological sciences.

14.30 Physiology (PHGY)

14.30.1 Location

McIntyre Medical Sciences Building, Room 1021
3655 Promenade Sir-William-Osler
Montreal, Quebec H3G 1Y6

Telephone: 514-398-4316
Fax: 514-398-7452
Website: *www.medicine.mcgill.ca/physio*

14.30.2 About Physiology

Physiology has its roots in many of the basic sciences including biology, chemistry, mathematics, and physics. Physiology overlaps with other biomedical sciences such as anatomy, biochemistry, pathology and pharmacology, and with psychology and biomedical engineering, and is one of the prime contributors of basic scientific knowledge to the clinical medical sciences.

Members of the Department of Physiology at McGill are engaged in studies dealing with molecules, single cells, or entire systems in a variety of vertebrates, including man. A wide range of interest and expertise is represented, including cardiovascular, respiratory, gastrointestinal and renal physiology, the physiology of exercise, neurophysiology, endocrinology, isnlu31p0 1 75.58 6975.58 69tPh

Emeritus Professors

George Mandl; B.Sc.(C'dia), Ph.D.(McG.)

G. Melvill Jones; B.A., M.A., M.B., B.Ch., M.D.(Cant.)

J. Milic-Emili; M.D.(Milan)

C. Polosa; M.D., Ph.D.

Douglas G.D. Watt; M.D., Ph.D.(McG.)

Professors

Monroe W. Cohen; B.Sc., Ph.D.(McG.)

Ellis J. Cooper; B.Eng.(Sir G. Wms.), M.Sc.(Sur.), Ph.D.(McM.)

Kathleen Cullen; B.Sc.(Brown), Ph.D.(Chic.)

Leon Glass; B.S.(Brooklyn), Ph.D.(Chic.) (*Isadore Rosenfeld Professor of Cardiology*)

Phil Gold; C.C., B.Sc., M.Sc., Ph.D., M.D.,C.M.(McG.), F.R.C.P.(C.), F.R.S.C. (*Douglas G. Cameron Professor of Medicine*) (*joint appt. with Medicine*)

David Goltzman; B.Sc., M.D.,C.M.(McG.) (*Antoine G. Massabki Professor of Medicine*) (*joint appt. with Medicine*)

John Hanrahan; Ph.D.(Br. Col.)

Gergely Lukacs; M.D., Ph.D.(Budapest)

Michael Mackey; B.A., Ph.D.(Wash.) (*Joseph Morley Drake Professor of Physiology*)

Sheldon Magder; M.D.(Tor.) (*joint appt. with Medicine*)

Jacapo P. Mortola; M.D.(Milan)

John Orlowski; B.Sc.(McG.), M.Sc., Ph.D.(Qu.) (*James McGill Professor*)

Premsyl Ponka; M.D., Ph.D.(Prague)

Alvin Shrier; B.Sc.(C'dia), Ph.D.(Dal.) (*Hosmer Professor of Applied Physiology*)

John White; B.Sc., M.Sc.(Car.), Ph.D.(Harv.)

Assistant Professors

Claire Brown; B.Sc.(St. Mary's) Ph.D.(W. Ont.)

Russell Jones; Ph.D.(Tor.)

Anmar Khadra; B.Sc.(C'dia), M.Sc., Ph.D.(Wat.)

Associate Members

Biomedical Engineering: Robert E. Kearney, Satya Prakash

Dentistry: Fernando Cervero

Electrical and Computer Engineering: Sam Musallam

Kinesiology and Physical Education: Dilson Rassier

Medicine: Volker Blank, Mark Blostein, Andrey Cybulsky, Raymonde Gagnon, Geoffrey Hendy, Louise Larose, Anne Marie Lauzon, Serge Lemay, James Martin, Mariana Newkirk, Barry Posner, Shafaat Rabbani, Mary Stevenson, Tomoko Takano, Elena Torban, Simon Wing, Hans Zingg

Microbiology and Immunology: Jörg Fritz

Neurology and Neurosurgery: Jack Antel, Massimo Avoli, Daniel Guitton, Christopher Pack, David Ragsdale, Ed Ruthazer, Amir Shmuel, Melissa Vollrath

Ophthalmology: Curtis Baker

Otolaryngology: Bernard Segal

Pediatrics: Charles Rohlicek

Pharmacology: Terence Hebert

Psychiatry: Nicolas Cermakian, Bernardo Dubrovsky,

3 credits selected from:

BIOL 309	(3)	Mathematical Models in Biology
BIOL 373	(3)	Biometry

Upper-Level Physiology (ULP) Courses

6 credits selected from the Upper-Level Physiology (ULP) course list as follows:

All Physiology courses 400 level and above.

Note:

The 6-credit course PHGY 459D1/D2 equals 3 credits of ULP and 3 credits of electives.

The 9-credit course PHGY 461D1/D2 equals 3 credits of ULP and 6 credits of electives.

ANAT 541	(3)	Cell and Molecular Biology of Aging
BIOL 532	(3)	Developmental Neurobiology Seminar
BMDE 519	(3)	Biomedical Signals and Systems
EXMD 502	(3)	Advanced Endocrinology 01
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 413	(3)	Parasitology
MIMM 414	(3)	Advanced Immunology
MIMM 465	(3)	Bacterial Pathogenesis
MIMM 466	(3)	Viral Pathogenesis
PHGY 524	(3)	Chronobiology
PSYC 470	(3)	Memory and Brain
PSYT 500	(3)	Advances: Neurobiology of Mental Disorders

14.30.5 Bachelor of Science (B.Sc.) - Major Physiology (65 credits)

The Major program includes, in addition to some intensive studies in Physiology, a strong core content of related biomedical sciences. Admission to the Major program will be in U2, upon completion of the U1 required courses, and in consultation with the student's adviser.

If not previously taken, CHEM 212 "Introductory Organic Chemistry 1" must be completed in addition to the 64-65 program credits.

Students may complete this program with a minimum of 64 credits or a maximum of 65 credits depending on their choice of complementary courses.

U1 Required Courses (18 credits)

BIOL 200	(3)	Molecular Biology
BIOL 202	(3)	Basic Genetics
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

U2 and U3 Required Courses (19 credits)

BIOC 311	(3)	Metabolic Biochemistry
BIOL 301	(4)	Cell and Molecular Laboratory
PHGY 311	(3)	Channels, Synapses & Hormones
PHGY 312	(3)	Respiratory, Renal, & Cardiovascular Physiology
PHGY 313	(3)	Blood, Gastrointestinal, & Immune Systems Physiology
PHGY 314	(3)	Integrative Neuroscience

Complementary Courses (28 credits)

12-13 credits selected as follows:

3 credits, one of:

BIOC 212	(3)	Molecular Mechanisms of Cell Function
BIOL 201	(3)	Cell Biology and Metabolism

3 credits, one of:

BIOL 309	(3)	Mathematical Models in Biology
BIOL 373	(3)	Biometry

3 credits, one of:

CHEM 203	(3)	Survey of Physical Chemistry
CHEM 204	(3)	Physical Chemistry/Biological Sciences 1

3-4 credits, one of:

ANAT 214	(3)	Systemic Human Anatomy
ANAT 261	(4)	Introduction to Dynamic Histology

Upper Level Physiology (ULP) Courses

9 credits selected from the Upper-Level Physiology (ULP) course list as follows:

All Physiology courses 400 level and above.

Note:

The 6-credit course PHGY 459D1/D2 equals 3 credits of ULP and 3 credits of electives.

The 9-credit course PHGY 461D1/D2 equals 3 credits of ULP and 6 credits of electives.

ANAT 541	(3)	Cell and Molecular Biology of Aging
BIOL 532	(3)	Developmental Neurobiology Seminar
BMDE 519	(3)	Biomedical Signals and Systems
EXMD 502	(3)	Advanced Endocrinology 01
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 413	(3)	Parasitology

MIMM 414	(3)	Advanced Immunology
MIMM 465	(3)	Bacterial Pathogenesis
MIMM 466	(3)	Viral Pathogenesis
PHGY 524	(3)	Chronobiology
PSYC 470	(3)	Memory and Brain
PSYT 500	(3)	Advances: Neurobiology of Mental Disorders

Upper Level Science (ULS) Courses

6 credits selected from the Upper-Level Science (ULS) course list as follows:

Note:

For Anatomy, Chemistry, Neurology, and Neurosurgery: select from all courses 300 level and above and the ULS courses listed below.

For Biochemistry, Computer Science, Microbiology and Immunology, Mathematics, Physics, and Pathology: select from all courses 300 level and above.

For Biology, Experimental Medicine, Pharmacology, and Psychology: select from the ULS courses listed below:

ANAT 214	(3)	Systemic Human Anatomy
ANAT 261	(4)	Introduction to Dynamic Histology
ANAT 262	(3)	Introductory Molecular and Cell Biology
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 Oncogenes
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 01
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)	(3)	Drug Discovery and Development 2

3 credits, one of:

MATH 248	(3)	Honours Advanced Calculus
MATH 314	(3)	Advanced Calculus

3 credits, one of:

MATH 315	(3)	Ordinary Differential Equations
MATH 325	(3)	Honours Ordinary Differential Equations

U2 Required Courses (24 credits)

MATH 242	(3)	Analysis 1
MATH 243	(3)	Analysis 2
MATH 323	(3)	Probability
MATH 326	(3)	Nonlinear Dynamics and Chaos
PHGY 311	(3)	Channels, Synapses & Hormones
PHGY 312	(3)	Respiratory, Renal, & Cardiovascular Physiology
PHGY 313	(3)	Blood, Gastrointestinal, & Immune Systems Physiology
PHGY 314	(3)	Integrative Neuroscience

U2 or U3 Required Courses (6 credits)

MATH 437	(3)	Mathematical Methods in Biology
PHYS 413	(3)	Physical Basis of Physiology

U3 Required Courses (18 credits)

BMDE 519	(3)	Biomedical Signals and Systems
MATH 319	(3)	Introduction to Partial Differential Equations
MATH 324	(3)	Statistics
PHGY 461D1	(4.5)	Experimental Physiology
PHGY 461D2	(4.5)	Experimental Physiology

14.30.7 Bachelor of Science (B.Sc.) - Major Physiology and Physics (80 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.

U1 Required Courses (17 credits)

* The corequisite BIOL 200, BIOL 201 is waived for this program.

MATH 222	(3)	Calculus 3
PHGY 212*	(1)	Introductory Physiology Laboratory 1
PHGY 213*	(1)	Introductory Physiology Laboratory 2
PHYS 230	(3)	Dynamics of Simple Systems
PHYS 232	(3)	Heat and Waves
PHYS 257	(3)	Experimental Methods 1

PHYS 258	(3)	Experimental Methods 2

U2 Required Courses (21 credits)

MATH 326	(3)	Nonlinear Dynamics and Chaos
PHGY 311	(3)	Channels, Synapses & Hormones
PHGY 312	(3)	Respiratory, Renal, & Cardiovascular Physiology
PHGY 313	(3)	Blood, Gastrointestinal, & Immune Systems Physiology
PHGY 314	(3)	Integrative Neuroscience
PHYS 328	(3)	Electronics
PHYS 339	(3)	Measurements Laboratory in General Physics

U2 or U3 Required Courses (6 credits)

Mods 2	(3)	Mathematical Methods in Biology

MATH 248	(3)	Honours Advanced Calculus
MATH 314	(3)	Advanced Calculus

14.30.8 Bachelor of Science (B.Sc.) - Honours Physiology (75 credits)

All admissions to the Honours program will be in U2, and the student must have a U1 GPA of 3.30, with no less than a B in PHGY 209 and PHGY 210. Admission to U3 requires a U2 CGPA of 3.20 with no less than a B in U2 Physiology courses. Decisions for admission to U3 will be heavily influenced by student standing in U2 courses.

The Department reserves the right to restrict the number of entering students in the Honours program. Students who do not maintain Honours standing may transfer their registration to the Major program in Physiology.

The deadline to apply to the Honours program is May 21. Application forms are available online at physiology.med@mcgill.ca or a hard copy can be picked up at McIntyre 1021. An e-mail will be sent to acknowlege receipt of your application.

Graduation: To graduate from the Honours Physiology program, the student will have a CGPA of 3.20 with a mark no less than a B in all Physiology courses.

If not previously taken, CHEM 212 Introductory Organic Chemistry 1 must be completed in addition to the 75 program credits.

Required Courses (60 credits)

3 credits, one of:

BIOL 309	(3)	Mathematical Models in Biology
BIOL 373	(3)	Biometry

3 credits, one of:

CHEM 203	(3)	Survey of Physical Chemistry
CHEM 204	(3)	Physical Chemistry/Biological Sciences 1

Upper-Level Physiology (ULP) Courses

6 credits selected from the Upper-Level Physiology (ULP) course list as follows:

All Physiology courses 400 level and above.

ANAT 541	(3)	Cell and Molecular Biology of Aging
BIOL 532	(3)	Developmental Neurobiology Seminar
BMDE 519	(3)	Biomedical Signals and Systems
EXMD 502	(3)	Advanced Endocrinology 01
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 413	(3)	Parasitology
MIMM 414	(3)	Advanced Immunology
MIMM 465	(3)	Bacterial Pathogenesis
MIMM 466	(3)	Viral Pathogenesis
PHGY 524	(3)	Chronobiology
PSYC 470	(3)	Memory and Brain
PSYT 500	(3)	Advances: Neurobiology of Mental Disorders

14.30.9 Physiology (PHGY) Related Programs

14.30.9.1 Interdepartmental Honours in Immunology

For more information, see *section 14.17: Immunology*. This program is offered by the Departments of Biochemistry, Microbiology and Immunology, and Physiology. Students interested in the program should contact Dr. C. Piccirillo, Microbiology and Immunology, *ciro.piccirillo@mcgill.ca*, 514-398-2872; or Dr. Monroe Cohen, Physiology, *monroe.cohen@mcgill.ca*, 514-398-4342.

14.31 Psychiatry (PSYT)

14.31.1 Location

1033 Pine Avenue West, Room 105
Montreal, Quebec H3A 1A1
Telephone: 514-398-4176
Website: *www.med.mcgill.ca/psychiatry*

14.31.2 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.

to students planning careers in professional fields other than psychology. These include, but are not restricted to, medicine, education, social work, human communication sciences, or business and industry.

Students who are interested in psychology as a career must pursue graduate studies. Persons who hold graduate degrees in Psychology, usually the Ph.D., may find employment in universities, research institutes, hospitals, community agencies, government departments, large corporations, or may act as self-employed consultants. At the graduate level, psychology has many specialized branches including social psychology, physiological psychology, experimental psychology, clinical psychology, child psychology, industrial psychology, community psychology

Professors

Richard F. Koestner; B.A., Ph.D.(Roch.)

Daniel J. Levitin; A.B.(Stan.), M.S., Ph.D.(Ore.) (*James McGill Professor*)

John Lydon; B.A.(Notre Dame), M.A., Ph.D.(Wat.)

Jeffrey S. Mogil; B.Sc.(Tor.), Ph.D.(Calif.-LA) (*E.P. Taylor Professor of Psychology and Canada Research Chair in Genetics of Pain*)

Debbie S. Moskowitz; B.S.(Kirkland), M.A., Ph.D.(Conn.)

Karim Nader; B.Sc., Ph.D.(Tor.) (*James McGill Professor*)

Yuriko Oshima-Takane; B.A.(Tokyo Women's Christian Uni

Associate Members

Jewish General Hospital: David Dunkley, Phyllis Zelkowitz

Montreal Neurological Institute: Alain Dagher, Lesley Fellows, Daniel Guitton, Marilyn Jones-Gotman, Brenda Milner, Edward Ruthazer, Wayne Sossin, Viviane Sziklas, Robert Zatorre

Psychiatry: Marco Leyton, Amir Raz

Schulich School of Music: Stephen McAdams

Vision Research Unit (Ophthalmology): Curtis Baker, Robert Hess, Frederick A.A. Kingdom, Kathleen Mullen

Adjunct Professors

M. Bruck; B.A.(Wheaton), M.A., Ph.D.(McG.)

S. Burstein; B.Sc.(McG.), M.A., Ph.D.(Wat.)

P. Delise; B.Sc., M.Ps., Ph.D.(Montr.)

S. Harnard; B.A.(McG.), M.A.(McG.), M.A., Ph.D.(Princ.)

Z. Pleszewski; M.A., Ph.D.(Poznan)

P. Zelazo; B.A.(Amer. Int'l. Coll.), M.S.(N. Carolina), Ph.D.(Wat.)

Part-time Appointments

Jennifer Coelho; B.Sc.(Br. Col.), M.A., Ph.D.(Tor.)

Frank Elgar; B.A., M.Sc., Ph.D.(Dal.)

Elizabeth Foley; B.Sc.(Tor.), Ph.D.(McG.)

Judith LeGallais; B.A., M.A., Ph.D.(McG.)

14.32.5 Admission Requirements to the Bachelor of Science (B.Sc.) – Honours Psychology

Applications can be obtained from the Undergraduate Office of the Department of Psychology, Room N7/9A, Stewart Biology Building. The applications must be completed and returned to the Undergraduate Office by August 1 for September admission. Candidates will be advised of the Department's decision via email before classes begin in September.

Students should note that awarding of the Honours degree will depend on both cumulative grade point average and a minimum grade of B on PSYC 380D1/PSYC 380D2 and PSYC 482. “First Class Honours” is awarded to students who obtain a minimum cumulative grade point average of 3.50, a minimum program GPA of 3.50, and a minimum grade of A- in the required Honours courses, namely PSYC 380D1/PSYC 380D2 and PSYC 482. “Honours” is awarded to students with a minimum cumulative grade point average of 3.00, a minimum program GPA of 3.00, and a minimum grade of B in the required Honours courses, namely PSYC 380D1/PSYC 380D2 and PSYC 482. Moreover, the awarding of the Honours degree normally requires completion of two full years of study, U2 and U3, in the Honours program. Students with particularly strong academic records may be admitted for the U3 year only on the basis of their marks and research experience. These students must complete all Honours program requirements.

For more information, see *section 14.32.9: Bachelor of Science (B.Sc.) - Honours Psychology (60 credits)*.

14.32.6 Bachelor of Science (B.Sc.) - Minor Psychology (24 credits)

A minor program in Psychology is available to students registered in any B.Sc. program other than Psychology. This program is intended to complement a student's primary field of study by providing a focused introduction to specialized topics in psychology.

A separate minor concentration exists for students registered in a program in the Faculty of Arts.

The Minor program for Science students requires the completion of 24 credits, of which no more than 6 may overlap with the primary program. All courses in the Minor program must be passed with a minimum grade of C. A prerequisite to the program is PSYC 204 or equivalent.

Complementary Courses (24 credits)

at least 3, but no more than 6, credits selected from:

PSYC 211	(3)	Introductory Behavioural Neuroscience
PSYC 212	(3)	Perception
PSYC 213	(3)	Cognition
PSYC 215	(3)	Social Psychology

18-21 credits selected from Psychology courses at the 300 level or above.

14.32.7 Bachelor of Science (B.Sc.) - Liberal Program - Core Science Component Psychology (45 credits)

This Core Science Component Psychology requires the completion of 45 credits in Psychology, all of which need to be passed with a minimum grade of C. A prerequisite to the program is PSYC 100 or equivalent. Students completing a Liberal Program with a Core Science Component Psychology must also complete at least one breadth component in a second area.

Recommended Background

It is expected that most students who enter the Liberal 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 equi

Human F

PSYC 512	(3)	Advanced Personality Seminar
PSYC 528	(3)	Vulnerability to Depression

PSYC 341	(3)	The Psychology of Bilingualism
PSYC 342	(3)	Hormones and Behaviour
PSYC 352	(3)	Cognitive Psychology Laboratory
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 Behaviour
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 514	(3)	Neurobiology of Learning and 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 532	(3)	Cognitive Science
PSYC 536	(3)	Correlational Techniques
PSYC 537	(3)	Advanced Seminar in Psychology of Language
PSYC 538	(3)	Categorization, Communication & 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
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: Abnormal Psychology 1
PSYC 338	(3)	Introduction: Abnormal Psychology 2
PSYC 351	(3)	Research Methods in Social Psychology
PSYC 408	(3)	Principles of Cognitive Behaviour Therapy
PSYC 409	(3)	Positive Psychology
PSYC 412	(3)	Developmental Psychopathology
PSYC 414	(3)	Social Development

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U1 or U2 Required Course (3 credits)

PSYC 305	(3)	Statistics for Experimental Design

U2 Required Courses (9 credits)

PSYC 380D1	(4.5)	Honours Research Project Seminar
PSYC 380D2	(4.5)	Honours Research Project Seminar

U3 Required Course (3 credits)

PSYC 482	(3)	Advanced Honours Seminar

Complementary Courses (33 credits)

12 credits to be selected from the list below and any Psychology course at the 500 level.

PSYC 403	(3)	Modern Psychology in Historical Perspective
PSYC 483	(3)	Seminar in Experimental Psychopathology
PSYC 495	(6)	Psychology Research Project 2
PSYC 496	(6)	Senior Honours Research 1
PSYC 497	(6)	Senior Honours Research 2
PSYC 498D1	(4.5)	Senior Honours Research
PSYC 498D2	(4.5)	Senior Honours Research

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 & 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 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 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 Behaviour
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 514	(3)	Neurobiology of Learning and 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 532	(3)	Cognitive Science
PSYC 536	(3)	Correlational Techniques
PSYC 537	(3)	Advanced Seminar in Psychology of Language
PSYC 538	(3)	Categorization, Communication & 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
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: Abnormal Psychology 1
PSYC 338	(3)	Introduction: Abnormal Psychology 2
PSYC 351	(3)	Research Methods in Social Psychology
PSYC 408	(3)	Principles of Cognitive Behaviour Therapy
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 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
PSYC 530	(3)	Applied Topics in Deafness
PSYC 533	(3)	International Health Psychology
PSYC 535	(3)	Advanced Topics in Social Psychology

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).

14.33 Redpath Museum (REDM)

14.33.1 Location

Redpath Museum
859 Sherbrooke Street West
Montreal, Quebec H3A 0C4

Telephone: 514-398-4086 ext. 3188
Fax: 514-398-3185
Website: *www.mcgill.ca/redpath*

14.33.2 About the Redpath Museum

The Redpath Museum exists to foster 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 399	Science Writing
REDM 400	Science and Museums
REDM 405	Natural History of East Africa
REDM 410	Writing Research Articles

14.33.3 Redpath Museum (REDM) Faculty

Revision, August 2013. Start of revision.

Director

David M. Green

Emeritus Professor

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

Professor

David M. Green; B.Sc.(Br. Col.), M.Sc., Ph.D.(Guelph), F.L.S.

Associate Professors

Andrew Hendry; B.Sc.(Vic., BC), M.Sc., Ph.D.(Wash.) (*joint appt. with Biology*)

Hans C.E. Larsson; B.Sc.(McG.), Ph.D.(Chic.) (*CRC Tier 2 Chair in Paleontology*)

BIOL 350**	(3)	Insect Biology and Control
BIOL 352	(3)	Vertebrate Evolution
BIOL 418	(3)	Freshwater Invertebrate Ecology
BIOL 427	(3)	Herpetology
BIOL 463	(3)	Mammalian Evolution
ENTO 330**	(3)	Insect Biology
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)	Biology of Organisms
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

14.34 Science or Mathematics for Teachers

14.34.1 Location

Dawson Hall, Room 405
853 Sherbrooke Street West
Montreal, Quebec H3A 0G5

Fax: 514-398-2157
Email: *pete.barry@mcgill.ca*
Website: *www.mcgill.ca/scienceforteachers*

14.34.2 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 have introduced several programs for students who wish to combine Science or Mathematics with Education at McGill. These include the Minor in Education for Science Students, and the Concurrent B.Sc. and B.Ed. The traditional Bachelor of Education, Secondary Program, Science and Technology, or Secondary Program, Mathematics is also available within the Faculty of Education; see *Programs, Courses and University Regulations > Faculties & Schools > Faculty of Education > Undergraduate > Department of Integrated Studies in Education > : Overview of Programs (Integrated Studies in Education)*.

- *section 14.34.5: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Cell/Molecular with Minor Chemistry for Teachers (135 credits)*
- *section 14.34.6: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Organismal with Minor Chemistry for Teachers (135 credits)*
- *section 14.34.7: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Cell/Molecular with Minor Physics for Teachers (135 credits)*
- *section 14.34.8: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Organismal with Minor Physics for Teachers (135 credits)*
- *section 14.34.9: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Chemistry with Minor Biology for Teachers (135 credits)*
- *section 14.34.10: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Chemistry with Minor Physics for Teachers (135 credits)*
- *section 14.34.13: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Mathematics for Teachers (135 credits)*
- *section 14.34.11: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Physics with Minor Biology for Teachers (135 credits)*
- *section 14.34.12: Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Physics with Minor Chemistry for Teachers (135 credits)*

14.34.3 Science or Mathematics for Teachers Faculty

Concurrent B.Sc. and B.Ed.

Coordinator – Science
Pete Barry
Telephone: 514-398-3202

Coordinator – Education
G. Seiler (*on leave*)
Telephone: 514-398-7106

Minor in Education for Science Students

Program Adviser
Joan Barrett
Student Affairs Office, Faculty of Education
General Information: 514-398-7042
Website: *www.mcgill.ca/edu-sao/current/minorseducation*

14.34.4 Bachelor of Science (B.Sc.) - Minor Education for Science Students (18 credits)

Revision, August 2013. Start of revision.

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 a substantial number of the necessary credits for the B.Ed. degree should they wish to enrol in that program. Students graduating with a B.Sc. should consider the Master of Arts in Teaching and Learning (http://www.mcgill.ca/dise/progs/matl) if they are interested in obtaining a teaching license.

For more information please contact:

Joan Barrett

Student Affairs Office, Faculty of Education

General Information: 514-398-7042

Website: http://www.mcgill.ca/edu-sao/current/minorseducation

Required Course (3 credits)

EDPE 300	(3)	Educational Psychology

Complementary Courses (15 credits)

6 credits of Electives, of which at least 3 credits must be Science Electives, depending on how many credits count toward both the B.Sc. and the B.Ed. degrees.

For details on the counting of credits toward both degrees (double-counting) visit the program website http://www.mcgill.ca/scienceforteachers/.

B.Sc. Freshman Program

Students who enter Science in U0 will normally be registered in the Science Freshman Program until they complete their first year. They must consult an adviser in the Science Office for Undergraduate Student Advising (SOUSA) to obtain advice and approval of their course selection. Full details are available on the SOUSA website at http://www.mcgill.ca/science/sousa. Academic advising is also available by email. The address is
ne

Second calculus course, one of:

MATH 141	(4)	Calculus 2
MATH 151	(4)	Calculus B

First physics course, one of:

PHYS 101	(4)	Introductory Physics - Mechanics
PHYS 131	(4)	Mechanics and Waves

Second physics course, one of:

PHYS 102	(4)	Introductory Physics - Electromagnetism
PHYS 142	(4)	Electromagnetism and Optics

Electives

Students wishing to take elective courses may choose them from introductory courses offered by departments in the Faculties of Science or of Arts. A list of recommended courses is found at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/approved/. Certain courses offered by other faculties may also be taken, but some restrictions apply

EDPE 300*	(3)	Educational Psychology
EDPE 304	(3)	Measurement and Evaluation
EDPI 309*	(3)	Diverse Learners
EDPI 341	(3)	Instruction in Inclusive Schools

Complementary Courses

6 credits selected as follows:

* Note: The courses marked with an asterisk are counted toward both degrees. They will count as "electives" for the B.Sc. degree, although a grade of "C" or better is required.

3 credits, one of the three following courses:

EDEC 233*	(3)	First Nations and Inuit Education
EDEC 248*	(3)	Multicultural Education
EDEC 249*	(3)	Global Education and Social Justice

3 credits, one of the two following courses:

EDEC 260*	(3)	Philosophical Foundations
EDEC 261*	(3)	Philosophy of Catholic Education

Major Concentration Biology - Cell/Molecular (36 credits)

The Major Concentration Biology - Cell/Molecular is a planned sequence of courses designed to permit a degree of specialization in cell/molecular biology.

Advising Note: Freshman students should be aware that PHYS 101 and/or PHYS 102 are required for some of the courses in the major and minor concentrations in Biology.

Required Courses

25 credits selected as follows:

BIOL 200	(3)	Molecular Biology
BIOL 201	(3)	Cell Biology and Metabolism
BIOL 202	(3)	Basic Genetics
BIOL 205	(3)	Biology of Organisms
BIOL 215	(3)	Introduction to Ecology and Evolution
BIOL 300	(3)	Molecular Biology of the Gene
BIOL 301	(4)	Cell and Molecular Laboratory
BIOL 303	(3)	Developmental Biology

Complementary Courses

At least 11 credits selected from:

BIOL 306	(3)	Neural Basis of Behaviour
BIOL 313	(3)	Eukaryotic Cell Biology
BIOL 314	(3)	Molecular Biology of Oncogenes
BIOL 370	(3)	Human Genetics Applied
BIOL 373	(3)	Biometry
BIOL 413	(1)	Directed Reading

BIOL 568	(3)	Topics on the Human Genome
BIOL 575	(3)	Human Biochemical Genetics

or other appropriate course at the 300 level or higher with the permission of an adviser.

Minor Chemistry (18 credits)

Required Courses

18 credits selected as follows:

* Note: denotes courses with CEGEP equivalents.

Substitutions for these by more advanced courses may be made at the discretion of the Adviser.

CHEM 203	(3)	Survey of Physical Chemistry
CHEM 212*	(4)	Introductory Organic Chemistry 1
CHEM 222*	(4)	Introductory Organic Chemistry 2
CHEM 253	(1)	Introductory Physical Chemistry 1 Laboratory
CHEM 281	(3)	Inorganic Chemistry 1
CHEM 287	(2)	Introductory Analytical Chemistry
CHEM 297	(1)	Introductory Analytical Chemistry Laboratory

Additional Science Courses

15 credits selected as follows:

12 credits:

BIOL 210	(3)	Perspectives of Science
CHEM 381	(3)	Inorganic Chemistry 2
MATH 203	(3)	Principles of Statistics 1
MATH 222	(3)	Calculus 3

plus 3 credits, one of:

CHEM 180	(3)	World of Chemistry: Environment
CHEM 181	(3)	World of Chemistry: Food
CHEM 182	(3)	World of Chemistry: Technology
CHEM 183	(3)	World of Chemistry: Drugs

Electives (6 credits)

6 credits, of which at least 3 credits must be Science Electives.

The electives must be chosen in such a way that the credit counts needed for graduation are satisfied.

14.34.6 Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Organismal with Minor Chemistry for Teachers (135 credits)

Note: New students are no longer being admitted to this program.

The Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Organismal with Minor Chemistry for Teachers is jointly offered by the Faculty of Science and the Faculty of Education. Separately, the Bachelor of Science degree requires 90 credits (or 120 credits for students who have not completed the basic sciences) and the Bachelor of Education degree requires 120 credits. In the concurrent program, the requirements for the two degrees are combined in such a way that students complete 135 (or 165 credits) to fulfil all the requirements for graduation for both the B.Sc. and the B.Ed.

Graduates of the B.Ed. degree are recommended by the University to the Quebec Ministère de l'Éducation, du Loisir et du Sport (MELS) for Quebec Teacher Certification. For more information about teacher certification in Quebec, please refer to the Faculty of Education section under "Overview of Faculty Programs", "Undergraduate Education Programs." and "Quebec Teacher Certification".

The Major Concentration Biology - Organismal with Minor Chemistry is one of the nine variations of the program and allows students to focus their Science degree in Organismal Biology with a subspecialization in Chemistry.

To fulfil the requirements for graduation for the Concurrent Bachelor of Science and Bachelor of Education, the 135 credits (or 165 credits for students admitted without basic sciences) include the following:

(30 credits of Science Freshman Program (for students admitted without basic sciences))

60 credits of Education Component

69 credits of Science Component consisting of:

- 36 credits of Major Concentration Biology - Organismal

- 18 credits of Minor Chemistry

- 15 credits of Additional Science Courses

6 credits of Electives, of which at least 3 credits must be Science Electives, depending on how many credits count toward both the B.Sc. and the B.Ed. degrees.

For details on the counting of credits toward both degrees (double-counting) visit the program website http://www.mcgill.ca/scienceforteachers/.

B.Sc. Freshman Program

Students who enter Science in U0 will normally be registered in the Science Freshman Program until they complete their first year. They must consult an adviser in the Science Office for Undergraduate Student Advising (SOUSA) to obtain advice and approval of their course selection. Full details are available on the SOUSA website at http://www.mcgill.ca/science/sousa. Academic advising is also available by email. The address is newstudentadvising.science@mcgill.ca.

Students normally complete 30 credits which must include at least seven courses from the list of Approved Freshman Science courses, selected as follows:

General Math and Science Breadth

Six of the Freshman courses must satisfy one of the following:

Option 1) 2 courses from MATH and 4 courses from BIOL, CHEM or PHYS;

or

Option 2) 3 courses from MATH and 3 courses from BIOL, CHEM or PHYS.

Science Complementary

The seventh course is chosen from the list of Approved Freshman Science Courses.

Notes:

1. Students who have not studied all of Biology, Chemistry and Physics at the grade 12 level or equivalent are strongly advised to include at least one course in the missing discipline in their Freshman Program.

2. Many students will complete more than seven courses from the Approved Freshman Science Courses list, particularly those who wish to leave several options open for their choice of major.

3. Students entering the Freshman Program must be aware of the department specific requirements when selecting their courses. Detailed advising information is available at http://www.mcgill.ca/science/sousa/bsc/freshman.

4. The maximum number of courses per term, required, complementary, and elective, is five.

List of Approved Freshman Science Courses

Select the approved courses according to the instructions above.

Note:

* CHEM 115 (not open to students who are taking or have taken CHEM 110 or CHEM 120)

* CHEM 120 (not open to students who have taken CHEM 115)

BIOL 111	(3)	Principles: Organismal Biology
BIOL 112	(3)	Cell and Molecular Biology
CHEM 110	(4)	General Chemistry 1
CHEM 115*	(4)	Accelerated General Chemistry: Giants in Science

CHEM 120*	(4)	General Chemistry 2
COMP 202	(3)	Foundations of Programming
ESYS 104	(3)	The Earth System
MATH 133	(3)	Linear Algebra and Geometry
PSYC 100	(3)	Introduction to Psychology

First calculus course, one of:

MATH 139	(4)	Calculus 1 with Precalculus
MATH 140	(3)	Calculus 1
MATH 150	(4)	Calculus A

Second calculus course, one of:

MATH 141	(4)	Calculus 2
MATH 151	(4)	Calculus B

First physics course, one of:

PHYS 101	(4)	Introductory Physics - Mechanics
PHYS 131	(4)	Mechanics and Waves

Second physics course, one of:

PHYS 102	(4)	Introductory Physics - Electromagnetism
PHYS 142	(4)	Electromagnetism and Optics

Electives

Students wishing to take elective courses may choose them from introductory courses offered by departments in the Faculties of Science or of Arts. A list of recommended courses is found at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/approved/. Certain courses offered by other faculties may also be taken, but some restrictions apply.

Consult the SOUSA website at http://www.mcgill.ca/science/sousa/continuing_students/bsc/outside/ for more information about taking courses from other faculties.

Education Component (60 credits)

60 credits of Education Component consisting of:

54 credits of required courses

6 credits of complementary courses

Required Courses

54 credits

* Note:

EDEC 254	(1)	Second Professional Seminar (Secondary)
EDEC 262*	(3)	Media, Technology and Education
EDEC 351	(2)	Third Professional Seminar (Secondary)
EDEC 404	(3)	Fourth Year Professional Seminar (Sec)
EDES 335	(3)	Teaching Secondary Science 1
EDES 350	(3)	Classroom Practices (Secondary)
EDES 435	(3)	Teaching Secondary Science 2
EDFE 200	(2)	First Field Experience (K/Elem & Secondary)
EDFE 254	(3)	Second Field Experience (Secondary)
EDFE 351	(8)	Third Field Experience (Secondary)
EDFE 451	(7)	Fourth Field Experience (Secondary)
EDPE 300*	(3)	Educational Psychology
EDPE 304	(3)	Measurement and Evaluation
EDPI 309*	(3)	Diverse Learners
EDPI 341	(3)	Instruction in Inclusive Schools

Complementary Courses

6 credits selected as follows:

* Note: The courses marked with an asterisk are counted toward both degrees. They will count as "electives" for the B.Sc. degree, although a grade of "C" or better is required.

3 credits, one of the three following courses:

EDEC 233*	(3)	First Nations and Inuit Education
EDEC 248*	(3)	Multicultural Education
EDEC 249*	(3)	Global Education and Social Justice

3 credits, one of the two following courses:

EDEC 260*	(3)	Philosophical Foundations
EDEC 261*	(3)	Philosophy of Catholic Education

Major Concentration Biology - Organismal (36 credits)

The Major Concentration Biology - Organismal is a planned sequence of courses designed to permit a degree of specialization in organismal biology.

Advising Note: Freshman students should be aware that PHYS 101 and/or PHYS 102 are required for some of the courses in the major and minor concentrations in Biology.

Required Courses

24 credits

BIOL 200	(3)	Molecular Biology
BIOL 201	(3)	Cell Biology and Metabolism
BIOL 202	(3)	Basic Genetics
BIOL 205	(3)	Biology of Organisms
BIOL 206	(3)	Methods in Biology of Organisms
BIOL 215	(3)	Introduction to Ecology and Evolution

BIOL 304	(3)	Evolution
		Ecological Dynamics

CHEM 180	(3)	World of Chemistry: Environment
CHEM 181	(3)	World of Chemistry: Food
CHEM 182	(3)	World of Chemistry: Technology
CHEM 183	(3)	World of Chemistry: Drugs

Electives (6 credits)

6 credits, of which at least 3 credits must be Science Electives.

The electives must be chosen in such a way that the credit counts needed for graduation are satisfied.

14.34.7 Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Cell/Molecular with Minor Physics for Teachers (135 credits)

Note: New students are no longer being admitted to this program.

The Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Biology - Cell/Molecular with Minor Physics for Teachers is jointly offered by the Faculty of Science and the Faculty of Education. Separately, the Bachelor of Science degree requires 90 credits (or 120 credits for students who hav

1. Students who have not studied all of Biology, Chemistry, and Physics at the grade 12 level or equivalent are strongly advised to include at least one course in the missing discipline in their Freshman Program.

2. Many students will complete more than seven courses from the Approved Freshman Science Courses list, particularly those who wish to leave several options open for their choice of major.

3. Students entering the Freshman Program must be aware of the department specific requirements when selecting their courses. Detailed advising information is available at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/specific/.

4. The maximum number of courses per term, required, complementary, and elective, is five.

List of Approved Freshman Science Courses

Select the approved courses according to the instructions above.

Note:

* CHEM 115 (not open to students who are taking or have taken CHEM 110 or CHEM 120)

* CHEM 120 (not open to students who have taken CHEM 115)

BIOL 111	(3)	Principles: Organismal Biology
BIOL 112	(3)	Cell and Molecular Biology
CHEM 110	(4)	General Chemistry 1
CHEM 115*	(4)	Accelerated General Chemistry: Giants in Science
CHEM 120*	(4)	General Chemistry 2
COMP 202	(3)	Foundations of Programming
ESYS 104	(3)	The Earth System
MATH 133	(3)	Linear Algebra and Geometry
PSYC 100	(3)	Introduction to Psychology

First calculus course, one of:

MATH 139	(4)	Calculus 1 with Precalculus
MATH 140	(3)	Calculus 1
MATH 150	(4)	Calculus A

Second calculus course, one of:

MATH 141	(4)	Calculus 2
MATH 151	(4)	Calculus B

First physics course, one of:

PHYS 101	(4)	Introductory Physics - Mechanics
PHYS 131	(4)	Mechanics and Waves

Second physics course, one of:

PHYS 102	(4)	Introductory Physics - Electromagnetism
PHYS 142	(4)	Electromagnetism and Optics

Electives

Students wishing to take elective courses may choose them from introductory courses offered by departments in the Faculties of Science or of Arts. A list of recommended courses is found at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/approved/. Certain courses offered by other faculties may also be taken, but some restrictions apply.

Consult the SOUSA website at http://www.mcgill.ca/science/sousa/continuing_students/bsc/outside/ for more information about taking courses from other faculties.

Education Component (60 credits)

60 credits of Education Component, consisting of:

EDEC 261*	(3)	Philosophy of Catholic Education

Major Concentration Biology - Cell/Molecular (36 credits)

The Major Concentration Biology - Cell/Molecular is a planned sequence of courses designed to permit a degree of specialization in cell/molecular biology.

Advising Note: Freshman students should be aware that PHYS 101 and/or PHYS 102 are required for some of the courses in the major and minor concentrations in Biology.

Required Courses*

29 credits selected as follows:

* Students who ha

The Major Concentration Biology - Organismal with Minor Physics is one of the nine variations of the program and allows students to focus their Science degree in Organismal Biology with a subspecialization in Physics.

To fulfil the requirements for graduation for the Concurrent Bachelor of Science and Bachelor of Education, the 135 credits (or 165 credits for students admitted without basic sciences) include the following:

(30 credits of Science Freshman Program (for students admitted without basic sciences))

60 credits of Education Component

70 credits of Science Component consisting of:

- 37 credits of Major Concentration Biology - Organismal

- 18 credits of Minor Physics

- 15 credits of Additional Science Courses

5 credits of Electives, of which at least 2 credits must be Science Electives, depending on how many credits count toward both the B.Sc. and the B.Ed. degrees.

For details on the counting of credits toward both degrees (double-counting) visit the program website http://www.mcgill.ca/scienceforteachers/.

B.Sc. Freshman Program

Students who enter Science in U0 will normally be registered in the Science Freshman Program until they complete their first year. They must consult an adviser in the Science Office for Undergraduate Student Advising (SOUSA) to obtain advice and approval of their course selection. Full details are available on the SOUSA website at http://www.mcgill.ca/science/sousa. Academic advising is also available by email. The address is newstudentadvising.science@mcgill.ca.

Students normally complete 30 credits which must include at least seven courses from the list of Approved Freshman Science courses, selected as follows:

General Math and Science Breadth

Six of the Freshman courses must satisfy one of the following:

Option 1) 2 courses from MATH and 4 courses from BIOL, CHEM or PHYS;

or

Option 2) 3 courses from MATH and 3 courses from BIOL, CHEM or PHYS.

Science Complementary

The seventh course is chosen from the list of Approved Freshman Science Courses.

Notes:

1. Students who have not studied all of Biology, Chemistry, and Physics at the grade 12 level or equivalent are strongly advised to include at least one course in the missing discipline in their Freshman Program.

2. Many students will complete more than seven courses from the Approved Freshman Science Courses list, particularly those who wish to leave several options open for their choice of major.

3. Students entering the Freshman Program must be aware of the department specific requirements when selecting their courses. Detailed advising information is available at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/specific/.

4. The maximum number of courses per term, required, complementary, and elective, is five.

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ESYS 104	(3)	The Earth System
MATH 133	(3)	Linear Algebra and Geometry
PSYC 100	(3)	Introduction to Psychology

First calculus course, one of:

MATH 139	(4)	Calculus 1 with Precalculus
MATH 140	(3)	Calculus 1
MATH 150	(4)	Calculus A

Second calculus course, one of:

MATH 141	(4)	Calculus 2
MATH 151	(4)	Calculus B

First physics course, one of:

PHYS 101	(4)	Introductory Physics - Mechanics
PHYS 131	(4)	Mechanics and Waves

Second physics course, one of:

PHYS 102	(4)	Introductory Physics - Electromagnetism
PHYS 142	(4)	Electromagnetism and Optics

Electives

Students wishing to take elective courses may choose them from introductory courses offered by departments in the Faculties of Science or of Arts. A list of recommended courses is found at http://www.mcgill.ca/science/sousa/nf Scie http://www

EDEC 351	(2)	Third Professional Seminar (Secondary)
EDEC 404	(3)	Fourth Year Professional Seminar (Sec)
EDES 335	(3)	Teaching Secondary Science 1
EDES 350	(3)	Classroom Practices (Secondary)
EDES 435	(3)	Teaching Secondary Science 2
EDFE 200	(2)	First Field Experience (K/Elem & Secondary)
EDFE 254	(3)	Second Field Experience (Secondary)
EDFE 351	(8)	Third Field Experience (Secondary)
EDFE 451	(7)	Fourth Field Experience (Secondary)
EDPE 300*	(3)	Educational Psychology
EDPE 304	(3)	Measurement and Evaluation
EDPI 309*	(3)	Diverse Learners
EDPI 341	(3)	Instruction in Inclusive Schools

Complementary Courses

6 credits selected as follows:

* Note:

BIOL 304	(3)	Evolution
BIOL 308	(3)	Ecological Dynamics
CHEM 212*	(4)	Introductory Organic Chemistry 1

Complementary Courses

9 credits selected from:

BIOL 303	(3)	Developmental Biology
BIOL 305	(3)	Animal Diversity
BIOL 306	(3)	Neural Basis of Behaviour
BIOL 307	(3)	Behavioural Ecology
BIOL 310	(3)	Biodiversity and Ecosystems
BIOL 331	(3)	Ecology/Behaviour Field Course
BIOL 342	(3)	Marine Biology
BIOL 350	(3)	Insect Biology and Control
BIOL 352	(3)	Vertebrate Evolution
BIOL 373	(3)	Biometry
BIOL 427	(3)	Herpetology
BIOL 435	(3)	Natural Selection
BIOL 441	(3)	Biological Oceanography
BIOL 465	(3)	Conservation Biology

or other appropriate course at the 300 level or higher with the permission of an adviser.

Minor Physics (18 credits)

Required Course

3 credits

One of:

PHYS 214	(3)	Introductory Astrophysics
PHYS 224	(3)	Physics of Music
PHYS 260	(3)	Modern Physics and Relativity
PHYS 271	(3)	Introduction to Quantum Physics

One of:

PHYS 340	(3)	Majors Electricity and Magnetism
PHYS 350	(3)	Honours Electricity and Magnetism

Additional Science Courses (15 credits)

BIOL 210	(3)	Perspectives of Science
MATH 203	(3)	Principles of Statistics 1
MATH 222	(3)	Calculus 3
MATH 223	(3)	Linear Algebra
MATH 314	(3)	Advanced Calculus

Electives (5 credits)

5 credits, of which at least 2 credits must be Science Electives.

The electives must be chosen in such a way that the credit counts needed for graduation are satisfied.

14.34.9 Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Chemistry with Minor Biology for Teachers (135 credits)

Note: New students are no longer being admitted to this program.

The Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Chemistry with Minor Biology for Teachers is jointly offered by the Faculty of Science and the Faculty of Education. Separately, the Bachelor of Science degree requires 90 credits (or 120 credits for students who have not completed the basic sciences) and the Bachelor of Education degree requires 120 credits. In the concurrent program, the requirements for the two degrees are combined in such a way that students complete 135 (or 165 credits) to fulfil all the requirements for graduation for both the B.Sc. and the B.Ed.

Graduates of the B.Ed. degree are recommended by the University to the Quebec Ministère de l'Éducation, du Loisir et du Sport (MELS) for Quebec Teacher Certification. For more information about teacher certification in Quebec, please refer to the Faculty of Education section under "Overview of Faculty Programs", "Undergraduate Education Programs", and "Quebec Teacher Certification".

B.Sc. Freshman Program

Students who enter Science in U0 will normally be registered in the Science Freshman Program until they complete their first year. They must consult an adviser in the Science Office for Undergraduate Student Advising (SOUSA) to obtain advice and approval of their course selection. Full details are available on the SOUSA website at http://www.mcgill.ca/science/sousa. Academic advising is also available by email. The address is newstudentadvising.science@mcgill.ca.

Students normally complete 30 credits which must include at least seven courses from the list of Approved Freshman Science Courses, selected as follows:

General Math and Science Breadth

Six of the Freshman courses must satisfy one of the following:

Option 1) 2 courses from MATH and 4 courses from BIOL, CHEM or PHYS;

or

Option 2) 3 courses from MATH and 3 courses from BIOL, CHEM or PHYS.

Science Complementary

The seventh course is chosen from the list of Approved Freshman Science Courses.

Notes:

1. Students who have not studied all of Biology, Chemistry, and Physics at the grade 12 level or equivalent are strongly advised to include at least one course in the missing discipline in their Freshman Program.

2. Many students will complete more than seven courses from the Approved Freshman Science Courses list, particularly those who wish to leave several options open for their choice of major.

3. Students entering the Freshman Program must be aware of the department specific requirements when selecting their courses. Detailed advising information is available at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/specific/.

4. The maximum number of courses per term, required, complementary, and elective, is five.

List of Approved Freshman Science Courses

Select the approved courses according to the instructions above.

Note:

* CHEM 115 (not open to students who are taking or have taken CHEM 110 or CHEM 120)

* CHEM 120 (not open to students who have taken CHEM 115)

BIOL 111	(3)	Principles: Organismal Biology
BIOL 112	(3)	Cell and Molecular Biology
CHEM 110	(4)	General Chemistry 1
CHEM 115*	(4)	Accelerated General Chemistry: Giants in Science
CHEM 120*	(4)	General Chemistry 2
COMP 202	(3)	Foundations of Programming

EDPI 309*	(3)	Diverse Learners
EDPI 341	(3)	Instruction in Inclusive Schools

Complementary Courses

6 credits selected as follows:

CHEM 531	(3)	Chemistry of Inorganic Materials
CHEM 571	(3)	Polymer Synthesis
CHEM 582	(3)	Supramolecular Chemistry
CHEM 591	(3)	Bioinorganic Chemistry

Minor Biology (24 credits)

Required Courses

15 credits

BIOL 200	(3)	Molecular Biology
BIOL 201	(3)	Cell Biology and Metabolism
BIOL 202	(3)	Basic Genetics
BIOL 205	(3)	Biology of Organisms
BIOL 215	(3)	Introduction to Ecology and Evolution

Complementary Courses

9 credits selected from the Biology Department's course offerings, at the 300 level or above.

Additional Science Courses (9 credits)

BIOL 210	(3)	Perspectives of Science
MATH 203	(3)	Principles of Statistics 1
MATH 222	(3)	Calculus 3

Electives (6 credits)

6 credits, of which at least 3 credits must be Science Electives.

The electives must be chosen in such a way that the credit counts needed for graduation are satisfied.

14.34.10 Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Chemistry with Minor Physics for Teachers (135 credits)

Note: New students are no longer being admitted to this program.

The Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Chemistry with Minor Physics for Teachers is jointly offered by the Faculty of Science and the Faculty of Education. Separately, the Bachelor of Science degree requires 90 credits (or 120 credits for students who have not completed the basic sciences) and the Bachelor of Education degree requires 120 credits. In the concurrent program, the requirements for the two degrees are combined in such a way that students complete 135 (or 165 credits) to fulfil all the requirements for graduation for both the B.Sc. and the B.Ed.

Graduates of the B.Ed. degree are recommended by the University to the Quebec Ministère de l'Éducation, du Loisir et du Sport (MELS) for Quebec Teacher Certification. For more information about teacher certification in Quebec, please refer to the Faculty of Education section under "Overview of Faculty Programs", "Undergraduate Education Programs", and "Quebec Teacher Certification".

The Major Concentration Chemistry with Minor Physics is one of the nine variations of the program and allows students to focus their Science degree in Chemistry with a subspecialization in Physics.

To fulfil the requirements for graduation for the Concurrent Bachelor of Science and Bachelor of Education, the 135 credits (or 165 credits for students admitted without basic sciences) include the following:

(30 credits of Science Freshman Program (for students admitted without basic sciences))

60 credits of Education Component

69 credits of Science Component consisting of:

- 36 credits of the Major Concentration Chemistry

- 18 credits of the Minor Physics

- 15 credits of Additional Science Courses

6 credits of Electives, of which at least 3 credits must be Science Electives, depending on how many credits count toward both the B.Sc. and the B.Ed. degrees.

For details on the counting of credits toward both degrees (double-counting) visit the program website http://www.mcgill.ca/scienceforteachers/.

B.Sc. Freshman Program

Students who enter Science in U0 will normally be re

Second calculus course, one of:

MATH 141	(4)	Calculus 2
MATH 151	(4)	Calculus B

First physics course, one of:

PHYS 101	(4)	Introductory Physics - Mechanics
PHYS 131	(4)	Mechanics and Waves

Second physics course, one of:

PHYS 102	(4)	Introductory Physics - Electromagnetism
PHYS 142	(4)	Electromagnetism and Optics

Electives

Students wishing to take elective courses may choose them from introductory courses offered by departments in the Faculties of Science or of Arts. A list of recommended courses is found at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/approved/. Certain courses offered by other faculties may also be taken, but some restrictions apply.

Consult the SOUSA website at http://www

EDPE 300*	(3)	Educational Psychology
EDPE 304	(3)	Measurement and Evaluation
EDPI 309*	(3)	Diverse Learners
EDPI 341	(3)	Instruction in Inclusive Schools

Complementary Courses

6 credits selected as follows:

* Note: 3)3)

CHEM 381	(3)	Inorganic Chemistry 2
CHEM 382	(3)	Organic Chemistry: Natural Products
CHEM 531	(3)	Chemistry of Inorganic Materials
CHEM 571	(3)	Polymer Synthesis
CHEM 582	(3)	Supramolecular Chemistry
CHEM 591	(3)	Bioinorganic Chemistry

Minor Physics (18 credits)

Required Course

3 credits

PHYS 257	(3)	Experimental Methods 1

Complementary Courses

15 credits to be selected as follows:

One of:

DynOTFf:

MATH 222	(3)	Calculus 3
MATH 223	(3)	Linear Algebra
MATH 314	(3)	Advanced Calculus

Electives (6 credits)

6 credits, of which at least 3 credits must be Science Electives.

The electives must be chosen in such a w

1. Students who have not studied all of Biology, Chemistry, and Physics at the grade 12 level or equivalent are strongly advised to include at least one course in the missing discipline in their Freshman Program.

2. Many students will complete more than seven courses from the Approved Freshman Science Courses list, particularly those who wish to leave several options open for their choice of major.

3. Students entering the Freshman Program must be aware of the department specific requirements when selecting their courses. Detailed advising information is available at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/specific/.

4. The maximum number of courses per term, required, complementary, and elective, is five.

List of Approved Freshman Science Courses

Select the approved courses according to the instructions above.

Note:

* CHEM 115 (not open to students who are taking or have taken CHEM 110 or CHEM 120)

* CHEM 120 (not open to students who have taken CHEM 115)

BIOL 111	(3)	Principles: Organismal Biology
BIOL 112	(3)	Cell and Molecular Biology
CHEM 110	(4)	General Chemistry 1
CHEM 115*	(4)	Accelerated General Chemistry: Giants in Science
CHEM 120*	(4)	General Chemistry 2
COMP 202	(3)	Foundations of Programming
ESYS 104	(3)	The Earth System
MATH 133	(3)	Linear Algebra and Geometry
PSYC 100	(3)	Introduction to Psychology

First calculus course, one of:

MATH 139	(4)	Calculus 1 with Precalculus
MATH 140	(3)	Calculus 1
MATH 150	(4)	Calculus A

Second calculus course, one of:

MATH 141	(4)	Calculus 2
MATH 151	(4)	Calculus B

First physics course, one of:

PHYS 101	(4)	Introductory Physics - Mechanics
PHYS 131	(4)	Mechanics and Waves

Second physics course, one of:

PHYS 102	(4)	Introductory Physics - Electromagnetism
PHYS 142	(4)	Electromagnetism and Optics

Electives

Students wishing to take elective courses may choose them from introductory courses offered by departments in the Faculties of Science or of Arts. A list of recommended courses is found at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/approved/. Certain courses offered by other faculties may also be taken, but some restrictions apply.

Consult the SOUSA website at http://www.mcgill.ca/science/sousa/continuing_students/bsc/outside/ for more information about taking courses from other faculties.

Education Component (60 credits)

60 credits of Education Component, consisting of:

EDEC 261*	(3)	Philosophy of Catholic Education

Major Concentration Physics (36 credits)

The Major Concentration Physics is a planned sequence of courses designed to permit a degree of specialization in this discipline.

Required Courses*

30 credits selected as follows:

* Note: Required courses taken at CEGEP or elsewhere that are not credited toward the Concurrent B.Sc. and B.Ed. must be replaced by courses from the Complementary Course List equal to or exceeding their credit value. Regardless of the substitution, students must take at least 36 credits in this program.

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 257	(3)	Experimental Methods 1
PHYS 333	(3)	Thermal and Statistical Physics
PHYS 340	(3)	Majors Electricity and Magnetism
PHYS 446	(3)	Majors Quantum Physics

Complementary Courses

6 credits selected from:

PHYS 214	(3)	Introductory Astrophysics
PHYS 224	(3)	Physics of Music
PHYS 241	(3)	Signal Processing
PHYS 258	(3)	Experimental Methods 2
PHYS 334	(3)	Advanced Materials
PHYS 534	(3)	Nanoscience and Nanotechnology

or any 300- or 400-level course approved by an adviser.

Minor Biology (24 credits)

24-25 credits for the Minor Biology selected as follows:

15 credits of required courses

9-10 credits of complementary courses

Required Courses

15 credits

BIOL 200	(3)	Molecular Biology
BIOL 201	(3)	Cell Biology and Metabolism
BIOL 202	(3)	Basic Genetics
BIOL 205	(3)	Biology of Organisms
BIOL 215	(3)	Introduction to Ecology and Evolution

Complementary Courses

9-10 credits of complementary courses, CHEM 212 and 6 selected from the Biology Department's course offerings, at the 300 level or above.

* Note: Students who have already taken CHEM 212 or its equivalent will choose another appropriate course, to be approved by the Adviser.

CHEM 212*	(4)	Introductory Organic Chemistry 1

Additional Science Courses (9 credits)

9 credits selected as follows:

6 credits:

BIOL 210	(3)	Perspectives of Science
MATH 203	(3)	Principles of Statistics 1

plus 3 credits, one additional Physics (PHYS) course approved by the Physics Department.

Electives (6 credits)

6 credits, of which at least 3 credits must be Science Electives.

The electives must be chosen in such a way that the credit counts needed for graduation are satisfied.

14.34.12 Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Physics with Minor Chemistry for Teachers (135 credits)

Note: New students are no longer being admitted to this program.

The Concurrent Bachelor of Science (B.Sc.) and Bachelor of Education (B.Ed.) - Major Concentration Physics with Minor Chemistry for Teachers is jointly offered by the Faculty of Science and the Faculty of Education. Separately, the Bachelor of Science degree requires 90 credits (or 120 credits for students who have not completed the basic sciences) and the Bachelor of Education degree requires 120 credits. In the concurrent program, the requirements for the two degrees are combined in such a way that students complete 135 (or 165 credits) to fulfil all the requirements for graduation for both the B.Sc. and the B.Ed.

Graduates of the B.Ed. degree are recommended by the University to the Quebec Ministère de l'Éducation, du Loisir et du Sport (MELS) for Quebec Teacher Certification. For more information about teacher certification in Quebec, please refer to the Faculty of Education section under "Overview of Faculty Programs", "Undergraduate Education Programs", and "Quebec Teacher Certification".

The Major Concentration Physics with Minor Chemistry is one of the nine variations of the program and allows students to focus their Science degree in Physics with a subspecialization in Chemistry.

To fulfil the requirements for graduation for the Concurrent Bachelor of Science and Bachelor of Education, the 135 credits (or 165 credits for students admitted without basic sciences) include the following:

(30 credits of Science Freshman Program (for students admitted without basic sciences))

60 credits of Education Component

69 credits of Science Component consisting of:

- 36 credits of the Major Concentration Physics

- 18 credits of the Minor Chemistry

- 15 credits of Additional Science Courses

6 credits of Electives, of which at least 3 credits must be Science Electives, depending on how many credits count toward both the B.Sc. and the B.Ed. degrees.

For details on the counting of credits toward both degrees (double-counting) visit the program website http://www.mcgill.ca/scienceforteachers/.

B.Sc. Freshman Program

Students who enter Science in U0 will normally be registered in the Science Freshman Program until they complete their first year. They must consult an adviser in the Science Office for Undergraduate Student Advising (SOUSA) to obtain advice and approval of their course selection. Full details are available on the SOUSA website at http://www.mcgill.ca/science/sousa. Academic advising is also available by email. The address is newstudentadvising.science@mcgill.ca.

Students normally complete 30 credits which must include at least seven courses from the list of Approved Freshman Science courses, selected as follows:

General Math and Science Breadth

Six of the Freshman courses must satisfy one of the following:

Option 1) 2 courses from MATH and 4 courses from BIOL, CHEM or PHYS;

or

Option 2) 3 courses from MATH and 3 courses from BIOL, CHEM or PHYS.

Science Complementary

The seventh course is chosen from the list of Approved Freshman Science Courses.

Notes:

1. Students who have not studied all of Biology, Chemistry, and Physics at the grade 12 level or equivalent are strongly advised to include at least one course in the missing discipline in their Freshman Program.

2. Many students will complete more than seven courses from the Approved Freshman Science Courses list, particularly those who wish to leave several options open for their choice of major.

3. Students entering the Freshman Program must be aw

Second physics course, one of:

PHYS 102	(4)	Introductory Physics - Electromagnetism
PHYS 142	(4)	Electromagnetism and Optics

Electives

Students wishing to take elective courses may choose them from introductory courses offered by departments in the Faculties of Science or of Arts. A list of recommended courses is found at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/approved/. Certain courses offered by other faculties may also be taken, but some restrictions apply.

Consult the SOUSA website at http://www.mcgill.ca/science/sousa/continuing_students/bsc/outside/ for more information about taking courses from other faculties.

Education Component (60 credits)

60 credits of Education Component, consisting of:

54 credits of required courses

6 credits of complementary courses

Required Courses

54 credits

* Note: The courses marked with an asterisk are counted toward both degrees. They will count as "electives" for the B.Sc. degree, although a grade of "C" or better is required.

The English Language Requirement (EDEC 215) must be taken in the Fall semester following the Freshman year.

EDEC 201	(1)	First Year Professional Seminar
EDEC 215	(0)	English Exam for Teacher Certification
EDEC 247*	(3)	Policy Issues in Quebec Education
EDEC 254	(1)	Second Professional Seminar (Secondary)
EDEC 262*	(3)	Media, Technology and Education
EDEC 351	(2)	Third Professional Seminar (Secondary)
EDEC 404	(3)	Fourth Year Professional Seminar (Sec)
EDES 335	(3)	Teaching Secondary Science 1
EDES 350	(3)	Classroom Practices (Secondary)
EDES 435	(3)	Teaching Secondary Science 2
EDFE 200	(2)	First Field Experience (K/Elem & Secondary)
EDFE 254	(3)	Second Field Experience (Secondary)
EDFE 351	(8)	Third Field Experience (Secondary)
EDFE 451	(7)	Fourth Field Experience (Secondary)
EDPE 300*	(3)	Educational Psychology
EDPE 304	(3)	Measurement and Evaluation
EDPI 309*	(3)	Diverse Learners
EDPI 341	(3)	Instruction in Inclusive Schools

Complementary Courses

6 credits selected as follows:

* Note: The courses marked with an asterisk are counted toward both degrees. They will count as "electives" for the B.Sc. degree, although a grade of "C" or better is required.

3 credits, one of the three following courses:

EDEC 233*	(3)	First Nations and Inuit Education
EDEC 248*	(3)	Multicultural Education
EDEC 249*	(3)	Global Education and Social Justice

3 credits, one of the two following courses:

EDEC 260*	(3)	Philosophical Foundations
EDEC 261*	(3)	Philosophy of Catholic Education

Major Concentration Physics (36 credits)

The Major Concentration Physics is a planned sequence of courses designed to permit a degree of specialization in this discipline.

Required Courses*

30 credits

* Note: Required courses taken at CEGEP or elsewhere that are not credited tow

Substitutions for these by more advanced courses may be made at the discretion of the Adviser.

CHEM 203	(3)	Survey of Physical Chemistry
CHEM 212*	(4)	Introductory Organic Chemistry 1
CHEM 222*	(4)	Introductory Organic Chemistry 2
CHEM 253	(1)	Introductory Physical Chemistry 1 Laboratory
CHEM 281	(3)	Inorganic Chemistry 1
CHEM 287	(2)	Introductory Analytical Chemistry
CHEM 297	(1)	Introductory Analytical Chemistry Laboratory

Additional Science Courses (15 credits)

15 credits selected as follows:

9 credits

BIOL 210	(3)	Perspectives of Science
CHEM 381	(3)	Inorganic Chemistry 2
MATH 203	(3)	Principles of Statistics 1

plus 3 credits, one of:

CHEM 180	(3)	World of Chemistry: Environment
CHEM 181	(3)	World of Chemistry: Food
CHEM 182	(3)	World of Chemistry: Technology
CHEM 183	(3)	World of Chemistry: Drugs

plus 3 credits, one additional Physics (PHYS) course approf Y

21 credits of Electives, of which at least 18 credits must be Science Electives, depending on how many credits count toward both the B.Sc. and the B.Ed. degrees.

For details on the counting of credits toward both degrees (double-counting) visit the program website http://www.mcgill.ca/scienceforteachers/.

B.Sc. Freshman Program

Students who enter Science in U0 will normally be registered in the Science Freshman Program until they complete their first year. They must consult an adviser in the Science Office for Undergraduate Student Advising (SOUSA) to obtain advice and approval of their course selection. Full details are available on the SOUSA website at http://www.mcgill.ca/science/sousa. Academic advising is also available by email. The address is newstudentadvising.science@mcgill.ca.

Students normally complete 30 credits which must include at least seven courses from the list of Approved Freshman Science Courses, selected as follows:

General Math and Science Breadth

Six of the Freshman courses must satisfy one of the following:

Option 1) 2 courses from MATH and 4 courses from BIOL, CHEM or PHYS;

or

Option 2) 3 courses from MATH and 3 courses from BIOL, CHEM or PHYS.

Science Complementary

The seventh course is chosen from the list of Approved Freshman Science Courses.

Notes:

1. Students who have not studied all of Biology, Chemistry, and Physics at the grade 12 level or equivalent are strongly advised to include at least one course in the missing discipline in their Freshman Program.

2. Many students will complete more than seven courses from the Approved Freshman Science Courses list, particularly those who wish to leave several options open for their choice of major.

3. Students entering the Freshman Program must be aware of the department specific requirements when selecting their courses. Detailed advising information is available at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/specific/.

4. The maximum number of courses per term, required, complementary, and elective, is five.

List of Approved Freshman Science Courses

Select the approved courses according to the instructions above.

Note:

* CHEM 115 (not open to students who are taking or have taken CHEM 110 or CHEM 120)

* CHEM 120 (not open to students who have taken CHEM 115)

BIOL 111	(3)	Principles: Organismal Biology
BIOL 112	(3)	Cell and Molecular Biology
CHEM 110	(4)	General Chemistry 1
CHEM 115*	(4)	Accelerated General Chemistry: Giants in Science
		General Chemistry 2

Second calculus course, one of:

MATH 141	(4)	Calculus 2
MATH 151	(4)	Calculus B

First physics course, one of:

PHYS 101	(4)	Introductory Physics - Mechanics
PHYS 131	(4)	Mechanics and Waves

Second physics course, one of:

PHYS 102	(4)	Introductory Physics - Electromagnetism
PHYS 142	(4)	Electromagnetism and Optics

Electives

Students wishing to take elective courses may choose them from introductory courses offered by departments in the Faculties of Science or of Arts. A list of recommended courses is found at http://www.mcgill.ca/science/sousa/new_students/u0/bsc_freshman/approved/. Certain courses offered by other faculties may also be taken, but some restrictions apply

EDPE 300*	(3)	Educational Psychology
EDPE 304	(3)	Measurement and Evaluation
EDPI 309*	(3)	Diverse Learners
EDPI 341	(3)	Instruction in Inclusive Schools

Complementary Courses

6 credits selected as follows:

* Note: The courses marked with an asterisk are counted toward both degrees. They will count as "electives" for the B.Sc. degree, although a grade of "C" or better is required.

3 credits, one of the three following courses:

EDEC 233*	(3)	First Nations and Inuit Education
EDEC 248*	(3)	Multicultural Education
EDEC 249*	(3)	Global Education and Social Justice

3 credits, one of the two following courses:

EDEC 260*	(3)	Philosophical Foundations
EDEC 261*	(3)	Philosophy of Catholic Education

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 for the program.

MATH 133	(3)	Linear Algebra and Geometry
MATH 140	(3)	Calculus 1
MATH 141	(4)	Calculus 2

Required Courses

27 credits

Where appropriate, Honours courses may be substituted for equivalent Major courses.

* Students select either MATH 249 or MATH 316 but not both.

MATH 222	(3)	Calculus 3
MATH 235	(3)	Algebra 1
MATH 236	(3)	Algebra 2
MATH 242	(3)	Analysis 1
MATH 243	(3)	Analysis 2
MATH 249*	(3)	Honours Complex Variables
MATH 314	(3)	Advanced Calculus
MATH 315	(3)	Ordinary Differential Equations
MATH 316*	(3)	Complex Variables
MATH 323	(3)	Probability

Complementary Courses

27 credits selected with the following specifications:

12 credits specifically required of students in the Concurrent B.Sc. and B.Ed. Major Mathematics:

COMP 202	(3)	Foundations of Programming
MATH 324	(3)	Statistics
MATH 338	(3)	History and Philosophy of Mathematics
MATH 348	(3)	Topics in Geometry

at least 3 credits from:

MATH 317	(3)	Numerical Analysis
MATH 335	(3)	Computational Algebra
MATH 340	(3)	Discrete Structures 2

12 credits from:

It is highly recommended that students include MATH 318 and MATH 346 in their complementary courses.

MATH 204	(3)	Principles of Statistics 2
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
MATH 327	(3)	Matrix Numerical Analysis
MATH 329	(3)	Theory of Interest
MATH 346	(3)	Number Theory
MATH 352	(1)	Problem Seminar
MATH 407	(3)	Dynamic Programming
MATH 410	(3)	Majors Project
MATH 417	(3)	Mathematical Programming
		Regression and Analysis of V3)

14.35 Technological Entrepreneurship for Science Students

14.35.1 Location

Desautels Faculty of Management
1001 Sherbrooke Street West, Suite 110
Montreal, Quebec H3A 1G5

14.35.2 About Technological Entrepreneurship for Science Students

Please note that this program is currently under review. Students should register for the Minor in Management (for Non-Management students).

This Minor is geared toward Science students with an interest in entrepreneurship and key business topics. The set of six courses will introduce them to concepts and skills needed to effectively complement the technical expertise obtained. These concepts and skills form the basis of successful companies in the high technology sector, be they start-ups, small, or medium sized.

14.35.3 Bachelor of Science (B.Sc.) - Minor Technological Entrepreneurship for Science Students (18 credits)

(Please note that this program is currently under review.)

This Minor is geared to Science students with an interest in entrepreneurship and key business topics. The set of six courses will introduce you to concepts and skills needed to effectively complement the technical expertise obtained. These concepts and skills form the basis of successful companies in the high technology sector, be they start-ups, small or medium-sized.

Acceptance to the program is both competitive and restricted. Application procedures will be announced in September. Please consult Ron Critchley, Student Adviser, Desautels Faculty of Management Student Affairs Office, Bronfman 110, for details.

Students registered in the Minor Technological Entrepreneurship for Science Students may not take additional courses outside the Faculties of Arts and of Science.

To obtain the Minor, all courses must be completed with a grade of C or better.